

Tourists and Tour Operators as Citizen Scientists: Potential and Challenges

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Abstract: Wildlife tour operators often visit natural habitats regularly and remote ones less often. Academic researchers and their students often do not have the budget to do so, or to send research assistants. Keepers in wildlife parks and zoos and ecolodge managers often have the opportunity to observe animals almost daily, but may lack the time to sit and watch for many hours. There would appear to be much scope for tour operations and their tourists to participate in citizen science. There are already numerous examples, from day-trippers photographing whale tails on cruises to help monitor migratory individuals, to experiences such as ‘Wildlife of the Mongolian Steppes’, a two-week citizen science excursion run by the Earthwatch Institute and Denver Zoo to collect data on Mongolian wildlife in cooperation with local researchers. Potential and actual problems of using tourists and tour operators as citizen scientists have been voiced, but there are ways of overcoming at least some of them. Tour operators looking for ways of engaging domestic tourists now that Covid-19 lockdown prevents many international visits may consider the potential for incorporating citizen science activities that offer their guests a food learning experience, a sense of achievement and perhaps a closer look at some species than would normally be possible.

Keywords- Tourism, tour operator, citizen scientists, potential, challenges

INTRODUCTION: Why Marry Tourism And Citizen Science?

Despite the blossoming of papers in ecological research journals in recent decades throughout the world, there is still much we do not yet know about natural ecosystems and the individual species that live within them. There is much yet to discover that is of interest for conservation management and other applied usage, or simply for curiosity and fascination.

Many scientific researchers would like to be sending research assistants every week to islands, reefs, forests, outback stations etc. but simply do not have budgets that can cater to enough travel or salary to gather sufficient results for the valid statistical analysis so important for advancing our knowledge and understanding of wildlife and ecosystems. Conservation managers who would find assessment of impacts by neighbouring developments or results of habitat restoration extremely useful are often hindered by lack of time to collect baseline data or to follow up with well-planned standardised monitoring.

Wildlife tour and ecotour operators often make frequent visits to natural areas, and ecolodge staff often work in such areas every day (and quite often evenings as well). Keepers in wildlife parks and zoos are often working in

somewhat less natural places but they do see native species day after day. This puts them in an excellent position to observe the behaviour of animals, the presence of various species in different seasons, the fruiting and flowering of trees and other plants, and many other events.

Many employed in wildlife tourism or running their own businesses have substantial background knowledge of specific groups (e.g. birds, reptiles, nocturnal mammals, butterflies, orchids etc.) and quite a few have scientific backgrounds and are quite capable of designing research projects of suitable quality to publish in academic journals (and thus share with other researchers and conservation managers around the world) or for food monitoring programs for local use, such as finding out what works and what doesn't in attempts to restore habitats, or when to expect the arrival of certain migratory bird species. Others may have the desire to assist in contributing to our knowledge but lack the training in scientific method. There is plenty of scope for them to collaborate with academic researchers. Quite often researchers wish to pursue general questions while those working within a particular area are more interested in finding out what happens in their particular spot, or even just a species list, but it can be quite possible to design a project that satisfies both requirements.

There are situations where the tour operator or ecolodge employee can easily jot down observations, such as whether any cygnets or ducklings are sighted on a frequently-visited lagoon, or whether particular trees or shrubs are flowering, which accumulate over time to a wealth of information. Wildlife park operators may be able to note and jot down the main activity periods of animals during the day, or which foods they eat first when offered a variety. Other observations, or extensions of the simple ones just mentioned, may take up too much time. This is where it could be handy to involve tourists as citizen scientists.

There would appear to be much scope for tour operations (whether guiding, eco-accommodation or wildlife parks) and their tourists to participate in citizen science, whether it is for basic ecological or behavioural research, conservation management, general natural history or topics such as minimising disturbance to animals and plants. There is much scope also for them to team up with other operators to accumulate more data, or with academic researchers, perhaps as part of a wider project.

In this paper I am exploring the potential of citizen science within nature-based tourism, especially wildlife tourism. My search for references and other information and opinion for this brief paper was not extensive, as I was not aiming at an exhaustive overview of successful and unsuccessful attempts at employing citizen science within tourism, but mostly seeking some examples of where it is happening, identifying some problems identified by scientists, tourism operators and citizen science volunteers and reflecting on a few pointers as to how to giving it the best chance of succeeding. I mostly used Academia.edu to seek all articles on citizen science in the past five years, and discarded those outside the range of native fauna and flora. I'm also drawing on direct discussions with ecologists and taxonomists, communication with various tour

guides and staff of ecolodges and wildlife parks, members of Wildlife Tourism Australia and delegates at the 2021 conference of the Australian Citizen Science Association. I also explored the websites of associations known to offer citizen science opportunities in nature tourism, especially Earthwatch and Conservation Volunteers Australia and a few non-government organisations (NGOs) doing the same.

A FEW EXAMPLES

There are already numerous examples of tourists participating in citizen science, from day- trippers with little or no training to lengthy excursions with in-depth training before participating in fieldwork. A research project at the Southern Cross University and the University of Newcastle in Australia collects photographs of the undersurface of whale tails as the whales plunge downwards, often taken by passengers on whale-watching tours (<https://www.scu.edu.au/marine-ecology-research-centre/whales-and-dolphins/whale-and-dolphin-research/east-coast-whale-watch-catalogue/>). If good quality and a sufficient area of tail is showing, the individual whale can be identified and thus its movements tracked, and analysed using the computerised system Fluke Matcher (Kniest, et al 2010). Anyone with a good camera or smartphone and able to follow a few simple instructions can assist with this research, and no background experience or special effort is required. The same applies to various research projects requiring tourists and other visitors to place their cameras or smartphones on special posts called “Fluker posts” (named after their inventor), take photos and send them to a central repository where they may be used to study for instance the progression of a habitat restoration site or the recovery of a coral reef following a cyclone (<https://www.flukerpost.com>).

Other projects require some degree of knowledge and expertise or physical fitness by participants. Bowra Wildlife Sanctuary, previously known as Bowra Station, a large former cattle station in outback Australia long known as a birding “hotspot” and now owned by the Australian Wildlife Conservancy, principally exists as a conservation area but is also involved in visitor management and visitor education in that individuals, study groups or small tourism groups can pay either for day visit or overnight camping to explore the varied habitats and observe birds and other wildlife. Each evening the camp hosts, staff and visitors gather to construct a list of birds seen that day, the estimated numbers and what part of the property they were seen in. This has been happening for many years now, resulting in much useful data, but depends on being able to trust the accuracy of observations by the birdwatchers. It is not a short drive from any major city, so it is usually dedicated birdwatchers who visit, with at least one experienced birder in the group. In Kruger National Park, South Africa, there are signs requesting tourists to contact a particular centre if they have sighted one of several named bird species. Coralwatch, a worldwide not-for-profit citizen science program based at the University of Queensland, Australia, (<https://coralwatch.org>) works with students, tourists and other volunteers aims to increase understanding of coral reefs, coral bleaching and

climate change. Very little background knowledge is needed for people to compare coral against the colour charts, but they at least need to be confident in diving, snorkelling or reef walking and able to assess whether the coral they are looking at belongs to one of four categories (easily-learned).

An example of a more complex and lengthy undertaking is the ‘Wildlife of the Mongolian Steppes’ project, where participants spend two weeks in a remote region of semi-arid mountain grassland wilderness with associated rocky outcrops, well away from most tourism routes. The excursions are led by the Earthwatch Institute and Denver Zoo, and involve the training volunteer tourists and subsequent collection of data on argali sheep, Siberian ibex, goitered gazelles, cinereous vultures, saker falcon, small carnivores, jerboas, other small mammals and vegetation. They may hike over 9 km a day, stay in yurts, eat traditional local food, and participate in capturing, measuring and releasing argali sheep as well as taking many detailed observations.

Australian tourism operations that involve opportunities for citizen science include, amongst others: Earthwatch Australia, Conservation Volunteers Australia, Lady Elliot Island, Daydream Island, Lindblad Expeditions-National Geographic, Biosphere Expeditions, Araucaria Ecotours, Aurora Expeditions and various marine wildlife tours. These and numerous others will soon be added to the Wildlife Tourism Australia website (see <https://www.wildlifetourism.org.au/resources/research-by-tour-operators-etc/>).

The Australian Citizen Science Association, in conjunction with Atlas of Living Australia, also lists projects that can be joined, some of which are associated with tourism: <https://citizenscience.org.au/ala-project-finder/>.

There are also now many apps allowing individual travellers to send information on what they see to central databases, for example:

- eBird <https://ebird.org/home> (worldwide and extensively used by birders)
- iNaturalist <https://www.inaturalist.org> (worldwide and also extensively used, and listing projects that can be joined)
- Atlas of Living Australia <https://www.ala.org.au> (which also lists many current projects that others can join in with)
- FrogId <https://www.frogid.net.au> (an Australian app)
- ClimateWatch <https://www.earthwatch.org.au/climatewatch> (developed by Earthwatch)

There are many other examples throughout the world.

POTENTIAL AND ACTUAL PROBLEMS OF USING TOURISTS AND TOUR OPERATORS AS CITIZEN SCIENTISTS

To be true citizen science, according to the European Citizen Science Association a project should have the following attributes (summarised from <https://ecsa.citizen-science.net/>):

- involve citizens in scientific endeavour that generates new knowledge or understanding.
- have a genuine science outcome.
- provide benefits to both science and society.
- citizen scientists participating in any of various stages of the scientific process, including development of research questions, design of methods, gathering and analysing of data, and communication of results.
- citizen scientists receiving feedback from the project.
- limitations and biases being considered and controlled for.
- where possible and suitable, project data being made publicly available.
- citizen scientists being suitably acknowledged.
- a range of benefits and outcomes being acknowledged and considered in project evaluation.
- the leaders of citizen science projects taking into consideration legal and ethical considerations of the project.

PROBLEMS FROM THE PERSPECTIVE OF SCIENTISTS

It has been suggested that a test for the project being genuine science is whether the results are publishable in a scientific journal (I don't see the actual publication as a strict criterion, as research for conservation purposes that follow scientific method could also be a valid project). For publication to be possible, valid methods of data collection and analysis must be employed, avoiding pseudo-replication, dubious assumptions, sample sizes far too low, untrained participants measuring or counting in different ways or not sticking closely with the rules set by the project leader, false identification of species, and other problems that can impede true scientific procedure.

Even if not destined for academic publication if the project is a genuine one to guide real conservation management plans or other practical outcomes accuracy is still of obvious importance. The actual data must also be reliable and also be seen to be reliable.

At meetings and discussions with scientists, the major reservations have revolved around whether participation of non-scientists can indeed reliably produce knowledge and understanding which constitutes a genuine science outcome. They worry that participants may be too inexperienced, not interested or bright enough to understand the requirements for scientific data, or to accurately identify species, too lazy or too easily bored, and perhaps not always honest about how much time they spent or what they saw.

Woodcock et al (2017) noted that participants tend to be either those who are primarily seeking entertainment and those with some kind of true scientific interest (including students, persons currently or formerly employed in a scientific capacity, and science teachers). It may be suspected that tourists would

mostly fall into the former category, but scientists, teachers and students are also amongst those who travel (e.g. Slocum et al 2015), and may relish the opportunity to spend a bit of time working with species they can't see in their homelands or otherwise would never get close to. Even those primarily there for entertainment (perhaps kayaking while counting seal numbers, or ascending high into the forest canopy to count butterflies visiting flowers of the treetops) are not necessarily unreliable. Of course some will be, and the same can apply to those with a science education if their enthusiasm wanes, they are trying to impress by exaggerating their results, or despite their background they're not as competent or motivated as the leaders would like them to be. Potentially at least, such problems can be mitigated by only giving simple tasks to the less experienced or motivated, or to tourists who are only participating for one day, with no opportunity for preparatory training. More serious work, conducted over a couple of weeks and including training before and upon arrival, gives an opportunity to weed out the less capable or reliable, or to assign them the simplest tasks, and for projects that include a level of background experience, or mental or physical difficulty or tedium, participants can be asked to apply beforehand with cv and references. This does not eliminate the problems, as science students and even professors have been known to get things wrong at times, but it should reduce the possibility.

For a lengthy citizen science excursion where it is important that volunteers can understand some of the principles of scientific method as they related to the particular project, these can be laid out in easily-read form on the website of the organiser, and also included in a downloadable pdf for participants to peruse long before the actual excursion.

There are also many tasks an untrained person can assist with. Some amateur naturalists, even if their knowledge of scientific method is limited, are very good at identification of their favourite taxa. An experienced birder may indeed recognise more species, including females and juveniles and geographic races than a professional research ornithologist who is well-versed in taxonomy of a few species he or she is studying the ecology or behaviour of but not the majority of bird species. A volunteer with little or no experience in either science or natural history can also still count the numbers of periwinkles in a quadrant, assess the colour of coral compared with a colour chart, measure tree-trunks, take photos of whale tails, help look for lizards or tell whether there is an animal appearing on a film from a motion-sensing camera (even if the identification must then be left to someone else). With minimal training they should be able to for instance recognise three different species of wallaby visiting a grazing area or sort beetles from other insects in a collection. Of course the accuracy still depends on the quality of the training, the integrity of the volunteer or the supervision by the leaders.

One senior lecturer objected to the idea of citizen science in tourism because tour businesses do not always last long, and may go out of business or change direction before sufficient results are collected. This may well be a problem with

some, but there are others which have already lasted several decades and some of these (e.g. O'Reilly's Rainforest Retreat in Australia) has supported scientific research (mostly by academic researchers) for many years. Also, if tour operations regularly send results to an academic institution or some other central point, there is always an option for someone else to build on and continue the research.

Another concern expressed by some scientists is that participation by non-specialists volunteers may take paid employment away from those who have spent years achieving a graduate or post-graduate science degree. It can indeed be galling for a trained ecologist or taxonomist to be passed over by governments or developers in favour of free surveys by natural history NGO members. However, there are simply not enough field workers to go around for all the questions we need to ask, and research scientists, including post-graduates, can be employed to lead projects that include volunteers, and for training sessions.

Some tour operators (and I think I have met at least a couple) may wish to conduct research but keep the results in-house, to impress their guests that they are doing research, and to predict where animals will be at various times but not wishing to share such information with possible competitors. We need to explain that this goes against the general aims of citizen science, and indeed of science itself (although it is certainly not unheard of in commercial research laboratories). Some (and again I think I know of at least a couple) may wish to be seen as doing research but have little idea of scientific method and their results are not of much use. Some basic training in scientific method is essential for those genuinely willing to learn to collect valid and meaningful data.

Can sufficient data be collected for true scientific advancement or even assessment of year-to-year changes due to habitat restoration, climate change or other events? Callahan et al (2017) investigated how many checklists from eBird (an online bird observation database) would need to be collected for a valid analysis of species richness, a species diversity index, or community composition. Their first estimate (for North American urban green spaces) was 210, 33, and 58 respectively. When they discarded observations of the rarest birds, these numbers decreased, and they made the point the numbers of checklists (which would apply also to individual observations or measurements) depends on the actual question being posed. It would be useful to see more reviews of this kind.

PROBLEMS FROM THE PERSPECTIVE OF VOLUNTEERS

Tourists joining a citizen science project are not only working for free, they are paying for the privilege of doing so, their money going towards basic requirements such as travel, meals and accommodation as well as any disposable items used in the project (e.g. food baits to attract wildlife into cage traps or to a point where they can be readily observed), plus payment for the project leaders' and other staff time and overheads (insurances, permits etc.), and often also a donation to local conservation efforts.

Persons choosing to pay to work as volunteers are generally highly motivated, whether by the perceived value of the project, the 'fun' element, the learning experience or the feeling of 'giving something back' to the country or the wildlife they are enjoying the experience of. Enthusiasm can wane however after performing the same task day after day, not being sufficiently aware of why the project is being conducted or how the outcomes will be used, or feelings of being insufficiently appreciated or even exploited (e.g. Woodcock et al 2017). Some are also disappointed at never being notified of the results of the research (I have felt this myself) or not being acknowledged in the results (if it involved a lot of their time they may for instance wish to include a reference to it in their curriculum vitae). Some may also feel frustrated at being given very simple tasks when they feel they are capable of much more, especially if they have had previous scientific training. Still others with a science background (personal communication with tourists) have realised the work they have been asked to do at some venues cannot be used for valid conclusions and as such is not truly science..

Some may also be insufficiently aware of discomforts or inconveniences they have to endure (rain, heat, mosquitos, leeches, long journeys on rough roads, lack of wifi, limited choice of meals etc.) or unaccustomed situations such as dark nights: we took one student from Kyoto camping on a fauna survey and he spent much of the night winding the handle of the lantern in the tent to keep it charged, as he had never in his life experienced total darkness before.

Some visitors to wilderness areas are unduly afraid of spiders, snakes and other creatures they erroneously think are invariably dangerous (although many snakes and by far the majority of spiders are not) and which they expect will be aggressive or will actively seek out humans to bite. I always point out that these creatures know we're too big to eat, don't want to waste their venom on us, and generally try to stay out of our way.

There are also actual dangers, ranging from minor injuries from falls or rashes from various plants or insects, to traffic accidents, snake bites (it can happen, especially if careless), tick bites or elephant attack, which should be made very clear before anyone signs up as a volunteer. Most tourism businesses will be familiar with the need for public liability insurance and indemnity forms to protect themselves, but should also give participants satisfactory guidelines for avoiding dangers and advise them to take out their own accident insurance, and of course give satisfactory assistance in the case of actual injury or illness.

PROBLEMS FROM THE PERSPECTIVE OF TOUR OPERATORS

Tour operators I have spoken to often mention a lack of time during tours to add in citizen science activities, and even more so a lack of time to train volunteers on top of all the other things they do. Some say they don't even have time within a tour to educate their guests about the ecology and behaviour of the animals they see, let alone explain how to collect information about them. This is quite reasonable if trying to fit in some observations to an existing tour, although

it may still be possible to participate in a small way, for instance simply by sending a list of birds sighted to eBird and showing guests how to do so, or by having good instructions on the website as to how to record other kinds of simple observations during the tour so that guests come prepared. If operators are so inclined they can also develop an additional tour or two dedicated to citizen science, with some recreational activity and perhaps some direct conservation action thrown in as well.

Some operators are afraid that tourists may feel exploited by paying to do work. Many operators are also fearful of bad reports on TripAdvisor and other social media, and feel that any discomfort their guests may feel could be complained about and put others off booking their tours. However, it would seem that as long as the work and general conditions are explained clearly on promotional material or in correspondence with the tourists when they express interest, this should not be such a problem. If still worried (not every tourist reads all the details about the tour they have booked, as I have found with our own tour company), the operator could make a point of personally contacting each potential guest and explaining the conditions. There are many for whom “roughing it” a bit is part of the adventure, and a few tastes of “luxury” (a special meal, one night at an accommodation with a spa bath or whatever) can be a nice contrast to keep everyone in a good mood. Some tours may be in comfortable lodgings throughout, with citizen science activities in the morning and more recreational ones or free time in the afternoon, especially if for instance near a beach good for swimming or a forest with well-marked walking tracks.

Ellis (2005) reported that “Although volunteering can appear to be work, it is undertaken as a leisure activity and the durable benefits Stebbin’s (1982) identified as outcomes of serious leisure appeared valid within the PERT sub-segment. This supports the findings of other researchers who also noted the validity of serious leisure theory in the field of volunteer tourism (Broad, 2001; Wearing & Neil, 1997).” She also noted that at least some volunteers seem to be motivated by “giving something back” to the environment, and that some participated to learn specific skills to apply in their own projects.

Some tour operators also feel a bit out of their depth with taking on citizen science, especially if they have had no scientific training. This is where some clear guidelines and explanations of basic scientific method, including the meaning of and reasons for random sampling, the problems of pseudo-replication, the basic idea of a statistical test, the reasons for ensuring an adequate sample size, the importance of sticking to the rules (e.g. not counting anything outside the transect), consideration of assumptions made during the fieldwork and analysis and other important principles can be invaluable. Operators can also attempt to find academic or other researchers who do have a science background and an interest to join in the program with them and either become project leaders or help them do so themselves.

Tour operators with scientific training but with many time constraints may realise the difficulty of getting sufficient results for statistical analysis, even with

volunteers. They could consider working in with other operators or a community group to bolster numbers of observations (or measurements).

They may also consider it easy enough to attract customers to pay for doing research with the “charismatic megafauna” such as koalas or seals, but wonder how they could do so with research that is important to our understanding of phenomena such as ecological interactions or climate change but involve less exciting creatures such as snails or ants. However, if a strong case can be made for the study and it is in an attractive location or they can add other more immediately appealing activities it may be worth at least a trial run.

INTO THE FUTURE

Since Covid lockdown many tour operators who previously relied on international guests are looking for ways of attracting domestic travellers. Even when lockdowns are lifted, we can never tell what events may restrict international flights in the future, whether through further pandemics, terrorist activity, natural disasters such as volcanic activity with extensive ash drift that closes multiple airports, or whatever. Citizen science programs that will benefit conservation management within their own country, and a chance to see wildlife up close and benefit from scientific or natural history training by experts could in some cases open up new opportunities for tours to attract local custom.

The advice on running citizen science programs and guidelines for these is getting ever more sophisticated (Beeker et al 2013, Prysby and Super 2017). As noted by Beeker et al, guidelines should be put to the test of practical use and evaluated accordingly. There are a number of citizen science associations around the world that tour operators can join to improve their own skills.

The Global Citizen Science Partnership (<http://citizenscienceglobal.org/network.html>) lists many of these.

There would appear to be a number of levels a tourist could join in on, depending on background education, experience, skill and motivation. Assigning tasks based on these can reduce error and improve confidence in the results. Of course it is not foolproof, but then nor is any scientific endeavour – fully-trained scientists themselves have certainly been known to make errors (hence the value of peer review). Participants who have some background in science, depending on their knowledge, experience and intelligence, may also be good candidates for involvement in higher levels of participation in citizen science – formulation of research questions, analysis of data etc., thus satisfying one of the criteria mentioned above. This may be more difficult in the case of travellers than for local residents, although for major projects involving lengthy stays and direct communication with participants before arrival it is not impossible.

Providing benefit to society is sometimes overlooked, but could be emphasised more in the future. It can include having the results published online in an open access platform (and in a style readily understood by an intelligent non-specialist), or assisting with the development of guidelines for conservation

management or educational programs. It can be very time-consuming to produce an initial scientific report (a fact not often realised by those not working in science) and then also write it up for the general public, so time should be allocated from the start for re-writing for a general readership, which - depending on its purpose and intended audience - can be at least as time-hungry. Education of the public can lead to increased education of and appreciation (whether local resident, or tourist) of the wildlife, some of which may have a negative image (e.g. bats, snakes even if non-venomous) and a concern for their conservation. (e.g. Lupino-Smith 2019).

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