Citizen Science in Ecology in India

An initial mapping and analysis

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Cover photograph: Teachers from Kerala, Andhra Pradesh and Tamil Nadu along with coordinators of the SeasonWatch Citizen Science Project during a meeting in October, 2018.
Photo credit: Veena, H.T.

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EXECUTIVE SUMMARY

The newly emerging field of Citizen Science, defined in the Oxford English dictionary as "scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions" is gaining rapid popularityin India, and shows considerable potential to contribute to environmental monitoring, regulation and decision-making. Growing interest of the citizenry in participating in science is central to this development, and this report presents the first study of its kind that maps Citizen Science initiatives in ecology in India. The aim is twofold: a) to understand the current status of Citizen Science in India and b) make recommendations to strengthen Citizen Science as a better tool for regulation and public decision-making.

The emergence of Citizen Science can be understood as the coming together of three broad contemporary trends at the intersection of scientific research and environmental regulation. The first of these is the increased and growing awareness among the public on matters of the environment and of the need, simultaneously, of a more robust, scientific and accountable environmental regulation regime. The second prominent trend is the growing availability of big data and the possibility this offers towards understanding the environment and ensuring that regulation, like in the case of Environment Impact Assessments and also in ensuring environmental safeguards are met by project implementing agencies. This has been hugely facilitated by the rapid evolution of technologies of data gathering, transmission and analysis, all of which would broadly constitute the frame of 'big data'. The third of these trends, which can also be seen a corollary or even an outcome of the first, is the increased interest and participation of the citizenry in scientific research and environmental monitoring on the one hand and regulation on the other. This is also a reflection of processes of greater democratization where citizens are not only demanding accountability and results but are increasingly participating in the processes of doing science and creating knowledge.

These three inter-linked trends offer exciting possibilities for scientific research as also environmental monitoring and regulation and this is most prominently visible in the growth of Citizen Science. One sees here the coming together of the citizen, modern technologies such as the smart phone, the internet and data analysis and the willingness from a certain section of the scientific establishment to open up possibilities and deliver outcomes that were not possible earlier. The one field in which Citizen Science has huge potential is that of ecological and environmental studies, and a number of Citizen Science projects have been initiated in India in the last decade to deal with a range of related questions.

This report is based on a detailed study of 17 different Citizen Science projects currently under-way and seeks to provide trends, analysis and insight on this rapidly growing way of 'doing science'. The two prominent stakeholders here include scientists and scientific institutions that are at the heart of these initiatives and the citizen scientists themselves – the thousands of 'citizens' who are participating in the projects and contributing to ecological data via Citizen Science projects.

The analysis is based on an extensive perusal of published literature on Citizen Science in India in the mainstream media and in academic journals, on secondary data accessed from reports put out by the project co-ordinators, information that is available on respective websites, and a series of

semi-structured interviews conducted with the co-ordinators of seven of the 17 Citizen Science projects mapped in this report.

The report and its findings would be relevant for practitioners of Citizen Science, research agencies and institutions, funding agencies and those that deal with policy inside and outside of government.

Sarus cranes in an agricultural landscape in Uttar Pradesh. The most successful Citizen Science initiatives in India and also globally are those involving birds (Photo: Pankaj Sekhsaria).

Key findings

The study suggests that even though it is a relatively recent development, Citizen Science is being used in new and interesting ways and offers many new possibilities:

a) There is a growing interest and use of the methods and tools of Citizen Science to do ecological research in India. The phenomenon is about a decade old here, with recent years seeing heightened interest. We estimate that there are 25-30 Citizen Science projects in ecology that are currently operational in India and one can expect that this number will grow slowly but steadily in the years to come.

b) A majority of the projects are being initiated by trained scientists/ecologists situated within state supported scientific institutions or in NGOs/ research organisations that have a conservation mandate.

c) The number of citizen scientists contributing to these projects varies considerably on account of a range of reasons. It ranges from a few 100 (sometimes even less) in many cases to a little more than 12,000 in the project with the highest participation.

d) A majority of the projects are what one might call 'data contributing' projects where citizens are uploading atomized data units in pre-determined formats. The volume of data being contributed also varies considerably across projects – from a few 1000 data points in a majority of the projects to nearly ten million in the case of the most popular, the Bird Count India – eBird India project.

e) A majority of the projects are family and/ or species based, but there are also those for mapping of environmental parameters (like for Beach Profile Monitoring Program) and others that map certain events (animal kills in road and train accidents). Another prominent category of projects arethose that aggregate information such as the India Biodiversity Portal and Bio Atlas India.

f) Central to the increasing popularity, even the possibility of Citizen Science, is a set of modern technologies that facilitate the recording, transmission and analysis of data. The technologies include among others, smart phones and a range of apps that help in recording and documentation, the internetthat facilitates transmission of data and a range of tools and softwares that help in analysis.

g) There is a growing interest in the mainstream

media in these projects, their potential and the outcomes. There is slow but visible trend of the publication of scientific papers based on analysis and data generated from citizen projects.

Some gaps and challenges going forward

Based on the experiences of Citizen Science projects that are part of this study and the interviews we conducted, we are able to identify at least five challenges being faced by Citizen Science projects in India:

a) Financial sustainability of the projects

b) Developing tools, pathways and mechanisms by which knowledge generated by Citizen Science projects can be used in the regulatory system

c) Sustaining and increasing citizen participation to realize its potential to the maximum

d) Issues of ensuring good quality data

e) Data ownership and conditions for use

It is important to note that each one of them may not be applicable to all the projects in the same way and may not apply at all in some cases.

Based on an extended perusal of literature, the analysis that we have carried out and extended inferences drawn from these, we have identified a larger set of gaps and challenges that are relevant in this context:

a. Enabling platform for discussion: No formal enabling platform exists currently for Citizen Science projects to come together and discuss matters. Project proponents and agencies like the Department of Science and Technology (DST), Ministry of Environment Forest and Climate Change (MoEFCC), The Ministry of Earth Sciences (MoES) and the Department of Biotechnology (DBT), among others, could consider catalyzing/ facilitating processes where discussions and exchanges between the projects can take place. Associations of Citizen Science projects now exist in the United States of America, Australia and Europe and something on these lines could be discussed for the Indian context as well.

b. Guidelines for Citizen Science: It might help to consider the creation of a set of best practices (things to do, things to avoid etc.) in the context of Citizen Science.These could be in the nature of enabling guidelines that will help existing projects think through their aims and methods and also provide a helping hand to others who are interested in initiating Citizen Science projects. It would be ideal if co-ordinators of Citizen Science projects were able to create a process to attempt such as effort.

c. Long-term sustainability: Many project proponents highlighted financial sustainability as one of the key constraints in ensuring that the projects can continue. This was related to both, the challenges of maintaining the technological architectures needed and also in keeping alive the interest and the motivation of the citizen contributors. The DST and other government and non-government agencies could consider creating a framework by which projects following the Citizen Science ideology and methodology could be provided financial and logistical support in addition to the more conceptual and methodological issues discussed earlier.

d. Data ownership and conditions for use: One issue that will need discussion and resolution in the context of Citizen Science is that of data ownership and conditions for use. While there is some discussion on these matters, it requires much more thought and deliberation in the context of data ownership and the larger trends

and politics of information and ownership in this context. One can already see differences of opinion and ideology and while one may not expect a convergence in understanding, discussions on this matter are needed and will certainly help. Discussions with experts in such domains as law, intellectual property, and data use and ownership will be useful for all parties involved.

e. Science education and public understanding of science: Research from across the world shows that in addition to contributing data and adding to scientific understanding, Citizen Science projects can play a very significant role is the science education and in the public understanding of Science. What is needed is more conceptual engagement and structuring of the projects to ensure this additional benefit and this is something project proponents might want to think about.

f. The technology interfaces: Modern technologies such as smart devices, the internet and data analysis capabilities are key in having facilitated Citizen Science projects. While this has been hugely enabling, attention needs to be paid to the in-built exclusions that could result by an exclusive (or even dominant) reliance on these technologies for Citizen Science.

g. Sociological studies of Citizen Science: Developments like Citizen Science offer very interesting insights and challenges in such domains as knowledge creation, the sociology of scientific knowledge and contestations over knowledge claims besides issues of data ownership and intellectual property. Studies on the 'non' scientific dimension such as those related to ethics, sociological dimensions and the political implications should be encouraged and facilitated.

INTRODUCTION

A brief history of Citizen Science

While the specific nomenclature of 'Citizen Science' is a relatively new one, its widely accepted and defining methodological characteristic - voluntary contribution of data by common citizens[1] (Bonney, Phillips, Ballard, & Enck, 2016)- has a reasonably long history. Indeed, the involvement of amateurs in natural history investigations has been traced to as far back as the seventeenth century (Miller-Rushing, Primack, & Bonney, 2012). The more recent initiatives in the United States of America in particular that have a direct bearing on the current popularity of Citizen Science projects globally, include The National Audubon Society's Christmas Bird Count (CBC) that began in 1900, and the US Fish and Wildlife Service's Breeding Bird Survey and the Cornell Nest Record Card Program, both of which were initiated in 1965 (Bonney et al., 2016).

A perusal of literature suggests that 1995 and 2014-15 respectively could be considered two watershed years in the context of Citizen Science. 1995 was the year that Alan Irwin published Citizen Science: A Study of People, Expertise, and Sustainable Development (Irwin, 1995), a book that fostered the idea of Citizen Science as a movement for the democratization of science (Bonney et al., 2016). Central to the argument here was the idea of "scientific citizenship" and the need for a greater involvement of the public in issues related to science and the environment. Bonney et al. (2016) note further that the other more popular definition that equates Citizen Science with public participation in scientific research can also be seen emerging in 1995. This stems in part from the decision made that year by the Cornell Lab of Ornithology to use the term Citizen Science for its rapidly growing assemblage of projects involving large numbers of individuals collecting data focused on birds (Bonney, 1996).

The two decade period that followed saw an exponential growth around the world of Citizen Scienceprojects with hundreds if not thousands of such projects engaging millions of citizens in collecting and/or processing data (Bonney et al., 2016). Influencedby all this and also the rapid spread and use of the internet (Bonney et al., 2016), the Oxford University Dictionary[2] included and defined Citizen Science in 2014 as "scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions."[3]

The following year, 2015, is important as it appears to mark the first successful efforts in the formalization and the organization of a community of Citizen Science.The Citizen Science Association (CSA), an organization of professionals who design, implement and study citizen science projects, held its first-ever conference in San Jose, California, USA, in February 2015. It was attended

[1]A deeper enquiry reveals that there may not be a full agreement on terms such as 'voluntary' and the 'citizen' even though these are central to the imaginations of the Citizen Science projects. A fuller engagement with these matters is beyond the scope of this report, but we do provide some initial analysis and insights in Part II of the Analysis section below.

[2]https://en.oxforddictionaries.com/definition/citizen_science; accessed 09 September 2018

[3]The citizen scientist has been defined as (a) a scientist whose work is characterized by a sense of responsibility to serve the best interests of the wider community (now rare); (b) a member of the general public who engages in scientific work, often in collaboration with or under the direction of professional scientists and scientific institutions; an amateur scientist. Source: https://daily.zooniverse.org/2014/09/16/citizen-science-in-dictionary/; accessed 09 September 2018

by more than 600 delegates from 25 countries. Representatives of the European Citizen Science Association (ECSA) met in Leipzig, Germany, in April 2015 to plan an inaugural ECSA meeting for winter 2016 (Anon, 2016)and the Australian Citizen Science Association (ACSA) also held its inaugural conference in Canberra in July 2016 (Bonney et al., 2016).

Ongoing assessments, meanwhile, have provided an overview of the scale at which Citizen Science is operating today. Based on a sampling restricted to projects reported in English and from major online citizen science clearing houses, Theobald et al. (2015)have identified 388 unique biodiversity-based projects where an estimated 1.36 to 2.28 million people voluntarily contributed an average of 21-24 hours collecting data per year. The annual value of this contribution, the authors estimated, was anywhere between US$667 million and US$2.5 billion. They also determined, primarily through a search of the Web of Life, that these projects have yielded a total of 446 scientific publications.

It is not surprising then that Bonney et al. (2016) note in their recent review paper that Citizen Science has become nearly as big a concept as science itself. What was once a novel idea-lay people engaging in the scientific enterprise-is becoming mainstream. Each coming year is likely to engage more people in scientific investigation as citizen science projects become more widespread, more accessible, more fun, and more rewarding. (Bonney et al., 2016, pp. 13-14) Citizen Science, one might conclude confidently,has established itself firmly and is here to stay.

Citizen Science in ecology in India

The situation in India appears to reflect the broad contours of the above discussion, except for the scale and size of projects that would go under the label. While amateur contributions have been central to modern ecological studies in India for more than a century, most agree that the Asian Waterbird Census (AWC), initiated in 1987 by the Asian Wetland Bureau (now Wetlands International) and co-ordinated in India by the Bombay Natural History Society (BNHS) (Rahmani, Laad, & Islam, 2003), was the first instance of such organized data collection by citizens here.

A look at the data available for the earlier years of the project shows,however, that the number of participants contributing and the wetlands covered during the counts varied considerably over the years. Data, in fact, is not even available today for certain periods during which the counts were carried out. The limitations and challenges of conducting such an exercise - lack of an organized structure, haphazard coverage, repeat counts, and lack of co-ordination - have all been acknowledged by the project co-ordinators themselves (Rahmani et al., 2003).

By all accounts, the AWC was a project ahead of its time and India was perhaps not ready, certainly in terms of technology, but also in terms of institutional capacity and understanding, to execute a project such as this. This is attested by the fact that no other project that sought to similarly involve interested citizens in any substantial manner was attempted till the current crop of Citizen Science projects started about a decade ago.

Much has clearly changed since then and the increasing number of projects, the wide range of their coverage and the volume of data and information that has been generated is an indication of that. While the AWC continues in its own right, participants have the option of uploading their counts through the Bird Count

India - eBird India (BCI-eBird)[4] platform and much more is being done now than what was attempted, or could have even conceived when it was initiated in 1987.

In the mainstream media

One useful barometer of assessing the growing interest in Citizen Science in India would be to look at reportage and features in the mainstream media. A quick Google based survey in August 2018 (when this report was written) could locate about 30 news articles and reports with the central theme of Citizen Science in India published across some of the country's most prominent English media platforms for the year 2018 alone. This translates to one article/news report a week on average and is certainly prolific and substantive considering that only about a third of this number (a total of about eight) of such reports could be located for the entire preceding year of 2017.

It is not just the increased volume of the reporting, but also the prominence and the space given to these articles that are instructive of the buzz around Citizen Science. This is most visible, for instance, in full-page prominent features that have been published in recent months in two of India's leading English news-dailies, Hindustan Times (Behrawala, 2018) and The Hindu (Perinchery, 2018b) (Annexure 3). The features are effusive in their optimism for Citizen Science and discuss a range of relevant issues such as the varietyof backgrounds (designers, life guards, bankers etc.), the broad age bracket (10-75 years) the citizen scientists come from, the diversity of ecological subjects they are contributing to and the central role being played by a set of certain kind of technologies - smart phones, apps and the internet - that is making it all happen.

And it is also not just professional journalists and reporters writing about Citizen Science. There is an increasing number of scientists and researchers, some of them at the heart of the Citizen Science initiatives, that are writing in the popular press about what they do, about the potential of Citizen Science and what it is actually being delivered (cf. Agnihotri, Hiremath, Vattakavan, Sachin, & George, 2016; Gubbi, 2018; Ramaswami & Quader, 2018).

In academic publishing in India

While the coverage in the media has been extensive (and increasing), peer reviewed publishing, both in terms of the number of publications or scientific insights generated from Citizen Scienceprojects is also starting to become visible. A majority of these academic papers have been published only in the last couple of years andare either assessmentsby the co-ordinators themselves of a particular Citizen Project like in the case of the India Biodiversity Portal (IBP) (Vattakaven et al., 2016) and Hornbill Watch India (Datta, Naniwadekar, Rao, Sreenivasan, & Hiresavi, 2018), or initial analysis and trends using data generated from one particular project, BCI-eBird, which is the source already of about a dozen published papers (see, for eg. Arjun & Roshnath, 2018; Baidya & M, 2018; Baidya, M, Dharwadkar, & Gauns, 2017; Kannan, Santharam, Kannan, & Nagarajan, 2018; Praveen, Subramanya, & Mohan Raj, 2016; Ramesh, Gopalakrishna, Barve, & Melnick, 2017b; Roshnath, 2017). The Biodiveristy

[4]Bird Count India (BCI) encourages documenting and monitoring of India's birds through the eBird-India platform. This project is therefore referred to as Bird Count India--eBird India and abbreviated hence forth as BCI-eBird.

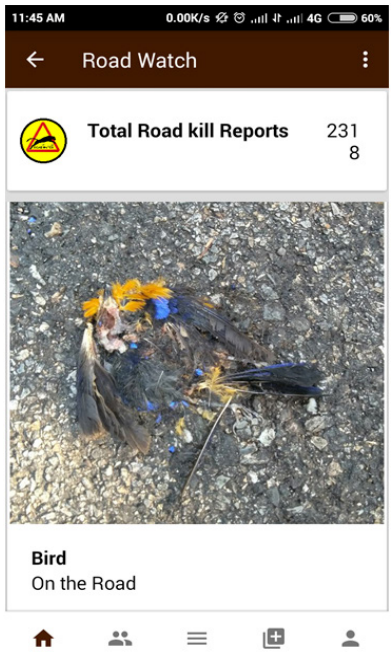
Atlas - India family of projects too has generated nearly 20 research papers and contributed to half a dozen new species description and many more species discoveries. Data available on IBP has also been cited in over 100 scientific publications clearly underlining the potential this kind of data gathering offers.

There can be no doubt that this will all increase in the near future as more such projects come on stream and they also deepen and widen the data they gather and therefore make available for further research and analysis[5] . This indeed is the trend worldwide and what one is seeing in India is clearly an extension of the same.

Northern pintails, one of the many species of migratory waterbirds that were documented as part of the AWC project (Photo: Pankaj Sekhsaria).

Box 1: Some notable outputs from the Citizen Science projects

- New information on tiger presence in the larger landscape of the Ranthambhore Tiger Reserve, Rajasthan; contribution in arresting poachers, helping in successful relocation of a tiger
- Discovery of new species of spiders, frogs; range extensions; spread of invasive alien species
- Better understanding of animals killed in road accidents
- Insights about snake-bite risk – data suggests that the risk is highest from 4-9 pm in the day
- Regular information on over 200 fruit bat roosts in India and neighbouring countries



Home page of Road Watch app with picture and details of bird kill in a road accident (Photo courtesy: Radhika Bhagat).

[5]*In some cases, in fact, 'doing science', may not even be the primary purpose of a Citizen Science project. These projects appear directed more towards conservation planning, policy intervention and advocacy rather than generating information and insights that will be published in peer reviewed journals.*

METHODOLOGY

This analysisis based on an initial study of 17 Citizen Science projects in ecology in India (See Annexure 1). Important to note here is the classification of Citizen Science projects. For the purpose of this study we have only included those projects that self identified themselves as Citizen Science[6]. This follows methodologies in the social studies of science and in Science and Technology Studies and provide an useful entry point into the field of study.

The report draws upon the information put out by these projects on their respective websites, the news reportage that has been discussed above, a perusal of the peer-reviewed literature generated from these projects (also mentioned above), one round of open-ended, semi-structured interviews with co-ordinators of seven of these Citizen Science projectsand one round of email communication to confirm and update the information included in the respective data sheets in Annexure 2.

The results of this analysis can be clubbed into four broad categories: a) the operative and operational part of the respective projects - details such as the organisations and individuals running the projects, their institutional prerogatives and priorities, the number of citizen scientists contributing to these projects and the data points generated so far; b) the methods and tools of data gathering (of doing the science) including questions related to gate keeping and peer review that will ensure quality of data; c) the logics, explicitly or implicitly, of using the nomenclature of 'Citizen Science, the opportunities it throws up and the challenges it offers; and d) a classification of the projects using Bonney et al's(2016)[7] typology for Citizen Science.

These four categories can be further split up into two broader sections: the first dealing with matters more quantitative that emerge from the tabulation we have done in Annexure 2, while the second is a discussion of some of the interpretive and normative dimensions based on the methods used, public articulations, the interviews we conducted and the insights from our analysis of all the above.

We use these categorisationsas a suggestive framework to help guide the analysis and its reading. As will be evident in the discussion below, these are not mutually exclusive categoriesand one does see significant overlap.

[6]16 of these projects follow the criteria of self identification as Citizen Science. We have included the 17th project ('Community based monitoring of fisheries in Lakshadweep' that appears as Project No. 4 in Annexure 1) in spite of the fact that it does not follow this central characteristic of self-identification as Citizen Science.

This particular project made a specific choice of not, calling itself a Citizen Science project mainly on account of what they believed is a class issue, where those gathering data and contributing information do so generally as a) a leisure activity, b) belong to a certain social class and c) do not have a stake in the resource being studied. The idea of the voluntary here was at odds with the understanding of the same in majority of the projects that self-identify as Citizen Science. While this understanding constitutes an important narrative by itself it also has considerable value when juxtaposed againt ideas and conceptualisations that are dominant in the current understanding and articuation of Citizen Science in India.

[7]Based on their analysis of projects mainly in the United State of America, Bonney et al. (2016) have classified Citizen Science projects into four different categories: a) Data collection, b) Data processing (categorisation, transcription, interpretation, c) Curriculum based and d) Community Science (initiated by members of the public).

A number of scholars have classified Citizen Science in different ways and developed different typologies for the same. We use Bonneyet. al (2016) only as an indicative framework that helps understand these projects in the Indian context along a particular axis. Use of other typologies will provide other insights; we don't, however, do that here because a larger study and analysis of these various typologies is beyond the scope of this report

ANALYSIS

Part I

a) Subjects of research

Citizen Science projects currently operational in India can be clubbed into four independent though sometimes overlapping categories depending on the subjects of research:

i) Class/species based: An important subset of these projects are either class and order based like BCI-eBird (Project 2, Annexure 1) and the Butterflies of India (Project 17, Annexure 1) respectively, individual species based likethe Fruit bat in the case of Pterocount (Project 14, Annexure 1) or the tiger in the Village Wildlife Volunteers Program (Project 1, Annexure 1) that, additionally, is also geographically confined to the landscape of the Ranthambhore Tiger Reserve in Rajasthan. These projects mainly seek data about the abundance, presence/absence, movement of the species concerned, helping to build up a larger understanding about these parameters.

ii) Event based: A 2nd smaller category of projects (two at the moment: RoadWatch and Roadkills; Projects 6 & 12 respectively in Annexure 1) are event/incident specific where the species does not matter. Both seek to record and thereby provide a larger understanding and patterns of deaths of wild animals in road and rail accidents.

iii) The 3rd category moves away from individual animals or species/class to look at larger ecological/ environmental/geographical dimensions of the landscape. The only project that constitutes this category at the moment is the Beach Profile Monitoring Program (Project 8, Annexure 1) on the east coast of India. Citizens are involved here in recordingdifferent characteristics such as slope, width and sand grain sized and type on a regular basis to map changes in the profile of a beach over time creating a time line analysis. It is an outlier in that sense and has other interesting perspectives, particularly on the category of the 'citizen', the nature of their participation and the logic and rationale for the use of the Citizen Science nomenclature.

The 4th category of Citizen Science projects in India would be constituted by two projects - the India Biodiversity Portal (Project 3, Annexure 1) and Bio Atlas India (Project 16, Annexure 1), which are, as the names suggest, omnibus online data aggregating platforms. The focus here is on gathering a range of ecological data that is indexed geographically and species wise.

b) Time frame

There are two parts to this: firstly, the vintage of these projects going by the year of their initiation and second, the time frames over which each

A tiger in the Ranthambhore Tiger Reserve.
(Photo: Pankaj Sekhsaria)

Home page of the Road Watch Citizen Science project
(Photo courtesy: Radhika Bhagat)

Women community volunteers record beach profile readings at Village Karukalacherry in Karaikal district, Puducherry, Year 2017 (Photo: Vivek Coelho)

of them is operating and seeking to collect information. A look at the tabulation in Annexure 1 suggests that Citizen Science in India is about a decade old. The earliest projects go back to the period 2006-2008 with five of the most recent coming up in only the last couple of years (2016-18).

Where the time frames on which they themselves operate is concerned, the projects can be divided into three main categories:

i) Ongoing projects where data is sought and being contributed continuously. This is the category in which one can place a majority of the projects we studied. There is also an overlap here with all the 'subjects of research' categories discussed above.

ii) Projects which are time bound, but episodic, where specific data is sought in a fixed period of time like in the case of migratory birds (a subset of BCI-eBird) or on the presence/absence of common birds like in Citizen Sparrow (Project 13, Annexure 1) and in the Common Bird Monitoring Program (Project 9, Annexure 1). The episodic nature appears to be a function in some cases of the nature of the natural event (arrival of birds), while in others, like in monitoring common bird species may be linked to institutional factors such as research mandates and availability of funds.

iii) The third is the one-off category, where the projects are also time-boundbut in a very specific manner. The study of the invasion of the Andaman Islands by the non-native Indian bullfrog (and other alien invasives) (Project 10, Annexure 1) (Ghosh, 2018a; Also see N. P. Mohanty & Measey, 2018; N. Mohanty, Sachin, Selvaraj, & Vasudevan, 2018)represents this category. This project is also an outlier in its use of the Citizen Science nomenclature. It was conductedlike a survey by one key researcher who gathered detailed information from a number of citizens in the particular landscape. It differs from all the other projects because the contribution and participation of citizensis passive- they were mainly respondents providing information and not pro-actively gathering data and/or information themselves as is the case in the all the other Citizen Science projects that are studied in this report.

c) Data related

One of the most important talking points and rationales for Citizen Science has been the huge potential in terms of the spatial and temporal scales of data that it offers. This becomesparticularly relevant in a large and diverse country such as India where gaps in ecological data and information continue to be considerable (see Box 2 for quotes from project co-ordinators on this). What the Citizen Science projects in India have generated thus far in terms of data is indeed very interesting. The numbers are also instructive when seen in light of the optimism and the potential expressed by many of the scientists who have initiated the current crop of such projects in India.

The range of data points generated varies vastly across the projects we looked at. BCI-eBird,

following a bird related trend worldwide, is the leader by many miles in the Indian context. The project has generated 10 million bits of information covering 1300 bird species thus far. Also uploaded to the site are more than 2,00,000 media (photo & audio) files and half a million checklists. BCI-eBirdis, in fact,now the fourth largest contributor[8] to the larger global eBird project that is located at Cornell Lab of Ornithology in the USA. The 2nd most data rich project is the India Biodiversity Portal (IBP) that has about 1.4 million entries over a much larger range covering nearly 29000 species.

On the other end of this spectrum are projects such as Frogwatch (Project 4, Annexure 1 and also a sub-set of IBP) with 2441 entries, Big4mapping (Project 7, Annexure 1) (that maps India's four most venomous snake species) with about 4400 contributions, and Hornbill Watch India (Project 15, Annexure 1) that has about a 1000 sightings contributed by citizens.

Citizen Scientists contributing

The other interesting and relevant statistic here is the number of individuals (the 'Citizen Scientists') who are actually contributing all this data. The highest

number of over 12000 individuals in again seen for the BCI-eBirdproject. This is matched by the India Biodiversity Portal (IBP) which has 10000-12000 'users' and about 1550 contributors (Prabhakar Rajgopal, Interview, 25 May 2017), though perhaps with an involvement that is relatively less intense as compared to the bird project. In many of the other cases the number

Students of Anderson Higher Secondary School, Nongstion, Meghalaya have been monitoring their peach tree for more than a year now as part of the SeasonWatch program (Photo courtesy: SeasonWatch)

of contributors runs into only a few 100s (eg. Big4 Mapping, SeasonWatch (Project 11, Annexure1) and Hornbill Watch India) and in the rest, like the Village Wildlife Volunteers program around Ranthambhore TR and the Beach Profile Monitoring Program on the Tamil Nadu and Puducherry coast, is less than a 100 individuals.

The potential and relevance of Citizen Science in gathering ecological data in a country like India is evident in this context, and the optimism and hope of scientists quite understandable - the temporal and spatial scales that need to be covered are simply not possible with the formal scientific expertise, and human and financial resources available currently. Perhaps they never will be. Citizens contributing, even while it has some clearly understood and accepted limitations, has significant advantages and potential: huge reach on the one hand and minimum cost to the establishment on the other.

[8]*Source: https://www.gbif.org/news/hWuwJwM98IisAqWaeGIQm/annual-ebird-refresh-adds-more-than-85-million-observation-records; Accessed 09 September 2018*

Box 2: On the relevance and potential of Citizen Science in India

"I think these are game changers (...) Look at (...) GBIF (the global biodiversity information facility)... (...). In the first few years it essentially used to be compiled from herbariums and museums. (...) Now citizen data, (...) has far overstepped any of this. Something like 60, 70, 80% of the data is public contributed data. It is a big changer in the kind of information that is available to you. (...) It is increasing and it will swamp it [other kind of data] very very soon (...).

We have this portal [IBP] running, right? It is reasonably easy to upload information (...) and we get - in a country of the size of India - (...) about 10-12 thousand users. (...) [This is] nowhere near the potential and the scale of this country. There are people everywhere. (...) Compare this with some country like Sweden [where] something like 100 [biodiversity related] observations an hour will get delivered (...) In India if we get 100 observations a day it is a big thing - can you imagine? (...)

We are not going to give up. This is the tip of the iceberg, this is a growing trend (...), this is the potential of this country. If not today, tomorrow, 5 years later, 10 years later they'll just beat Sweden hands down. We know this. There are people everywhere, we have nature everywhere"

- Interview, Prabhakar Rajgopal, co-ordinator, India Biodiversity Portal, 25 May 2017

d) Data Quality

The issue of the 'quality' of data in one of the big concerns where Citizen Science projects are concerned and two quotes (See Box 3), the first from a poster of the CitizenSparrow Project (Citizen Sparrow Report, 2012) which presents an analysis of nearly 11000 observations on sparrows contributed by 5655 participants and the second from an interview conducted with SuhelQuader of BCI-eBirdhighlight both, the central challenges before the Citizen Science kind of data collection and also the fact that the project proponents are acutely aware of these challenges. One of the key criticisms of the Citizen Science kind of data gathering is indeed related to the quality (Harvey, Nelson, Pacquet, Ferster, & Fox, 2018) and even the validity of the data that is contributed.

There is also a very instructive correspondence in recent (2017) issues of the journal Biological Conservation on the use of Citizen Science data from the BCI-eBird project (Praveen, 2017; Ramesh, Gopalakrishna, Barve, & Melnick, 2017a; Ramesh et al., 2017b), which points to intense debates and claims over issues of quality, reliability and methods and underscores one of the central challenges before Citizen Science.

It also highlights the awareness and effort at dealing with this from within the community of the Citizen Science projects. This is seen on either side of the data gathering exercise: creating computational tools, as Quader mentions (Box 3), to analyse and make sense of the data that has come in already, and creating, on the other end, effective gate keeping and peer review systems

that screens and approves (or keeps pending) data that contributors have uploaded:

i) BCI-eBird, which uses the review processes of eBird, has perhaps the most substantial mechanism for these in the Indian case. There are automatic filters that perform a first level check on the data that is uploaded. Mobilising big data techniques, this is approved or flagged and brought to the attention of the review system. There is an elaborate mechanism by which review responsibilities are granted for the second level of checks and reviewing. The review process is multi-layered, with reviewers being drawn from the pool of contributors itself, leading to a multi-layered gate keeping and review mechanism that is also the most inclusive of the current crop of Citizen Science projects.

ii) In other projects, Roadwatch and Big4 Mapping in particular (the same individuals are behind both the projects), the smart phone based app that drives the project is designed to limit the kind of information that can uploaded. Only those images that have been clicked at that moment via the app can be uploaded to the database. The intention is to ensure that no 'cheating' is done and only genuine instances of these road kills are recorded.

iii) In the remaining projects, which constitute the majority, the review process is controlled either by the key project co-ordinator or a team appointed by the co-ordinator. This either happens proactively like in the case of the Bio Atlas India and its various sub-projects or by default like in the Village Wildlife Volunteers program where no review mechanism appears to be in place, or has not been specifically articulated, at least.

What is also visible from an overview perspective is that this issue of quality of data and peer review has not yet been given the attention it perhaps deserves. One way to account for this is the recent vintage of the projects. One might expect to see a more engaged and rigorous quality regime as the projects mature and also face the challenges first hand. While this might not be as big a concern in projects where the main mandate is awareness generation and policy intervention, it will have a significant bearing in those projects where the claims are more scientific in nature.

Collecting data via the eBird app

Box 3: On issues of data quality related to Citizen Science

"The results presented here are based entirely on the contributions of members of the public from different parts ?of India. Although we trust that every piece of information has been contributed with good faith and the best intentions, the summaries shown here must be interpreted with caution. Because this was an opportunistic survey, the number of responses vary widely across regions and cities. In particular, reporting was much higher from cities than from towns and villages (clubbed here as "rural"). Results based on small sample sizes should be treated with appropriate caution. There is likely to be an unconscious bias on the part of participants towards reporting information about locations where sparrows are present. This would lead to an under-reporting of sparrow absence, which is very likely to be the case here"

- (Citizen Sparrow Report, 2012)

"Huge amounts of information is coming in, but it is low quality information. So that's the balance - small but high quality information and large volumes of low quality information. And BCI-eBird has decided on this end of the trade-off. We can devise the computational and analytical tools to deal with low quality information so long as there are large volumes of information."

- Interview, Suhel Quader, Co-ordinator, BCI-eBird, 26 May 2017

Analysis Part II

a) Citizen Science as data collection

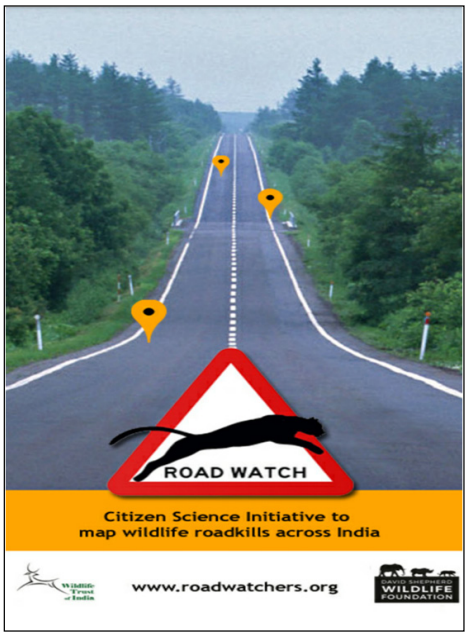
It emerges in the present context that the projects labeling themselves as Citizen Science in India like is the trend across the globe,fall primarily in the Data Collection category of the Bonneyet al. (2016) typology (see fn 7, above). Very few of the projects fit any of the other categories and if they do, these are more in terms of co-lateral engagements. The best examples of this would be the SeasonWatch project that has an explicit mandate of science educationthrough data gathering (Curriculum based in the Bonney et al. (2016) typology), and the Beach Profile Monitoring Program where the public is quite central to the development of the mandate and the agenda (Public Science in the Bonney et al. (2016) typology).

b) From within the establishment

The other complimentary and instructive dimension of Citizen Science in India as a data gathering exerciseis the institutionallocation of the projects. All of these projects have been initiated from within the structures of formal/institutional science - either, institutions with considerable state support and a mandate that is primarily academic, or non-governmental organisations that have ecological science and conversation as their primary agendas. In a majority of the projects the key individuals behind each of these projects also have a doctoral degree in the broad field of biological/ecological sciences or have an explicitly stated interest in conservation science and practice.

It is noteworthy that in a large majority of these projects it is the scientist and the scientific establishment that is seeking to invoke the category of the citizen and not the non-scientist citizen seeking to invoke a phenomenon (or a possibility) called science. It could be a function either of the need and the agency of the scientist, perhaps both, that explains the current scenario. This would perhaps be further reinforced if one tried to answer such questions about these projects as: Who initiates the projects and who participates? Who creates (perhaps even owns) the structures of data gathering and aggregation? Who takes the decisions on what is good quality data? How are citizens motivated to participate and contribute?

The only project that does not fit this categorization would be the Beach Profile Monitoring Program mentioned above, where the key initiators, though also in the non-governmental sector, have primary mandates in the social sciences and/or public mobilization of/for political/social and ecological issues.



Opening screen of the Road Watch app (Photo courtesy: Radhika Bhagat)

c) Technologies of Citizen Science

A common characteristic running across Citizen Science projects is the set of technologies that are being used for recording, collecting, transmitting, aggregating and analyzing data (Harvey et al., 2018). It is, in fact, this particular set of technologies – smart phones, apps specially created for these hand held instruments, recording devices,different softwares and the internet (Google maps, for instance) – that has made these Citizen Science projects possible in the first place. The imaginary of the most of the projects we studied is centredaround the availability of these technologies and many proponents were explicit in their articulation that what they are doing would not have been possible otherwise (See Box 4).

The absence of such technologies was also presented as one of central reasons why such projects could not have been executed in the past - an explanation, perhaps, of why the earlier discussed Asian Waterbird Census could only do this much and no more. The availability of a technology like the internet is now also facilitating the aggregation of data and information generated in the pre-internet era. One of the key efforts in some of these projects is to access and digitize data from personal and institutional archives to create histories and understandings that go much further into the past.

A prominent thread in the argument is of widening possibilities and of greater inclusion that technologies such as the internet and smart devices offer. This technology driven possibility does, however, also have a counter-point in the implications this can (and in some cases already does) have for the kind of data that can be collected, the nature of science that can be done and indeed for the very claims of inclusion, increased participation and'leveling out' of the

field. People without access to these hand-held devices or to the internet, or those without the skills to handle these technologies are likely to get excluded from the very beginning.

Another such issue that manifests in a very particular way, for instance, emerged around the idea and the discussion of 'voluntary contribution'.

Box 4: On the central role being played by a certain set of technologies

Q) "Would you tell us about this platform - the technological platform which makes this possibility possible?"
Ans) "Internet"

- Interview, Prabhakar Rajgopal, co-ordinator, India Biodiversity Portal 25 May 2017

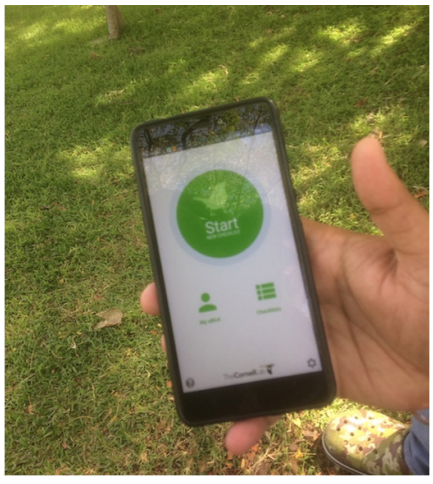
"It [technology] is a great leveller - my dad never had access - until internet came into his life. Influx of technology levelled [it] for every one and made it possible for anyone to take part."

- Interview, Ramit Singal, co-ordinator BCI-eBird, 25 May 2017

"And that is where technology actually changed my scenario. We made an app; (...) [and] added (...) frog calls into it. People can now listen to them. (...) And this February we made a frog bot. We have a facebook page (...) and [if] you ask for Rhacophorusmalbaricus - it will give you a list of things the database has. You ask [for its] calls [and] it will play that sound (...).

For me, in the field, it has changed a lot. So the way I used to do my fieldwork way back in 2000 (...),has changed drastically. Even call recording devices have already come up with software and techniques where it triggers itself. You need not have to sit there - it triggers automatically for a frog call and records for long hours."

- Interview, KV Gururaja, co-ordinator, FrogWatch, 27 May 2017



The ebird app used by the Bird Count India project (Photo: Pankaj Sekhsaria).

d) Voluntarity

The idea of 'voluntary contribution' of data by citizens was in the opinion of most project proponents central to the idea of Citizen Science. It emerged in the interviews and the detailed discussions, however, that the idea is much more fluid and complex that was initially assumed. Many meanings of 'voluntary' emerged even as it became evident that different kinds of incentives were indeed being offered to the citizens implicitly and/or explicitly for their contributions. These included, among others, a mobilization of the individual's sense of satisfaction in contributing to science[9] , authorship over the data and scientific outputs, positively structured competitive frameworks that help in increased contributions at the same time as creating a sense of achievement for the citizen, a public acknowledgement of notable contributors, giving the 'citizen' the label of a scientist, in one case a letter of appreciation by a very prominent individual and in another, certificates of participation and acknowledgement as a citizen scientist.

Money itself was not offered in any of these projects, except, interestingly, in the Village Wildlife Volunteers program. The project that has 'Volunteer' in its title refuses to label itself Citizen Science because the 50 odd rural citizens that are the major data contributors do not participate voluntarily; they are paid a monthly stipend. On the one hand it reinforces the idea of voluntarity being central in the current imagination of Citizen Science, while on the other it also re-emphasises the fact that concepts and their meanings are still very fluid as researchers, scientists and project proponents go about implementing and simultaneously understanding Citizen Science and its many dimensions.

e) The Citizen Science nomenclature

A similar ambiguity and fluidity emerged in the rationale and the decision for using the Citizen Science nomenclature. Most (though not all) of the interviewees admitted that the choice had been made without any substantial thinking or discussion on the logic, need and implications of using the term. It seemed the most natural thing to do, suggesting in an important way, the spread and tacit acceptance and the normalization of the nomenclature. Many of the project proponents found the discussion with us refreshing and useful because they were explicitly engaging withissues such as those of to 'voluntarity' and the use of the term 'Citizen Science' for the first time ever. It was forcing them, they said, to think deeper and more carefully than they had done in the past.

The discussions revealed many different reasons, understandings and logics for the use of the term and the way it was operationalized (see Box 5). Our idea of sharing some of these logics is not to indicate one is better than the other, leave alone which is right or wrong, but to mainly show the diversity in terms of understanding, articulation and interpretations.

This we believe is important and relevant from the large perspective of Citizen Science as a tool of knowledge making, of people's participation, the move towards greater participation and democratization and also the role that technology plays and will play in scientific research, monitoring and regulation.

[9]A corresponding assumption, sometimes articulated explicitly as well, was that citizens should not except any returns/rewards because they are making a meaningful contribution; this was an appeal to their capacity for altruism.

Sand grain analysis in the Sri KannanurMariyamman Temple in Village Raasapettai, District Cuddalore, Tamil nadu (Photo: Tara Rachel Thomas).

Box 5: On the logic and rationale of using the nomenclature of 'Citizen Science'

Q) This IBP for instance - is it a citizen science project?

Ans) So, I don't know the terminology. I don't know what terms you use. The way the (...) India Biodiversity Portal is constructed, (...) we would like to consider it as (...) an integrated biodiversity information platform. And what do we mean by that? (...) So there are essentially four modules that the IBP has. It has what we call an observation module which is essentially a citizen science [module] - public access, amateurs, any user comes and puts in data and asks the question (...). And anybody can observe any species - that is the citizen science...that is the observation module. That is really the public, citizen science module that we have.

- Interview, Prabhakar Rajgopal, co-ordinator, India Biodiversity Portal, 25 May 2017

And when those who are not professional scientists in this field get involved in some way, I guess, for me that is citizen science. Maybe, a slightly more suitable term being used (...) much more [now] is (...) PPSR - Public Participation in Scientific Research. That's more descriptive because it describes what's going on. Citizen science is a bit ambiguous - are citizens doing the science entirely, are they part of science? But even PPSR can be misleading because sometimes it may not be public participation but maybe the public [driven] entirely like in the case of the Kerala Bird Atlas and the Mysore Bird Atlas.

- Interview, Suhel Quader, Co-ordinator, BCI-eBird, 26 May 2017

Sudarshan Rodriguez, interestingly, had a narrative that was quite in the opposite direction. A very explicit decision was made here, he said, to label their Beach Profile Monitoring Project as 'Citizen Science' and not, for instance, 'Community based monitoring'. This, they did, he said to explicitly acknowledge that rural folk are also 'citizens'. There is, in his opinion, a class bias in the thinking and the assumptions in other citizen science projects, and this is something they wanted to explicitly address by staking a claim, as it were, on the idea of the citizen and of citizenship.

CONCLUSION

While it is clear that Citizen Science in ecology and related fields of environmental research and monitoring is rather young in India, its important to note the growing interest and rapid uptake. Different kinds of projects using the Citizen Science nomenclature and a particular set of methodologies and technological capacities are coming on line and they offer interesting possibilities.

One of the big pluses of the Citizen Science way of gathering data, particularly in the fields of ecology and the environment are the large temporal and spatial scales that they can help achieve. This is already visible in some of the projects and the opportunity is huge indeed. Citizen Science has the potential of delivering important scientific outputs, of simultaneously democratising the processes of environmental monitoring and regulation and also increase the public involvement and understanding of science. There are some key bottlenecks and challenges, however, that will have to be overcome if this is to be achieved.

One of the key challenges articulated by project proponents is that of sustainability linked to the availability of financial resources. Another challenge is to increase the participation of more citizens, in addition of course, to sustaining the enthusiasm and motivation of the citizens who are already contributing. The third challenge is related to the data that is being generated by Citizen Science projects. One of these concerns is related to the quality and validity of the data being contributed, while the other is that of intellectual property – matters of the ownership of data and also the conditions under which publicly sourced data will be allowed for use. There is also the need for developing tools and institutional structures whereby data generated from Citizen Science projects can be widely and effectively used in decision making processes and also in regulation and monitoring.

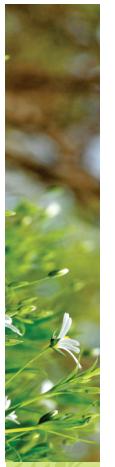
We would say in conclusion that there is an exciting time ahead for scientific research on the one hand and monitoring and regulation on the other given what Citizen Science has to offer and much can indeed be done by all stakeholders – project co-ordinators, citizens and citizen scientists, technology platforms and innovations, funding agencies, the media, non-governmental organisations and governmental agencies such as the DST, DBT and the MoEFCC–in contributing towards this end.

ANNEXURE 1

Summary of Citizen Science projects studied

No.	Title of Project	Year	Project website	Co-ordinating Institution/s	Co-ordinator (Individual/s)	Species/ Taxa/ Subject	Geographical spread of project	Notable outputs, egs.
1	Village Wildlife Volunteers (VWV)	2013	***	Tiger Watch	Dharmendra Khandal	Tigers (Mainly); also leopards;	Around Ranthambhore TR (RTR), Rajasthan	New information of tiger presence; Contribution in arrest of many poachers, successful relocation of tiger
2	BirdCount India – eBird India (BCI-eBird)	2014	https://birdcount.in/; https://ebird.org/india/home;	Nature Conservation Foundation	Ramit Singal; Suhel Quader	Birds	All India	Many! (Check website for details!)
3	India Biodiversity Portal	2008	https://indiabiodiversity.org/	Strand Lifes Sciences	Prabhakar Rajgopal; Thomas Vettakavan	All biodiversity	All India	Many: A new spider species recordedl range extension of a reptile
4	Frogwatch	2014	https://indiabiodiversity.org/group/frog_watch/show?pos=7	Individual driven; collaboration/ piggybacking on IBP	KV Gururaja	Frogs	All India	Description of two new frog species in 2016
5	Community based monitoring of fisheries in Lakshadweep	2014	https://www.dakshin.org/	Dakshin Foundation, Bengaluru	Naveen Namboothri	Fishes and Fisheries	Lakshadweep Islands	***
6	Roadwatch	2018	https://www.roadwatchers.org/	Wildlife Trust of India	Radhika Bhagat, Jose Louies	Road kills of animals	All India	Reptiles appear to top the list of animals killed on the road!
7	Big4 Mapping	2016	https://snakebiteinitiative.in/snake/	Individual driven	Jose Louis	Snakes (particularly the four poisonous snakes of India)	All India	Max risk of bites is 4-9pm

8	Beach Profile Monitoring Program	2013	***	Tata Institute of Social Sciences	Sudarshan Rodriguez; Vivek Coelho; Jesu Rethinam; Gandimathi Alagar	Beach characteristics	Karaikkal, Nagapatinam and Cuddaloredists of TN; also Puducherry	***
9	Common Bird Monitoring Project (BNHS)	2015	www.ibcn.in	Bombay Natural History Society	Nandkishor Dudhe	All birds	Initially Maharashtra; eventually all India	***
10	The invasive Indian bullfrog on the Andaman archipelago	2015	***	DST-NRF Center of Excellence for Invasion Biology, Department of Botany and Zoology Stellenbosch University	Nitya Prakash Mohanty	Indian bullfrog, Giant African snail Common myna, house sparrow,	Andaman Islands	An understanding of the spread of an invasive species
11	SeasonWatch	2008	www.seasonwatch.in/	Nature Conservation Foundation and the National Centre for Biological Sciences	Geetha Ramaswami	Leaf phenology, flowering and fruiting of 100+ common trees in India	All India	Some insights whether flowering of trees is changing?
12	Roadkills	2018	www.roadkills.in	Wildlife Conservation Trust	Milind Pariwakam	Animal kills in road and train accidents	All India	
13	Citizen Sparrow	2012	http://www.citizensparrow.in/	BNHS, MoEF	***	Sparrows	All India	***



14	Pterocount - South Asia Bat Monitoring Programme	2005	https://pterocount.org/	Zoo Outreach Organisation	Sanjay Molur; Shahroukh Mistry	Bats; in particular Flying fox or Fruit Bat	India and neighbouring countries	Information on over 200 roosts in India and neighbouring countries observed. At least three PhDs
15	Hornbill Watch India	2014	http://www.hornbills.in/	Nature Conservation Foundation	Aparajita Datta	Hornbills - 9 species found in India	All India	***
16	Biodiversity Atlas - India	2017	http://bioatlasindia.org/	National Centre for Biological Sciences	Krushnamegh Kunte	All biodiversity	All India	Half a dozen new species description, a few dozen species rediscoveries and new species reports for India
17	Butterflies of India	2010	http://www.ifoundbutterflies.org/home	National Centre for Biological Sciences	Krushnamegh Kunte	Butterflies	All India	One new species discovery; rediscoveries of a dozen endemic and endangered species and comprehensive species inventories of several biodiversity hotspots across India

ANNEXURE 2

Details of the Citizen Science projects studied

No. 1		
1	**Title of Project**	**Village Wildlife Volunteers (VWV)**
2	Sub Projects	***
3	Year of initiation	2013
4	Project website	***
5	Co-ordinating Institution	Tiger Watch
6	Nature of Institution	NGO
7	Location of Institution	Sawai Madhopur, Rajasthan
8	Institution website	https://www.tigerwatch.net/
9	Collaborating institutions	***
10	Co-ordinator (Individual/s)	Dharmendra Khandal
11	Co-ordinator qualifications	Phd (Biological/Ecological Sciences)
12	Contact details	dharmkhandal@gmail.com
13	Species/Taxa/Subject	Tigers (Mainly); also leopards; monitoring wildlife movement outside protected areas
14	Geographical reach/spread of project	Around Ranthambhore TR (RTR), Rajasthan
15	Notable outputs, egs.	New information of tiger presence; adding to list of tigers in landscape; other notable ecological and animal behaviour information. Contribution in arrest of many poachers, successful relocation of tiger
16	Citizen Scientists' participating	51 VWVs in the field managed by 8 coordinators
		Each is paid about US$58 per month ($@Rs. 70)
17	Data points generated	***
18	Purpose of project	
	A)	Wildlife monitoring (Filling in a gap in available information on tiger dispersal from RTR)
	B)	Human wildlife conflict reporting and assistance
	C)	Management and conservation (not so much for scientific purposes)
	D)	To get information on wildlife related crimes
19	Normative articulation for project (as articulated)	Local villagers are best placed to do this monitoring
20	Genesis of idea	Long experience in the field; identifying gaps and potential based on situation on the group and first hand experience
21	Technologies involved	Camera traps, Smart phones, cameras
22	Credibility of data issues (Gate keeping, review, etc)	No formal mechanism; driven by expertise of PI/NGO head
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	No
	C) Curriculum based	No

	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	Yes
	B) Conservation	Yes
	C) Investigation	Partially
	D) Virtual projects	No
	E) Education projects	No
25	Agenda Setting	By the Scientist/NGO
26	Nomenclature	
	A) Public image	Citizen Science/ (conservation initiative)
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	Not citizen science because not voluntary. VWVs are paid; otherwise all forest staff should be considered citizen scientists
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	No
27	Voluntarity (as articulated)	
	A) As articulated	Voluntarity is crucial if it is to be called Citizen Science
	B) Other dimensions	VWVs are given a financial incentive, a stipend. What about forest field staff that have been recorded as doing >40 different tasks on field?
28	Nature of Citizen Scientist	Local farmers, livestock keepers
29	Class Issues (as articulated)	***
30	Challenges	Collaboration and coordination with FD
31	Limitations	***
32	Promises	***
33	Threats	Threat to life of VWV's due to work in forests
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	Proactive mechanism to keep VWVs motivated and to increase people involved, awareness, area of work etc.
37	Licences/ data ownership/sharing/ accessing	***
38	Sources	
	Interviews	2; one with PI and one with lead VWV
	Literature	(Bengali, 2016; TigerWatch, 2015, 2016, 2017)
*** A) Action (community initiated); B) Conservation (natural resource management; include explicit educational goals; data centric);C) Investigation (focused on scientific research and data collection; knowledge production; initiated by academics); D) Virtual projects (ICT mediated, no physical elements: astronomy, paleontology, proteomics); E) Education projects (education and outreach are primary goals)		

No. 2		
1	**Title of Project**	**BirdCount India – eBird India (BCI-eBird)[10]**
2	Sub Projects	Bird Count India is a partnership of a large number of organizations and groups working to increase our collective understanding of the distribution, abundance, and population trends of Indian birds; eBird is a global, internet based platform for collating observations of birds, and for birders to maintain records of their sightings. It is housed in Cornell University's Laboratory of Ornithology. Hundreds of thousands of birders use eBird, including many thousand from India.
3	Year of initiation	2014
4	Project website	https://birdcount.in/; https://ebird.org/india/home
5	Co-ordinating Institution	Nature Conservation Foundation
6	Nature of Institution	NGO/Scientific
7	Location of Institution	Bengaluru, Karnataka
8	Institution website	www.ncf-india.org
9	Collaborating institutions	National Centre for Biological Sciences, Bengaluru; ebird, Cornell University (Both scientific/academic); there is a full list of 42 organisations on the website!
10	Co-ordinator (Individual/s)	Ramit Singal; Suhel Quader
11	Co-ordinator qualifications	B Engg.; PhD (Biological/Ecological Sciences)
12	Contact details	ramitsingal@gmail.com; suhelq@gmail.com
13	Species/Taxa/Subject	Birds
14	Geographical reach/spread of project	All India; but participation and contribution is not uniform across the country
15	Notable outputs, egs.	Many! (Check website for details!)
16	Citizen Scientists' participating	>12,000 (May 2018)
17	Data points generated	> 10 million; >1300 species; > 2,00,000 media (photo & audio); >half a million checklists (May 2018)
18	Purpose of project	
	A)	Filling a huge data gap about bird distribution, abundance and migration
	B)	Creating an interest in the public in birds and in nature
	C)	Management, conservation
	D)	
19	Normative articulation for project (as articulated)	Democratisation of science; scientists need not (should not) have a strong role/claim/control over knowledge; Breaking the scientist/non-scientist barrier
20	Genesis of idea	(for Suhel): experience with the Royal Society for the Protection of Birds (RSPB), UK; also critiques from former (amateur) birdwatchers that scientists don't come back to work with them even though they birded together in the earlier days

[10] Bird Count India (BCI) encourages documenting and monitoring of India's birds through the eBird-India platform. This project is therefore referred to as Bird Count India--eBird India and abbreviated hence forth as BCI-eBird.

21	Technologies involved	Smart phone, internet, big data (AI, softwares), Softwares like Excel, R, Stata
22	Credibility of data issues (Gate keeping, review, etc)	Elaborate multi-tiered mechanism for review (function of the huge data and large network involved); high volume, low quality data
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	Yes
	C) Curriculum based	Yes
	D) Community science (initiated by members of public)	Yes, but not initiated from the community side; (smaller, regional level efforts like the Kerala Bird Atlas and the Mysore Bird Atlas initiated by community)
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	Partially
	C) Investigation	Yes
	D) Virtual projects	Partially
	E) Education projects	Yes
25	Agenda Setting	By the Scientist/Institution
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	Peoples/Public participation in Scientific Research
	B) Reason for use of the nomenclature	
	C) Informal backstage articulations	Have moved away from emphasising Citizen Science; public participation; Citizen Science is a term that's widely used and understood and it doesn't matter what it is called as long as you are clear what you want to achieve and how
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	No; nomenclature less important that principles such as public access, contribution to public purpose
27	Voluntarity (as articulated)	
	A) As articulated	Important dimension (altruism!)
	B) Other dimensions	But non-financial incentives are given: games, credit, acknowledgement, that of contributing to something bigger!
28	Nature of Citizen Scientist	Voluntary bird enthusiasts
29	Class Issues (as articulated)	Technology and language are barriers
30	Challenges	Get more people to participate; use existing date for more analysis; lack peer to peer review culture (deference to authority of age/experience); long term survival - can this continue beyond 20 years; fun of birding lost because of automation/too much structuring? maintaining data quality; maintaining motivation;

31	Limitations	Activities circumscribed within what the project wants; conditions people to think in particular ways; not achieved the scale possible; limited by connectivity/ access to/of birders
32	Promises	Huge
33	Threats	The possibility that false data be seeded to achieve vested interests and goals. It happened in one case and individual was blacklisted
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	Ebird became successful when it re-articulated its job not as science but as a tool to make birding easier and fun for participants
37	Licences/ data ownership/sharing/ accessing	Free for download and use for education, research and conservation
38	Sources	
	Interviews	2
	Literature	(Behrawala, 2018; Bisht, 2018; Ghosh, 2018b; Lopez, 2018; Perinchery, 2018b; Shinde, 2018)

A Black-necked stork, Kutch, Gujarat (Photo: Pankaj Sekhsaria).

No. 3		
1	**Title of Project**	**India Biodiversity Portal**
2	Sub Projects	TreesIndia, MothsIndia, Alien invasives, Frogwatch etc. (60 such subgroups/subprojects)
3	Year of initiation	2008 (picked up steam 2011)
4	Project website	https://indiabiodiversity.org/
5	Co-ordinating Institution	Strand Life Sciences
6	Nature of Institution	Academic - Corporate-NGO collaborative
7	Location of Institution	Bengaluru, Karnataka
8	Institution website	
9	Collaborating institutions	A consortium of academic institutions and environmental NGOs; a civil society initiative with no government participation; initiated by ATREE, National Knowledge Commission
10	Co-ordinator (Individual/s)	Prabhakar Rajgopal; Thomas Vattakavan
11	Co-ordinator qualifications	PhD (Biological/Ecologial Sciences)
12	Contact details	prabha.prabhakar@gmail.com
13	Species/Taxa/Subject	All biodiversity
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	Many: A new spider species recorded; range extension of a reptile.
16	Citizen Scientists' participating	About 1500 contributors (@ 15000 users)
17	Data points generated	13.5 lakh data points for over 43000 species; descriptive content for over 28700 species (2018); cited in over 100 publications
18	Purpose of project	
	A)	Harnessing technology and citizens to fill big data gaps
	B)	Democratisation of science
	C)	creating/stimulating social networks where biodiversity amateurs and experts can interact
	D)	aggregating curated biodiversity data for all species in India
19	Normative articulation for project (as articulated)	Democratisation of science; blowing away of hierarchy and flattening out of systems; scientists and citizens are part of the same spectrum
20	Genesis of idea	Experience during PhD and post-doc days - exposure to and realisation of the scale of issues and data gaps; civil society initiative to come together - catalysed by funding provided by the Critical Ecosystem Partnership Fund (CEPF); following from initiative of the NKC
21	Technologies involved	Internet, mobile devices; big data and mapping technologies
22	Credibility of data issues (Gate keeping, review, etc)	Elaborate mechanism for gate keeping involving a small group of people as gate keepers and reviewers
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	Yes

	C) Curriculum based	No
	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	No
	C) Investigation	Yes
	D) Virtual projects	Yes
	E) Education projects	Partially?
25	Agenda Setting	By scientist
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	No
27	Voluntarity (as articulated)	
	A) As articulated	Voluntarity is central (altruism!)
	B) Other dimensions	But citizens do get other benefits such as name, fame, a satisfaction of contributing!
28	Nature of Citizen Scientist	A wide range of people - professionals, amateurs, farmers
29	Class Issues (as articulated)	***
30	Challenges	Funding and long term sustainability; losing competitive edge if a big player like Google decides to come into the picture
31	Limitations	Unable to achieve the scale it has the promise for; taxonomic and geographical biases
32	Promises	***
33	Threats	If information is power, will this create new power hierarchies?
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	Observation module is the mainly Citizen Science module
37	Licences/ data ownership/sharing/ accessing	Creative Commons Public Domain Waiver (CC-Zero)
38	Sources	
	Interviews	1
	Literature	(Agnihotri et al., 2016; David, 2008; Perinchery, 2018b; Vattakaven et al., 2016; Warrier, 2017)

No. 4		
1	**Title of Project**	**Frogwatch**
2	Sub Projects	Part of India Biodiversity Portal
3	Year of initiation	2014
4	Project website	https://indiabiodiversity.org/group/frog_watch/show?pos=7
5	Co-ordinating Institution	Individual driven; collaboration/ piggybacking on IBP
6	Nature of Institution	***
7	Location of Institution	Bengaluru, Karnataka
8	Institution website	
9	Collaborating institutions	Srishti School of Art, Design and Technology;Gubbi Labs, Earthwatch Institute
10	Co-ordinator (Individual/s)	KV Gururaja
11	Co-ordinator qualifications	PhD (Biological/Ecological Sciences)
12	Contact details	gururaja.kv@srishti.ac.in
13	Species/Taxa/Subject	Frogs
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	Description of two new frog species in 2016
16	Citizen Scientists' participating	454 members, 2 founders, 6 moderators
17	Data points generated	2840
18	Purpose of project	
	A)	To get scientific information on frogs
	B)	Create more interest and expertise on frogs in lay public
	C)	Conservation
	D)	***
19	Normative articulation for project (as articulated)	Democratisation of science; push up baseline understanding and expertise of science, forcing science and scientists to go one notch further
20	Genesis of idea	Partly because of personal experiences of apathy and dis-interest shown by PhD supervisor
21	Technologies involved	Internet, smart phones, apps
22	Credibility of data issues (Gate keeping, review, etc)	part of the IBP structures/operation; 6 moderators
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	No
	C) Curriculum based	No
	D) Community science (initiated by members of public)	Partially; perhaps as an un/intended outcome of the growth and reach of project
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	Partially
	C) Investigation	Yes

	D) Virtual projects	No
	E) Education projects	Unintended, yes
25	Agenda Setting	By Scientist
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	By default
	C) Informal backstage articulations	Not explicitly telling participants that they are doing science!
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	No
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	City based wildlife enthusiasts; rural folk; FD staff
29	Class Issues (as articulated)	Lots of IT types, who don't recognise this as voluntary work!
30	Challenges	Is structured/formal science coming in its own way - through hierarchy and such other structures of power?
31	Limitations	Very limited reach; also limited expertise available
32	Promises	***
33	Threats	***
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	Science should be made simple; not 60 parameters but 4-5 so that citizens can participate and don't get intimidated or lose interest
37	Licences/ data ownership/sharing/ accessing	Same as IBP
38	Sources	
	Interviews	1
	Literature	

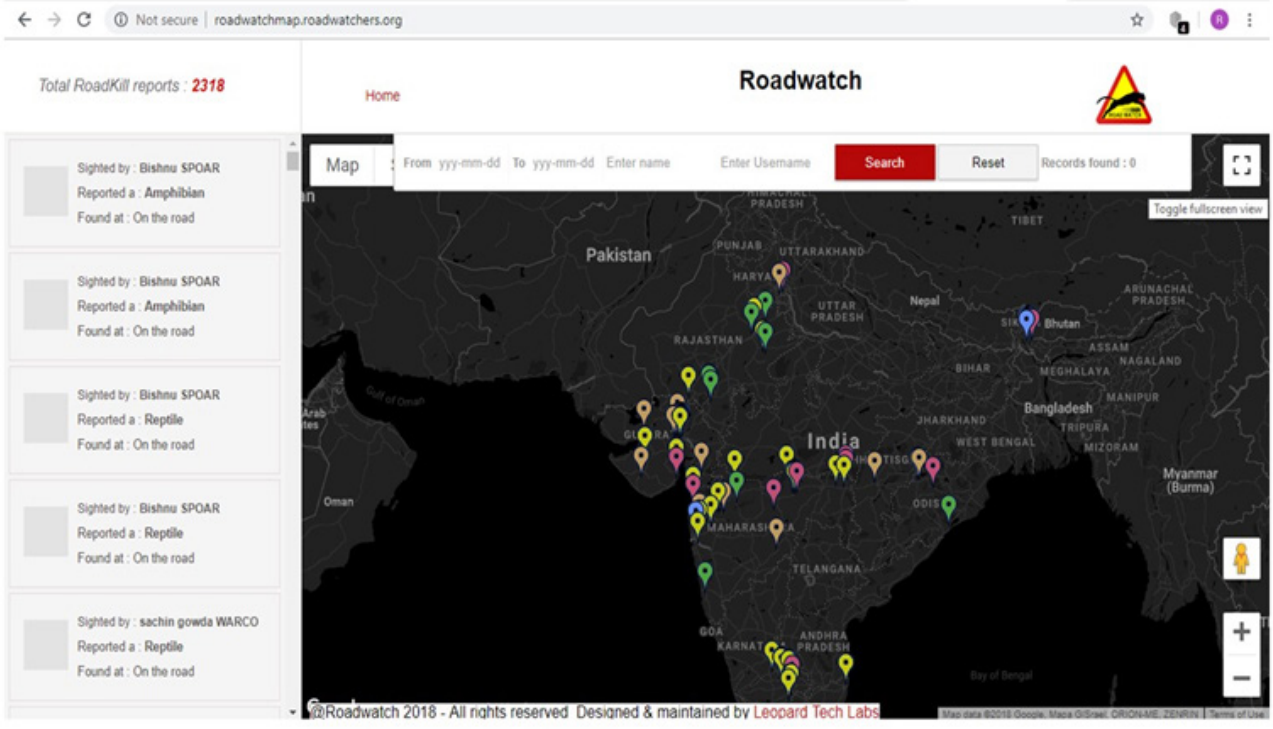
No. 5		
1	**Title of Project**	**Community based monitoring of fisheries in Lakshadweep**
2	Sub Projects	
3	Year of initiation	2014
4	Project website	https://www.dakshin.org/mobilizing-communities-for-sustainable-and-equitable-fisheries-governance-in-lakshadweep/
5	Co-ordinating Institution	Dakshin Foundation, Bengaluru
6	Nature of Institution	Science/Conservation NGO
7	Location of Institution	Bengaluru, Karnataka
8	Institution website	www.dakshin.org
9	Collaborating institutions	***
10	Co-ordinator (Individual/s)	Naveen Namboothri
11	Co-ordinator qualifications	Phd (Biological/Ecological Sciences)
12	Contact details	naveen.namboo@gmail.com
13	Species/Taxa/Subject	Fishes and Fisheries
14	Geographical reach/spread of project	Lakshadweep Islands
15	Notable outputs, egs.	***
16	Citizen Scientists' participating	A total of 39 boats have contributed to the community-generated dataset till data over four years. This amounts to approximately 18% of actively fishing boats in the project islands viz. Agatti, Kadmat, Kavaratti and Minicoy
17	Data points generated	39, if each fishing boat is considered a data point. 4037 fishing records in total, till date.
18	Purpose of project	
	A)	Monitor fisheries stock along with the people who are in constant engagement with the resource
	B)	Create an alternative, peoples narrative on resource related trends and patterns
	C)	Empower community through creation and ownership of data
	D)	***
19	Normative articulation for project (as articulated)	Democratisation of science; decentralisation of power
20	Genesis of idea	***
21	Technologies involved	Low end technology: paper pen; possibility of smart phone; MS Excel (technologies create imbalances egs. of motorisation, internet)
22	Credibility of data issues (Gate keeping, review, etc)	No explicit mechanisms; built on trust and mutual affinities; Communities have complete ownership over the data points they generate and can decide to not share the data Dakshin can only use aggregated datasets and will not share data that will allow tracing back to which boat/individual the data came from.
23	Typology (Bonney et. al)	
	A) Data collection	Yes

	B) Data processing (categorisation, transcription, interpretation)	No
	C) Curriculum based	No
	D) Community science (initiated by members of public)	Yes, in a significant way, but process is driven by the NGO/ Scientists
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	Partially, yes
	B) Conservation	Partially, yes
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	No
25	Agenda Setting	By Scientist, but more explicitly with the community than all the others
26	Nomenclature	
	A) Public image	Community based fisheries monitoring
	Alternative nomenclature	Fish for the future
	B) Reason for use of the nomenclature	Discomfort with using terms 'citizen' and 'science' because both come with their baggage
	C) Informal backstage articulations	CBCM
	D) Deeper normative positions/ explanations/explorations	Term 'Citizen Science' has specific class, resources and other such baggages; also related to stake of participants; participation in CS is driven by a sense of altruism or the perceived need to do "your two bits" for the planet; participation in the CBM is driven by a perceived need to develop reliable information both for personal and general use CS takes what comes its way, whereas CBM goes out to seek information in a particular way
	E) Thought explicity about nomeclature?	No
27	Voluntarity (as articulated)	
	A) As articulated	Is voluntarity a function of class? In this project clear stakes are involved. It is voluntary but stakes are involved
	B) Other dimensions	There is a stake and an incentive though it is non-financial; fishers given other incentives like visibility
28	Nature of Citizen Scientist	Fisherfolk
29	Class Issues (as articulated)	There is a urban/rural divide; people participating in 'Citizen Science' come from a certain class and section of society; they can afford to do CS as it also a leisure activity
30	Challenges	To keep interest of the community going; to pull out tangible results that are relevant and useful for the community; to follow up with the fishers on a regular basis to ensure steady participation

31	Limitations	Currently dependent on individual boat representatives. If the participating crew member or owner is absent from fishing for a certain period of time, data from that boat is also lost. Fishing records received from participants are often sporadic and not consistent over time. This needs to be scaled-up and streamlined to create a more robust dataset.
32	Promises	A new narrative of resource and resource use; challenging status quo; empowering community
33	Threats	Fudging data because of the stakes involved
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	- A calendar series titled Fish for the Future (2015-2018) created in English, Malayalam (language in islands other than Minicoy) and Mahl (language in Minicoy) as outreach material. The calendars showcase photographs of actively participating boats in the programme . They also include data collected through this programme or specific messages regarding sustainability or resource management in a simplified, customized format, for the benefit of the local community - Has created an alternative narrative about the resource; other CS projects like Ebird make abstract contributions as against something clear and solid here; Tapping into local knowledge of fisheries!
37	Licences/ data ownership/sharing/ accessing	Owned by the community in collaboration with the institution
38	Sources	
	Interviews	1
	Literature	(Khot et al., 2017)

No. 6		
1	**Title of Project**	**Roadwatch**
2	Sub Projects	
3	Year of initiation	2018
4	Project website	https://www.roadwatchers.org/
5	Co-ordinating Institution	Wildlife Trust of India
6	Nature of Institution	NGO
7	Location of Institution	New Delhi
8	Institution website	
9	Collaborating institutions	David Shephard Wildlife Conservation Foundation, UK; a number of others on the website!
10	Co-ordinator (Individual/s)	Radhika Bhagat, Jose Louies
11	Co-ordinator qualifications	Radhika – MSc Wildlife Sciences Jose – BSc Computer Science; PG Diploma in IT Security and Networking
12	Contact details	radhika@wti.org.in; roadwatchindia@gmail.com
13	Species/Taxa/Subject	Road kills of animals
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	Reptiles appear to top the list of animals killed on the road!
16	Citizen Scientists' participating	Over 1000
17	Data points generated	Over 2200 (October 2018)
18	Purpose of project	
	A)	To understand scale and spread of problem of roadkills
	B)	To initiate mitigation measures
	C)	Raise public awareness through the “I Brake for Wildlife" campaign
	D)	To impact policy level decisions of linear infrastructure impact on wildlife
19	Normative articulation for project (as articulated)	***
20	Genesis of idea	Issue based ideation in response to roadkills and availability of technology based solutions
21	Technologies involved	Smart phone, apps, internet
22	Credibility of data issues (Gate keeping, review, etc)	In built locked-in features in app to ensure no cheating!
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	No
	C) Curriculum based	No
	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No

	B) Conservation	Yes
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	No
25	Agenda Setting	NGO
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	Technology based conservation solution
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	Citizen knowledge, data gathered by citizen is also science
	E) Thought explicity about nomeclature?	Yes
27	Voluntarity (as articulated)	
	A) As articulated	Integral to project success
	B) Other dimensions	Hadn't thought of it, but accepted in discussion that voluntarity was central
		Participants get non-material, intangible benefits like recognition and of contribution to a larger issue
28	Nature of Citizen Scientist	Interested wildlifers
29	Class Issues (as articulated)	***
30	Challenges	Getting govt to accept this data is valid; getting physical access to places (like in PAs); need for constant engagement of citizens to ensure data flow
31	Limitations	Range and spread of data is decided by presence/absence of citizen
32	Promises	Centralised database with open access and accurate data
33	Threats	***
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	***
37	Licences/ data ownership/sharing/ accessing	***
38	Sources	
	Interviews	1
	Literature	(Behrawala, 2018; Chatterjee, 2018; Singh, 2018)



A screenshot of the Roadwatch project website homepage with live map

A joint initiative by

GLOBAL SNAKEBITE INITIATIVE

Opening screen of the Big4Mapping

No. 7		
1	**Title of Project**	**Big4 Mapping**
2	Sub Projects	
3	Year of initiation	2016
4	Project website	https://snakebiteinitiative.in/snake/
5	Co-ordinating Institution	Individual driven
6	Nature of Institution	NGO supported
7	Location of Institution	New Delhi
8	Institution website	https://www.indiansnakes.org/
9	Collaborating institutions	Wildlife Trust of India, Madras Crocodile Bank Trust, Tropical Institute of Ecological Sciences
10	Co-ordinator (Individual/s)	Jose Louis
11	Co-ordinator qualifications	BSc, Computer Science; PG diploma in IT security
12	Contact details	jose@wti.org.in
13	Species/Taxa/Subject	Snakes (particularly the four poisonous snakes of India)
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	Max risk of bites is 4-9pm
16	Citizen Scientists' participating	1200 volunteers
17	Data points generated	4400 (July 2018)
18	Purpose of project	
	A)	Getting information about snake distribution, ecology
	B)	Information on snake-bites
	C)	Dealing with the snake bite problem in India
	D)	***
19	Normative articulation for project (as articulated)	***
20	Genesis of idea	***
21	Technologies involved	Mobile phone, apps, internet
22	Credibility of data issues (Gate keeping, review, etc)	This is a key concern; Couple of individuals are the gate keepers; also inbuilt features locked into the app that ensure credibility (like a photo cannot be attached unless taken at that moment)
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	No
	C) Curriculum based	No
	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	Yes
	C) Investigation	Yes

	D) Virtual projects	No
	E) Education projects	No
25	Agenda Setting	Individual/NGO
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	Citizen knowledge, data gathered by citizen is also science
	E) Thought explicity about nomeclature?	No
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	Hadn't thought of it, but accepted in discussion that voluntarity was central
		Participants get non-material, intangible benefits like recognition and of contribution to a larger issue
28	Nature of Citizen Scientist	Snake rescuer community
29	Class Issues (as articulated)	***
30	Challenges	***
31	Limitations	***
32	Promises	***
33	Threats	***
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	***
37	Licences/ data ownership/sharing/ accessing	***
38	Sources	
	Interviews	1
	Literature	(Anon., 2017; Sudhi, 2018)

No. 8		
1	**Title of Project**	**Beach Profile Monitoring Program**
2	Sub Projects	
3	Year of initiation	2013
4	Project website	
5	Co-ordinating Institution	TISS
6	Nature of Institution	Academic/Social Science
7	Location of Institution	Mumbai
8	Institution website	www.tiss.edu
9	Collaborating institutions	SNEHA and Law Trust
10	Co-ordinator (Individual/s)	Sudarshan Rodriguez; Vivek Coelho; Jesu Rethinam; Gandimathi Alagar
11	Co-ordinator qualifications	Vivek Coelho – MSc Disaster Management
12	Contact details	sudarshan.rodriguez@gmail.com; vivekcoelho@gmail.com; snehangt@gmail.com; lawtrust1986@gmail.com
13	Species/Taxa/Subject	Beach characteristics – beach profiles, sand grain size analysis
14	Geographical reach/spread of project	Karaikkal district of PuducherrylNagapatinam and Cuddaloredistricts of Tamil Nadu
15	Notable outputs, egs.	***
16	Citizen Scientists' participating	35; also 120 community volunteers trained in beach profiling and sand size analysis at 20 locations
17	Data points generated	12 beach profiles per year (monthly data collection) at six locations for two years. Total of 216 sand samples analysed i.e. three per location/per month
18	Purpose of project	
	A)	Get timeline/time sequence data on the dynamic nature of beaches, their changing proflies like slope, type of sand (satellite data can only give width); to observe, document, monitor and evaluate shoreline dynamics that occur due to various natural and anthropogenic processes
	B)	Build capacity, social capital, stewardship of coastal ecology
	C)	Science education and awareness; entry point for disaster risk reduction and building community resilience
	D)	Possible 'counter-science'. Generate locale specific micro-level data
19	Normative articulation for project (as articulated)	Democratisation of science; Do it yourself
20	Genesis of idea	Personal experience of working with scientists and wondering a) what is the status of the field assistants and b) what of the future of their skills and capacities built during the course of a research project
21	Technologies involved	Very basic; jugaad like innovations developed locally - like surveying tools from locally available material like PVC pipes, bathroom fittings, girl's hair bands etc. Data sheets, photographs and graphs; Cost of equipment, data collection is Rs. 10000/per location/per year

22	Credibility of data issues (Gate keeping, review, etc)	Not clear what the exact mechanism is, but articulated as a very important issue to ensure legitimacy, credibility etc; Field staff does first level of checking, verification and archiving of data generated from the project. There will be errors but citizen science can achieve much more than just generating data (eg. social capital, capacity etc)
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	Yes
	C) Curriculum based	Partially
	D) Community science (initiated by members of public)	Yes, partially
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	Yes, partially
	B) Conservation	No
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	No
25	Agenda Setting	Educational institution/NGO/ community
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	Very explicit: to show that rural coastal fishing communities are also made up of 'citizens'; it is to mobilise this constitutional category
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	Democratisation; challenging institutions and formal data; counter-science; community building, social capital building, community stewardship and resilience building
	E) Thought explicity about nomeclature?	Yes
27	Voluntarity (as articulated)	
	A) As articulated	A mid-way position; voluntarism is not mandated or expected, but conceptually should play a role
	B) Other dimensions	Livelihood is the primary priority. Scope for voluntarism is limited as financial stability is a criteria to volunteer ones time an resource
28	Nature of Citizen Scientist	Members of the local fishing communities!
29	Class Issues (as articulated)	Mobilising the category of citizen for the rural, coastal dwelling community
30	Challenges	Funding; inability to scale; getting the local people interested initially - to make them see the benefits!
31	Limitations	Not much data during lowest tide days as these are days of best fishing and the community is busy fishing/attending to livelihood needs

32	Promises	Huge; there is in fact no other mechanism to map /monitor the coastline
33	Threats	***
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	Some of the citizen wanted to be called scientists - wanted a certificate from TISS – over 30 community volunteers and field staff have recd these certificates
37	Licences/ data ownership/sharing/ accessing	The community, field partner organisations and TISS jointly own the data
38	Sources	
	Interviews	1
	Literature	(Coelho, Rethinam, Alagar, & Thomas, 2018; "Empowering local communities to take care of our beaches," 2017; Prasad, 2017; TISS, 2017)

Young volunteers recording beach profile at village North Vanjore, District: karaikal, Puducherry (Photo: Vivek Coelho).

No. 9		
1	**Title of Project**	**Common Bird Monitoring Project (BNHS)**
2	Sub Projects	
3	Year of initiation	2015
4	Project website	www.ibcn.in
5	Co-ordinating Institution	Bombay Natural History Society
6	Nature of Institution	Scientific NGO
7	Location of Institution	Mumbai, Maharashtra
8	Institution website	www.bnhs.org
9	Collaborating institutions	***
10	Co-ordinator (Individual/s)	Nandkishore Dudhe, Program Officer, BNHS
11	Co-ordinator qualifications	MSc Environmental Science
12	Contact details	n.dudhe@bnhs.org
13	Species/Taxa/Subject	All birds
14	Geographical reach/spread of project	The programme will initially focus on Maharashtra state, but amateur bird watchers will eventually be involved across India
15	Notable outputs, egs.	***
16	Citizen Scientists' participating	More than 150 participants (2017)
17	Data points generated	51095 bird sightings in 2017
18	Purpose of project	
	A)	Understanding long-term changes in bird populations at pan-Maharashtra level
	B)	Promotion of awareness and bird conservation
	C)	***
	D)	***
19	Normative articulation for project (as articulated)	***
20	Genesis of idea	***
21	Technologies involved	Quite basic - using excel sheets; laying of grids using GIS software; email
22	Credibility of data issues (Gate keeping, review, etc)	Using standard monitoring protocols like the line transect method; repeat visit to same place at same time etc.; a fixed protocol put in place by BNHS; probably done by BNHS researchers at the backend
23	Typology (Bonney et. al)	
	A) Data collection	yes
	B) Data processing (categorisation, transcription, interpretation)	no
	C) Curriculum based	no
	D) Community science (initiated by members of public)	no
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No

	B) Conservation	Partially
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	No
25	Agenda Setting	Institution
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	Amateur birders
29	Class Issues (as articulated)	***
30	Challenges	***
31	Limitations	***
32	Promises	***
33	Threats	***
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	***
37	Licences/ data ownership/sharing/ accessing	***
38	Sources	
	Interviews	0
	Literature	(Behrawala, 2018; Bose, 2012; "Line transect methodology to make bird watching more scientific," 2017; "Monitoring prog for common birds," 2015; Sridhar, 2017)

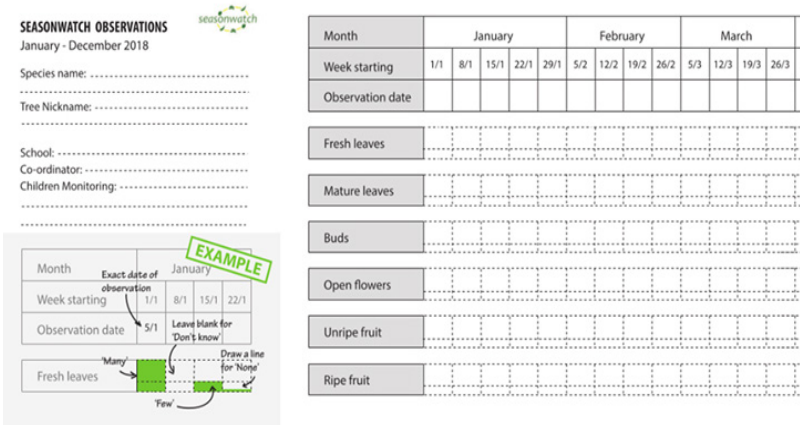
No. 10		
1	**Title of Project**	**The invasive Indian bullfrog on the Andaman archipelago**
2	Sub Projects	Using public surveys to rapidly and reliably estimate the distributions of synanthropic invasive species like the Giant African Snail, Common myna and House Sparrow
3	Year of initiation	2015
4	Project website	NA
5	Co-ordinating Institution	DST-NRF Center of Excellence for Invasion Biology, Department of Botany and Zoology Stellenbosch University
6	Nature of Institution	Academic
7	Location of Institution	Stellenbosch, South Africa
8	Institution website	https://academic.sun.ac.za/cib/
9	Collaborating institutions	Andaman and Nicobar Environment Team (ANET); Centre for Cellular and Molecular Biology (CCMB), Hyderabad
10	Co-ordinator (Individual/s)	Nitya Prakash Mohanty
11	Co-ordinator qualifications	PhD candidate (Biological/Ecological Sciences)
12	Contact details	nitya.mohanty@gmail.com
13	Species/Taxa/Subject	Indian bullfrog (Hoplobatrachustigerinus); Giant African snail (Achatinafulica); Common myna (Acridotherestristis); house sparrow (Passer domesticus)
14	Geographical reach/spread of project	Andaman Islands
15	Notable outputs, egs.	An understanding of the spread of an invasive species
16	Citizen Scientists' participating	***
17	Data points generated	892 interviews
18	Purpose of project	
	A)	Generate information on pathways and rate of spread of the invasive Indian bullfrog on the Andaman archipelago
	B)	Evaluate the use of public surveys as a potential tool to obtain reliable data on invasive species distribution and spread
	C)	***
	D)	***
19	Normative articulation for project (as articulated)	***
20	Genesis of idea	Direct experience in the field; literature
21	Technologies involved	Occupancy modelling in 'Presence'
22	Credibility of data issues (Gate keeping, review, etc)	Data collected byresearch team directly; use of false-positive occupancy modelling to account for misidentification/ misreporting
23	Typology (Bonney et. al)	
	A) Data collection	yes
	B) Data processing (categorisation, transcription, interpretation)	Yes
	C) Curriculum based	no

	D) Community science (initiated by members of public)	no
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	No
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	No
25	Agenda Setting	Scientist
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	***
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	Farmers, pond owners, plantation workers
29	Class Issues (as articulated)	***
30	Challenges	Accuracy and reliability of information
31	Limitations	Effort intensive; additional field surveys required
32	Promises	Rapid estimation of multiple species distributions; potential for simultaneous perception surveys
33	Threats	Unsuitability of key informants/interviewees in other settings
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	Citizen scientists were mainly respondents to a questionnaire survey; Calling this citizen science is the most outlier of all projects looked at thus far because in all other cases, citizens proactively contribute information and data! This was more a survey.
37	Licences/ data ownership/sharing/ accessing	Data openly available on dryad
38	Sources	
	Interviews	0
	Literature	(Ghosh, 2018a; N. Mohanty, 2016; N. P. Mohanty & Measey, 2018; N. Mohanty et al., 2018)

No. 11		
1	**Title of Project**	**SeasonWatch**
2	Sub Projects	
3	Year of initiation	2008
4	Project website	www.seasonwatch.in/
5	Co-ordinating Institution	Nature Conservation Foundation and the National Centre for Biological Sciences
6	Nature of Institution	NGO/Scientific
7	Location of Institution	Mysuru, Bengaluru
8	Institution website	www.ncf-india.org; www.ncbs.res.in
9	Collaborating institutions	NCBS, Wipro, Mathrubhumi-SEED, State Council for Science. Technology and Environment (Meghalaya)
10	Co-ordinator (Individual/s)	Geetha Ramaswami
11	Co-ordinator qualifications	DST-SERB Young Scientist, PhD
12	Contact details	geetha@ncf-india.org
13	Species/Taxa/Subject	Leaf phenology, flowering and fruiting of 100+ common trees in India
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	Some insights whether flowering of trees is changing?
16	Citizen Scientists' participating	389 individuals; 591 schools; Two distinct types of audiences contribute data to SeasonWatch. 'Individuals' are interested citizens, who have registered and made observations with SW of their own accord (usually by reading up online). 'Schools' comprise of groups of teachers and students (who may be different from one year to the next) from a school who monitor trees together. Indeed, 591 schools will translate to at least 5910 persons (likely more)
17	Data points generated	7000+ trees, 1.7 lakh observations,
18	Purpose of project	
	A)	To study the changing seasons by monitoring the leaf flush, flowering, and fruiting patterns (called 'phenology') of common Indian trees
	B)	Education – To encourage children to value the natural world
	C)	To understand the environmental factors underlying phonological variation in trees
	D)	***
19	Normative articulation for project (as articulated)	***
20	Genesis of idea	***
21	Technologies involved	Pen paper, internet, mobile app

22	Credibility of data issues (Gate keeping, review, etc)	No quality check mechanisms for individuals currently. In schools, fewer errors are expected because teachers and students are trained in-person to collect data. We plan to implement checks at the data-base level in order to capture input of erroneous phenophases.
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	Partially
	C) Curriculum based	Yes (In Kerala and Meghalaya the program is part of school eco-club activities)
	D) Community science (initiated by members of public)	Yes, but not initiated by community
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	No
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	Yes
25	Agenda Setting	Scientist/ Institution
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	***
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	School children (mainly!), but now expanding to individuals through social media. Program to be extended to college students soon
29	Class Issues (as articulated)	In schools: reaches mostly govt schools; very few private or public schools involved Individuals: Only those with access to internet/smart phones are able to participate

30	Challenges	Reach: Yearly efforts to reach more partners and individuals initiating: getting people started is the first barrier, given that it requires initial training (for teachers) and has a number of steps to follow the first time round (register user, register tree etc.) sustaining interest: citizens may be enthusiastic in collecting data once, or for a short duration, but require motivation to continue monitoring trees over the long term
31	Limitations	Data quality: some aspects cannot be checked at present (e.g. if tree species has been identified correctly) Engaging continuously with the diverse audience
32	Promises	Make data available to everyone Learn something about nature through engaging with trees
33	Threats	Funding: we need to continuously raise funds for various aspects of the program, including salaries. The biggest threat would be the program running out of money to continue!
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	***
37	Licences/ data ownership/sharing/ accessing	Not decided yet. We plan to make the data completely open access, depending on when we get the technology in place.
38	Sources	
	Interviews	0
	Literature	(Patel, 2018; Perinchery, 2018b; Ramaswami & Quader, 2018)



The SeasonWatch format for recording observations

No. 12		
1	**Title of Project**	**Roadkills**
2	Sub Projects	
3	Year of initiation	2018
4	Project website	www.roadkills.in
5	Co-ordinating Institution	Wildlife Conservation Trust
6	Nature of Institution	NGO
7	Location of Institution	Mumbai, Nagpur
8	Institution website	
9	Collaborating institutions	At least 10 other prominent wildlife conservation and research groups in the country
10	Co-ordinator (Individual/s)	Milind Pariwakam
11	Co-ordinator qualifications	MSc (Wildlife Sciences)
12	Contact details	milind@wctindia.org; roadkills.india@gmail.com
13	Species/Taxa/Subject	Animal kills in road and train accidents
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	
16	Citizen Scientists' participating	500 installations of app
17	Data points generated	500 (March 2018)
18	Purpose of project	
	A)	Collect data on mortality of wild animals on roads or railway lines in India.
	B)	Democratise data collection
	C)	***
	D)	***
19	Normative articulation for project (as articulated)	Democratisation of data collection
20	Genesis of idea	***
21	Technologies involved	Smart phones, apps, internet
22	Credibility of data issues (Gate keeping, review, etc)	***
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	partially
	C) Curriculum based	No
	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	Partially
	C) Investigation	Yes
	D) Virtual projects	No

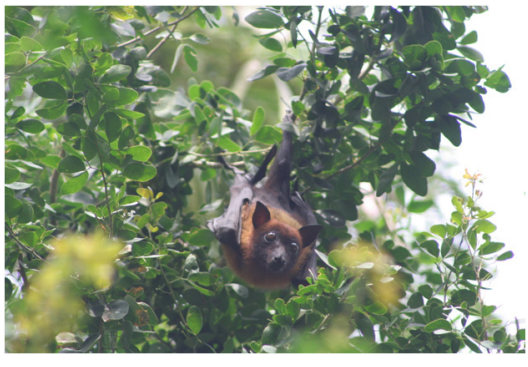
	E) Education projects	No
25	Agenda Setting	Institution
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	***
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	***
29	Class Issues (as articulated)	***
30	Challenges	***
31	Limitations	***
32	Promises	***
33	Threats	***
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	***
37	Licences/ data ownership/sharing/ accessing	Creative commons
38	Sources	
	Interviews	0
	Literature	(Perinchery, 2018a, 2018b; Pinjarkar, 2018)

No. 13		
1	**Title of Project**	**Citizen Sparrow**
2	Sub Projects	
3	Year of initiation	2012
4	Project website	http://www.citizensparrow.in/
5	Co-ordinating Institution	BNHS, MoEF
6	Nature of Institution	Academic/NGO/Govt
7	Location of Institution	Mumbai
8	Institution website	www.bnhs.org
9	Collaborating institutions	NCF, NCBS plus about 30 other organisations
10	Co-ordinator (Individual/s)	***
11	Co-ordinator qualifications	***
12	Contact details	***
13	Species/Taxa/Subject	Sparrows
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	***
16	Citizen Scientists' participating	6000 people (2013)
17	Data points generated	11291 (2012)
18	Purpose of project	
	A)	Monitoring sparrow populations in the country
	B)	***
	C)	***
	D)	***
19	Normative articulation for project (as articulated)	***
20	Genesis of idea	***
21	Technologies involved	***
22	Credibility of data issues (Gate keeping, review, etc)	***
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	No
	C) Curriculum based	No
	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	Partially
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	No

25	Agenda Setting	NGO
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	***
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	***
29	Class Issues (as articulated)	***
30	Challenges	***
31	Limitations	***
32	Promises	***
33	Threats	***
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	One time, two month project; not repeated. A different (Episodic) kind of Citizen Science project from most of the others which are of an ongoing nature
37	Licences/ data ownership/sharing/ accessing	***
38	Sources	
	Interviews	0
	Literature	(Sudhira & Gururaja, 2013)

No. 14		
1	**Title of Project**	**Pterocount - South Asia Bat Monitoring Programme**
2	Sub Projects	
3	Year of initiation	2005
4	Project website	https://pterocount.org/
5	Co-ordinating Institution	Zoo Outreach Organisation
6	Nature of Institution	NGO/Scientific
7	Location of Institution	Coimbatore, Tamil Nadu
8	Institution website	www.zooreach.org
9	Collaborating institutions	Chiroptera Conservation & Information Network of South Asia
10	Co-ordinator (Individual/s)	Sanjay Molur; Shahroukh Mistry
11	Co-ordinator qualifications	PhD (Biological/Ecological Sciences)
12	Contact details	sanjay@zooreach.org
13	Species/Taxa/Subject	Bats; in particular Flying fox or Fruit Bat
14	Geographical reach/spread of project	India and neighbouring countries
15	Notable outputs, egs.	Information on over 200 roosts in India and neighbouring countries observed. Some of them monitored over time; At least three volunteers have gone on to get PhDs (two on bats and one on information technology) and four have gone on to get their Masters in wildlife or related subjects.
16	Citizen Scientists' participating	***
17	Data points generated	More than 400 roost records
18	Purpose of project	
	A)	Getting information about the bat; trends in populations of roosts; status of roosts impacted by development projects
	B)	Assessing if conservation action/intervention is needed
	C)	***
	D)	***
19	Normative articulation for project (as articulated)	Citizen Science
20	Genesis of idea	During the 2005 Small Mammal training workshop Zoo Outreach Organization had organized in Dhaka, Bangladesh where SharoukhMistry was one of the resource persons
21	Technologies involved	Filling up forms, email, online,
22	Credibility of data issues (Gate keeping, review, etc)	Detailed protocol is laid out for collection of data
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	No
	C) Curriculum based	No
	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	

	A) Action	No
	B) Conservation	Partially
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	No
25	Agenda Setting	Institution
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	***
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	***
29	Class Issues (as articulated)	***
30	Challenges	***
31	Limitations	***
32	Promises	***
33	Threats	***
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	Information available in public domain is dated; a new iteration of the project is expected to roll out in a few months
37	Licences/ data ownership/sharing/ accessing	***
38	Sources	
	Interviews	0
	Literature	



A Fruit bat in Bhuj Town, Kutch, Gujarat (Photo: Pankaj Sekhsaria)

No. 15		
1	**Title of Project**	**Hornbill Watch India**
2	Sub Projects	
3	Year of initiation	2014
4	Project website	https://www.hornbills.in/
5	Co-ordinating Institution	Nature Conservation Foundation
6	Nature of Institution	Conservation and research NGO
7	Location of Institution	Bengaluru
8	Institution website	www.ncf-india.org
9	Collaborating institutions	Conservation India
10	Co-ordinator (Individual/s)	Aparajita Datta, Rohit Naniwadekar, Ramki Sreenivasan, Vikram Hiresavi
11	Co-ordinator qualifications	Phd (Biological Sciences)
12	Contact details	veena@ncf-india.org
13	Species/Taxa/Subject	Hornbills - 9 species found in India
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	***
16	Citizen Scientists' participating	430 (More than 50% made one entry)
17	Data points generated	938 sightings from 27 states (June 2014-Feb 2017)
18	Purpose of project	
	A)	Generate baseline information on hornbill distribution in India
	B)	Longterm monitoring of hornbill distribtion
	C)	Encouraging citizen participation and interest in documenting hornbill presence
	D)	***
19	Normative articulation for project (as articulated)	Citizen Science
20	Genesis of idea	***
21	Technologies involved	The internet
22	Credibility of data issues (Gate keeping, review, etc)	Standard protocol on website to fill in data; three key people (editors) act as reviewers/gate keepers and have powers of acceptance, rejection, editing etc.
23	Typology (Bonney et. al)	
	A) Data collection	Yes
	B) Data processing (categorisation, transcription, interpretation)	No
	C) Curriculum based	No
	D) Community science (initiated by members of public)	Yes
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	Partially
	C) Investigation	Yes

	D) Virtual projects	No
	E) Education projects	Partially
25	Agenda Setting	Scientist/Institution
26	Nomenclature	
	A) Public image	Citizen Science
	Alternative nomenclature	***
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	***
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	Mainly birders, nature enthusiasts, photographers
29	Class Issues (as articulated)	***
30	Challenges	To access and pull in data that is not specifically contributed, like from posts on fb and other sites
31	Limitations	Data influenced by access, not comprehensive due to various reasons
32	Promises	***
33	Threats	Web security concerns
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	***
37	Licences/ data ownership/sharing/ accessing	Data made available on request
38	Sources	
	Interviews	0
	Literature	(Datta et al., 2018; Datta & Rao, 2017; Perinchery, 2018b)

No. 16		
1	**Title of Project**	**Biodiversity Atlas - India**
2	Sub Projects	Butterflies of India, Birds of India Moths of India, Cicadas of India, Odonataof India, Reptiles of India, Amphibians of India and Mammals of India
3	Year of initiation	2017
4	Project website	http://bioatlasindia.org/
5	Co-ordinating Institution	National Centre for Biological Sciences, Tata Institute of Fundamental Research
6	Nature of Institution	Scientific/Academic
7	Location of Institution	Bengaluru
8	Institution website	https://www.ncbs.res.in
9	Collaborating institutions	Indian Foundation for Butterflies, Titli Trust, DiversityIndiaa, NatureMates
10	Co-ordinator (Individual/s)	Krushnamegh Kunte
11	Co-ordinator qualifications	Phd (Biological/Ecological Sciences)
12	Contact details	krushnamegh@ncbs.res.in; krushnamegh@ifoundbutterflies.org
13	Species/Taxa/Subject	Indian butterflies, moths, cicadas, dragonflies and damselflies, reptiles, amphibians, birds, mammals and Indian biodiversity
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	Half a dozen new species descriptions, a few dozen species rediscoveries, comprehensive faunal inventories; range maps and occurrence data generated on nearly 3,500 species
16	Citizen Scientists' participating	Approx 3,000
17	Data points generated	85,000 peer reviewed reference images corresponding to an estimated 50,000 spot records (2018)
18	Purpose of project	
	A)	Document biodiversity of India; education and outreach on biodiversity
	B)	Harness and channel enthusiasm about biodiversity in amateurs and professionals alike
	C)	Contribute to sound conservation strategies and prioritisation
	D)	***
19	Normative articulation for project (as articulated)	Citizen Science
20	Genesis of idea	The success of the first such website and citizen science initiative called Butterflies of India. That project webside grew into this larger bioinformatics platform
21	Technologies involved	Online biodiversity informatics platform, digital photography, Google maps
22	Credibility of data issues (Gate keeping, review, etc)	Observations and reference images are peer reviewed by advanced amateurs and professional biologists who are designated as editors and reviewers; controlled by the project personnel
23	Typology (Bonney et. al)	
	A) Data collection	Yes

	B) Data processing (categorisation, transcription, interpretation)	Yes
	C) Curriculum based	No
	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	Partially
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	Partially
25	Agenda Setting	Scientist/Institution
26	Nomenclature	
27	A) Public image	Amateur Citizen Scientists
28	Alternative nomenclature	Public participation in scientific research and biodiversity conservation
29	B) Reason for use of the nomenclature	***
30	C) Informal backstage articulations	***
31	D) Deeper normative positions/ explanations/explorations	***
32	E) Thought explicity about nomeclature?	***
33	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
34	Nature of Citizen Scientist	Volunteeering naturalists, nature enthusiasts, photographers
35	Class Issues (as articulated)	***
36	Challenges	Limited participation Dearth of enough expertise on Indian biodiversity (particularly insects and other invertebrates) Gulf between professional scientists (eg. Entomologists) and amateurs; getting academicians and taxonomists out of their ivory towers Long term sustainability
37	Limitations	Not mobile friendly yet Main contributors are from urban areas by urban naturalists
38	Promises	Huge potential for value added peer reviewed data sets on various ecological aspects
39	Threats	Fragmentation of efforts as existing participants get bored and want to build something new on their own

40	Nature of Science	
41	Nature of the Citizen	
42	Misc	Has a competitive framework to gather information and data – offers awards in the form of natural history books, and merchandise like mugs, t-shirts
43	Licences/ data ownership/sharing/ accessing	Copyright © 2017–2018, National Centre for Biological Sciences (NCBS) holds copyright for all the original material and data compilations on the site; except that photographers hold copyright for images, as stated
44	Sources	
	Interviews	0
	Literature	(Patel, 2018; Perinchery, 2018b)

No. 17		
1	**Title of Project**	**Butterflies of India**
2	Sub Projects	Butterfly lifecycles, plant associations, distributions
3	Year of initiation	2010
4	Project website	https://www.ifoundbutterflies.org/home
5	Co-ordinating Institution	National Centre for Biological Sciences (NCBS), Tata Institute of Fundamental Research, Indian Foundation for Butterflies (IFB)
6	Nature of Institution	Scientific/Academic (NCBS); Foundation (IFB)
7	Location of Institution	Bengaluru
8	Institution website	***
9	Collaborating institutions	Title Trust, DiversityIndia, NatureMates
10	Co-ordinator (Individual/s)	Krushnamegh Kunte (KK), Sanjay Sondhi, Purnendu Roy
11	Co-ordinator qualifications	PhD (Biological/Ecological Sciences) (for KK)
12	Contact details	krushnamegh@ncbs.res.in; krushnamegh@ifoundbutterflies.org; sanjay.sondhi@gmail.com; purnendu@infoundbutterflies.org
13	Species/Taxa/Subject	Indian butterflies
14	Geographical reach/spread of project	All India
15	Notable outputs, egs.	One new species discovery; rediscoveries of a dozen endemic and endangered species and comprehensive species inventories of several biodiversity hotspots across India
16	Citizen Scientists' participating	Over 1150
17	Data points generated	56,000 peer-reviewed reference images and approx. 100000 other spot records (December 2018)
18	Purpose of project	
	A)	Consolidate available information on Indian butterflies and make it freely available on the website
	B)	Actively collect new information on all aspects of Indian butterflies through research
	C)	Conservation - communicate this information to policy-makers and work with various governing bodies
	D)	Public education
19	Normative articulation for project (as articulated)	Citizen Science
20	Genesis of idea	Realisation in 2009 that naturalists and photographers across the country were generating considerable data on Indian butterflies but that there was no online platform to archive this information and make it available
21	Technologies involved	Online biodiversity informatics platform, digital photography, Google maps
22	Credibility of data issues (Gate keeping, review, etc)	Observations and references are peer-reviewed and curated by advanced amateurs and professional who are designated as editors and reviewers; project co-ordinator/initiator has a key role
23	Typology (Bonney et. al)	
	A) Data collection	Yes

	B) Data processing (categorisation, transcription, interpretation)	Yes
	C) Curriculum based	No
	D) Community science (initiated by members of public)	No
24	Typology (Wiggins and Crowston 2011)***	
	A) Action	No
	B) Conservation	Partially
	C) Investigation	Yes
	D) Virtual projects	No
	E) Education projects	Partially
25	Agenda Setting	Scientist/Institution, amateur naturalists
26	Nomenclature	
	A) Public image	Amateur citizen scientists, community project on biology and conservation of Indian butterflies
	Alternative nomenclature	Public participation in scientific research and butterfly conservation
	B) Reason for use of the nomenclature	***
	C) Informal backstage articulations	***
	D) Deeper normative positions/ explanations/explorations	***
	E) Thought explicity about nomeclature?	***
27	Voluntarity (as articulated)	
	A) As articulated	***
	B) Other dimensions	***
28	Nature of Citizen Scientist	Volunteering naturalists, nature enthusiasts, photographers
29	Class Issues (as articulated)	***
30	Challenges	Casual data collection by Indian naturalists; little commitment to collection data over long time periods
31	Limitations	Not mobile friendly yet; no accompanying mobile apps. Not possible to contribute checklists and non-image-based information
32	Promises	The possibility of collaboration and integration of scientific and amateur groups
33	Threats	Potentially differing views between academics and amateurs about the value of data; the alliance over citizen science projects could therefore be fragile
34	Nature of Science	
35	Nature of the Citizen	
36	Misc	Quite expressly competitive in terms of explicitly offering awards for greater contributions – awards like natural history books and merchandise like mugs, t-shirts etc

37	Licences/ data ownership/sharing/ accessing	Copyright (c) 2010-2018, All Rights Reserved. National Centre for Biological Sciences (NCBS) holds copyright for all the original material and compilations on the Butterflies of India website, except that that photographers hold copyright, as cited
38	Sources	
	Interviews	0
	Literature	(Perinchery, 2018b)

Screen shot of website home page

ANNEXURE 3

A feather in your app

By Aathira Perinchery, *The Hindu*, March 18, 2018

https://www.thehindu.com/todays-paper/tp-features/tp-sundaymagazine/a-feather-in-your-app/article23283156.ece

It is nearly twilight, and the yellow orb of a full moon has just set behind swaying coconut trees. Flecks of pink appear in the sky and a glorious red ball of fire slowly rises.But no stunning sunrise can distract 27-year-old Emanuel George. Birds have begun to congregate in their hundreds in the Changaram wetland in Kerala's Alappuzha district where we stand. George, binoculars glued to his eyes, is busy rattling off names: "Little egrets, garganeys, pygmy cotton-geese, black-winged stilts..." He pauses and scans the muddy bunds that separate the rice fields in the wetland. "Wood sandpipers, common kingfishers, lesser whistling-ducks...," he continues, "but what are those three there? Ah, spot-billed ducks," he says when he spots the distinguishing band of brilliant jade-green on the wings.

His binoculars are off his eyes now, but his fingers are flying over his Android phone screen, typing the names of the species he has sighted on eBird, an app where birdwatchers upload real-time, list-based information on species. George lays tiles for a living — but in his spare time he is a citizen scientist, feeding into the app vital data that will reveal bird distribution patterns, numbers and changes in species across seasons and years.

George tells me he caught the birding bug from his friends who worked as naturalists at a resort nearby. They would accompany tourists who wanted to see local birdlife. Today he begins every morning with a pair of binoculars gifted to him by a tourist, spotting birds around his home in Ezhupunna village. He has been on eBird for three years and takes pride in being the country's 'eighth best eBirder' based on the number of check-lists he has submitted.eBird is just one of many digital fora that are now drawing in ordinary people — non-scientists, if you like — into the process of ecological science and conservation.

Citizen scientists can ask questions, volunteer to collect data, and analyse it. For researchers, citizen scientists are a boon: with their sheer numbers, they can contribute extensive data over vast geographical areas, something trained scientists could not dream of gathering either individually or in teams.

While it may appear to be a novel concept, the public has always participated in ecological science, said a team of American scientists in a 2012 study. Chinese citizens and officials, for instance, tracked locust attacks for at least 3,500 years although they did not know their observations would later be used for science.

But today, thanks to smartphones, the Internet and the endless possibilities of apps — with special help from Google Maps — citizen science has truly come of age around the world. And India is by no means lagging. Whether flowering patterns in trees, the mating habits of butterflies, or the arrival of migratory birds, the country's citizen scientists are helping create a vast and valuable corpus of data.

One of the most recent initiatives is Roadkills, an app launched in January by the Bengaluru-based Wildlife Conservation Society. Here, people upload geo-tagged photographs taken on their mobile phones of wild animal deaths they come across on roads they travel through. Scientists use these

pictures to identify stretches where roadkills are high, and communicate the information to policy-makers so they can help create mitigation measures such as underpasses. Just two months into its launch, the app has registered around 500 cases of roadkills — of many species including tigers, hyenas and pythons.

Rakesh Kolhe, a data operator with Maharashtra's Nagzira-Navegaon Tiger Reserve, has uploaded more than 70 photographs of roadkills since the app was launched. "Most are birds and snakes. Fifteen days ago, I also uploaded a photo of a spotted deer roadkill on NH-6," he says. "I think this is a great app. I used to collect photographs of roadkills earlier too but there was no forum I could share them on."

Citizen scientists have also been discovering new species, new behaviour and distribution patterns. Writuparna Dutta, a Ph.D scholar from Kolkata, uploaded some curious pictures on the Butterflies of India online forum: they were images of the tiny monkey puzzle butterfly mating with a completely different species, the ciliate blue.Photographs also came in from across the country of male monkey puzzles engaged in a kind of combat: resting face to face, holding their wings in a peculiar angle, their proboscis intertwined and mouth parts locked tight. "This strange contest has never been recorded before," says butterfly biologist Krushnamegh Kunte of Bengaluru's National Centre for Biological Sciences (NCBS), who launched the website in 2010. "Why are they doing this? We don't know."

Again, thanks to photographs uploaded by citizen scientists, Kunte and his team in 2015 were able to describe a new butterfly species — the banded tit — from Arunachal Pradesh. Another new species of butterfly will soon be added, and two new species of cicadas, which citizen scientists uploaded on a sister site, Cicadas of India, will also be soon described. Moths, amphibians, reptiles, dragonflies and damselflies are the subjects of other sites launched under the umbrella Biodiversity Atlas of India set up by the team.

There is one website dedicated just to hornbills. On Hornbill Watch, launched four yearago by Nature Conservation Foundation of Mysuru, birders can report sightings of India's nine hornbill species. By February 2017, the project had recorded 938 sightings across 27 States. This data can help identify locations that need to be protected to conserve hornbills, many of which are threatened by habitat loss and hunting.

On the other hand, the India Biodiversity Portal, launched in 2008, welcomes information on any life form — plants, insects, birds, mammals, reptiles. Not surprisingly, some 12,80,000 observations have been made, covering more than 30,000 species as of 2016.

Spot the aliens

In their 'Spotting Alien Invasive Species' campaign, they call participants to upload photos of any one of 20 invasive species in India, including the notorious shrub Lantana camera and African fish Tilapia. Researchers can add locations so that scientists can identify the places where these non-native species have made inroads.

Plant life is equally in the spotlight. From the remotest parts of Meghalaya to urban Kerala, school children are keying in their basic observations of the leaves, flowers and fruits of cherry trees every week to Seasonwatch, a national project launched in 2008 as part of the citizen science programme at NCBS. The project tries to monitor how climate change is impacting plant phenology across seasons.

"I now observe trees wherever I go," says 14-year-old Kailas K.S., a Class X student of the Kuttamassery Government High School in Kochi, who has been observing a 15-foot-tall elephant-ear fig tree in the school courtyard for two years now as part of Seasonwatch. "I never bothered about trees before. Observing my tree has changed things." Kailas observes it every Thursday and notes down whether there are more mature leaves or young tender leaves; if caterpillars are feasting on them; whether the fruits are unripe or mature, and if birds or small mammals eating them.

Meanwhile, other tree-watchers in Kerala have been discussing if the Indian laburnum, which usually blooms around the Malayalam New Year (Vishu festival, April 14) now blooms much earlier. Seasonwatch data does indicate that though the tree shows a peak in flowering between March and April, some trees do flower at other times of the year. But because there are no historical records, there is no way of knowing if this is due to climate change.

One of the first formal citizen science programmes in India and the longest-running is the Asian Waterbird Census (AWC) initiated in 1987, says scientist Suhel Quader of Nature Conservation Foundation (NCF) who has been instrumental in launching two citizen science efforts. During the AWC, thousands of volunteers fan out over more than 6,100 sites across 27 countries in Asia and Australasia to count waterbirds in wetlands. All this data also goes on eBird.

With more than 3.8 lakh birdwatchers worldwide and around 100 million sightings each year, eBird is the world's largest biodiversity-related citizen science project. Technology has made the exercise far easier. "It was difficult for participants to get back to their computers and log in their bird lists at the end of the day on the eBird website," says Pronoy Baidya, a doctoral student at Indian Institute of Sciences who has been using eBird for several years now. "The mobile app has changed this completely. It is now easier to submit data and this can be done during birdwatching too."

And much like the new insects being discovered thanks to citizen scientists, so is the odd new bird. A year ago, photography enthusiast Arun Bhaskaran, a clerk at a government hospital in Kerala, photographed a gull and uploaded it on eBird. A Portuguese birdwatcher who happened to see the photograph halfway across the world pointed out that it was a Mew gull: the first ever spotted south of Goa.

What motivates them?

Importantly, data gathered through citizen science initiatives are now accessible to the public who generate it. This is a powerful tool, with which enthusiastic citizen scientists can even analyse patterns, something that was once the forte of trained scientists alone. However, transparency in data has prompted some observers to raise concerns about what this means in terms of revealing locations of threatened or trafficked species. To tackle this, eBird, for instance, now has a 'Sensitive Species' setting so the locations of certain rare or threatened species are not divulged.

So what makes citizen scientists tick? A recent study examined the factors that motivate volunteers' initial and long-term participation in Costa Rica, U.S. and India. The team found that though initial motivation stemmed from enjoyment or an interest in nature, citizen scientists are inclined to participate in projects that address their interests and offer them self-advancement. Aspects that assured long-term participation

include acknowledgement and trust. “Trust is very important while running such projects,” says Ramki Sreenivasan, a former IT company owner and co-founder of the website Conservation India. “Users should clearly know the goals of the project and how their contributions specifically help.”

Scientists are increasingly beginning to see citizens as partners rather than as data-collectors, says Quader. And long-term participation can even translate into deeper interest and active conservation advocacy.

George takes his eyes off his binoculars for a moment and points to some noisy black-winged stilts, their long red legs a stark contrast to their pied coats. “Earlier, some villagers hunted migratory birds like these and sold them to restaurants. But we’ve been talking to them and reporting incidents to the forest department, and it has decreased now.” George adds that he now notices villagers getting excited when migrant birds arrive and taking pride in them. “They can even identify spot-billed pelicans and bee-eaters.”

ANNEXURE 4

Interviews conducted

No	Interviewee	Place, Date
1	Dharmendra Khandal	Sawai Madhopur, March 2017
2	Hanuman Gujar	Sawai Madhopur, March 2017
3	KV Gururaja,	Bengaluru, May 2017
4	Suhel Quader	Bengaluru, May 2017
5	Ramit Singal	Bengaluru, May 2017
6	Prabhakar Rajgopal	Bengaluru, May 2017
7	Naveen Namboothri	Bengaluru, May 2017
8	Shyamal Lakshmanan	Bengaluru, May 2017
9	Sudarshan Rodriquez	New Delhi, April 2018
10	Avinash Sharma	Pune, May 2018
11	Umesh Vaghela	Pune, May 2018
12	Radhika Bhagat and Jose Louis	New Delhi, May 2018
13	Aadya Singh	New Delhi, May 2018
14	Pankaj Gupta	New Delhi, May 2018
15	Misha Bansal	New Delhi, May 2018
16	Yogesh Parashar	New Delhi, May 2018

ANNEXURE 5

List of panels and discussions organised on Citizen Science

- Students Conference on Conservation Science (SCCS) - 2017, Indian Institute of Science (IISc), Bengaluru, September 2017
- 9th Biennial Conference of the Indian Society for Ecological Economics (INSEE) , Kerala Instiute of Local Administration (KILA), Thrissur, November 2017
- Students Conference on Conservation Science – 2018, IISc, September 2018

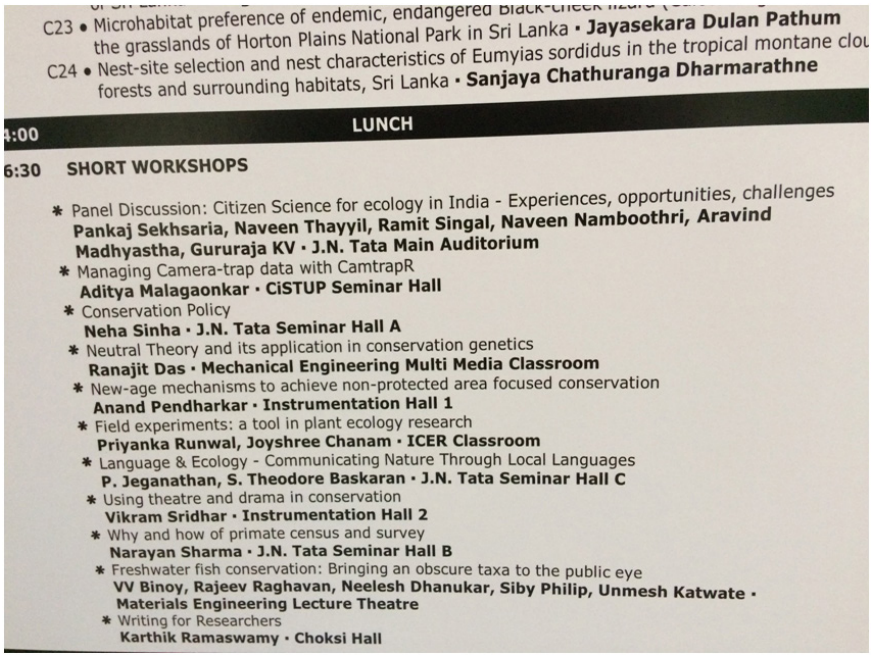
ANNEXURE 6

Report on the panel discussion at the Student's Conference on Conservation Science (SCCS), Indian Institute of Science, Bengaluru, 21-24 September, 2017

Citizen Science for Ecology in India

Experiences, opportunities, challenges

A panel at SCCS-2017



C23 • Microhabitat preference of endemic, endangered Black-cheek lizard (
the grasslands of Horton Plains National Park in Sri Lanka • **Jayasekara Dulan Pathum**

C24 • Nest-site selection and nest characteristics of Eumyias sordidus in the tropical montane clou
forests and surrounding habitats, Sri Lanka • **Sanjaya Chathuranga Dharmarathne**

4:00 **LUNCH**

6:30 **SHORT WORKSHOPS**

* Panel Discussion: Citizen Science for ecology in India - Experiences, opportunities, challenges
Pankaj Sekhsaria, Naveen Thayyil, Ramit Singal, Naveen Namboothri, Aravind Madhyastha, Gururaja KV • J.N. Tata Main Auditorium
* Managing Camera-trap data with CamtrapR
Aditya Malagaonkar • CiSTUP Seminar Hall
* Conservation Policy
Neha Sinha • J.N. Tata Seminar Hall A
* Neutral Theory and its application in conservation genetics
Ranajit Das • Mechanical Engineering Multi Media Classroom
* New-age mechanisms to achieve non-protected area focused conservation
Anand Pendharkar • Instrumentation Hall 1
* Field experiments: a tool in plant ecology research
Priyanka Runwal, Joyshree Chanam • ICER Classroom
* Language & Ecology - Communicating Nature Through Local Languages
P. Jeganathan, S. Theodore Baskaran • J.N. Tata Seminar Hall C
* Using theatre and drama in conservation
Vikram Sridhar • Instrumentation Hall 2
* Why and how of primate census and survey
Narayan Sharma • J.N. Tata Seminar Hall B
* Freshwater fish conservation: Bringing an obscure taxa to the public eye
VV Binoy, Rajeev Raghavan, Neelesh Dhanukar, Siby Philip, Unmesh Katwate • Materials Engineering Lecture Theatre
* Writing for Researchers
Karthik Ramaswamy • Choksi Hall

Organised by Naveen Thayyil and Pankaj Sekhsaria
As part of the project
Data Aggregation and Public Participation: Possible futures in Policy-making and Regulation
DST Centre for Policy Research, Dept of Humanities and Social Sciences
IIT-Delhi

Brief Project Rationale: Increasingly in the last decade, automation techniques are being employed across the world to collect, organise, validate and distribute disparate data to make knowledge claims, particularly in the environmental sciences. Scientific knowledge is generated in a variety of ecological sites through large-scale data aggregation by employing automated algorithms, often by citizens and groups who are not generally part of the scientific establishment, but in collaboration with the scientific community.

Such collection and aggregation of large quantities of data by and about people, referred to differently as citizen science (CS), community based monitoring (CBM) and public participation in scientific research (PPSR), holds the promise of creating new kinds of data as also a new understanding of (scientific) events, processes and probabilities.

The current project seeks to map and understand how such techniques are being currently employed in different ecological sites in India to make knowledge claims, and what strengths and challenges lie in incorporating such methodologies and the knowledge generated in policy-making and regulation.

The panel at the SCCS was the first public discussion on the subject involving those projects and researchers who are involved in citizen science projects and who have been respondents in our research project

Panel Details

Panel Abstract

Is it possible that the scientist and the citizen can join hands to work toward a common purpose within the realm of scientific research and understanding? The involvement of the citizen in science & technology research via what is popularly called 'Citizen Science' is a relatively new development where the division between the 'expert' scientist and the citizen is sought to be blurred, where the citizen also does the science, and the knowledge that is generated is generated by them jointly.

One area of scientific research in which Citizen Science has taken off in the Indian context is that of field ecology, where a number of projects have been initiated by scientists and researchers in active collaboration with citizens. The panel brought practitioners of Citizen Science on one platform for probably the first time in India and sought to create a forum for engagement with and discussion on 'Citizen Science' initiatives in ecology in India. The idea was to understand the various dynamics involved, to see how data and knowledge is created, to understand the motivations of the scientific community in initiating these projects and of the citizens in participating/contributing/collaborating, to see what these means for settled categories of knowledge and knowledge creation and also to see what, if any, policy and on-field impacts does this participation by citizens results in.

The panel offered the participating students and researchers an opportunity to understand how the current citizen science projects are being carried out in India, what are the methodologies being used, what new data and patterns Citizen Science projects are able to offer, and what are the challenges in executing Citizen Science projects. The idea, as the sub-title of the panel suggested was to explore the experiences, opportunities and challenges of doing citizen science in India in environmental and ecological studies

The Panelists

1) Ramit Singal, Bird Count India, Nature Conservation Foundation, Mysuru Project: Bird Count India

Bird Count India, a pan-India project where citizens contribute large spatial and temporal data related to the presence, absence, arrival and activities of birds in the Indian subcontinent. It is associated with *Ebird India*[11], which is part of the global E-bird project that is co-ordinated by the Cornell Lab of Ornithology in the USA and is one of the largest aggregations of data and information put together by citizens on any taxa globally.

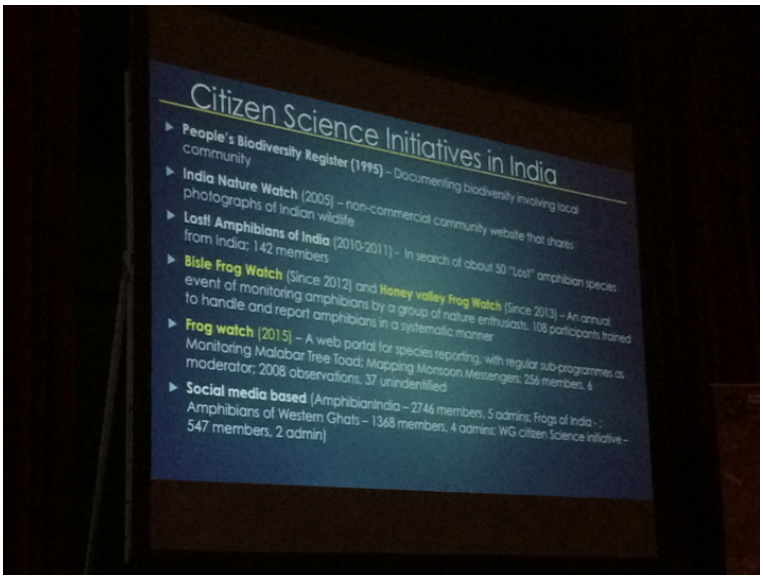
2) Naveen Namboothri, Dakshin Foundation, Bengaluru

Project: Community based fisheries monitoring in the Lakshadweep islands

Community based fisheries monitoring in the Lakshadweep islands[12], is a project where members of the fishing community are keeping a regular account of the natural resource (fish catches) on which their lives and livelihoods are critically dependent.

3) Gururaja KV, Srishti Institute of Art, Design and Technology, Bengaluru

Frog Watch[13], which is associated with the IBP and seeks in particular to map amphibians (frogs and toads, caecilians and salamanders) based on data that include observations, photographs, call records, identifications, location and behaviour collected by citizens and citizen science programmes in India.



Gururaja KV lists the various citizen science projects in India in his presentation

[11] *http://ebird.org/content/india/*

[12] *http://www.dakshin.org/mobilizing-communities-for-sustainable-and-equitable-fisheries-governance-in-lakshadweep/*

[13] *http://indiabiodiversity.org/group/frog_watch/userGroup/about*

Each of the panelists made a presentation that broadly covered the following dimensions of their work:

a. The context of the project – the reason why it was conceptualised, the data or understanding gaps it seeks to fulfil and the rationale for the chosen methodologies

b. The structure by which the project is executed

c. The new data, insights, patterns and scientific discoveries that the project has enabled

d. The different challenges in ensuring citizen participation in the project, of keeping their motivation high, of ensuring reliability of data that comes in

Key issues during discussion

The discussion that followed the presentations was rich, involved and diverse and brought up a number of issues and questions on the execution of the citizen projects, of the opportunities it offers and on the various challenges.

Some of the key issues that came up included among others:

a. The reliability of the data generated by Citizen science initiatives. Related issues were those of gate-keeping and of the process of review. The panelists explained that they have various mechanisms by which this was ensured. A related point raised was questions on the reliability of data should not be asked only of citizen science projects but also of 'conventional' science and research because there are serious concerns of quality over there as well

b. The normative positioning of citizen science projects. It was noted, for instance, that the projects presented as part of the panel all had a rather well articulated normative position that science needs to be democratised and citizen science is one way of doing it. The other contention, however, was that not all citizen science projects have this normative position and many just use the methodology to gather data and do science

c. Challenges of keeping the citizen scientists motivated and involved: Each of the projects described the different nature of the challenges they respectively faced because the nature of each of the projects is different from the other.

d. Specific suggestions were then made how students and researchers could either become part of these existing citizen science initiatives or work towards conceptualising and structuring new projects if they chose to do so for their research and thesis work

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