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# Imagining wildlife: New technologies and animal censuses, maps and museums

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ABSTRACT

By enabling the creation of networks of electronic sensors and human participants, new technologies have shaped the ways in which conservation-related organisations monitor wildlife. These networks enable the capture of data perceived as necessary to evidence conservation strategies and foster public support. We collected interview and archival data from UK-based conservation organisations with regard to their use of digital technologies for wildlife monitoring. As a conceptual device to examine these efforts, we used Benedict Anderson's (1991) work on censuses, maps and museums as social instruments that enabled the imagining of communities. Through a critical application of this framework, the technologically-aided acquisition of wildlife data was shown to inform the new ways in which conservation organisations identify and quantify wildlife, conceptualise animal spaces, and curate conservation narratives. In so defining, delineating and displaying the non-human animal world with the backing of organisational authority, new technologies aid in the representational construction of animal censuses, maps and museums. In terms of practice, large amounts of new data can now be gathered and processed more cost-effectively. However, the use of technologies may also be the result of pressures on organisations to legitimise conservation by being seen as innovative and popular. Either way, human participants are relegated to supporting rather than participatory roles. At a more abstract level, the scale of surveillance associated with instrumentation can be read as an exercise of human dominance. Nonetheless, new technologies present conservation organisations with the means necessary for defending wildlife against exploitation.


## 1. Introduction

There has been a discernible proliferation of monitoring and recording projects of varying scales, frequently spearheaded by non-government nature conservation organisations, aimed at plugging the knowledge gaps without which we cannot sustainably use, manage and protect biodiversity resources (Catalogue of Life, 2015; see also Wilson, 2003). To expand monitoring capabilities, organisations have increasingly turned to digital technology platforms. Such expanded capacities address a perceived need within conservation communities to evidence gains, losses and impacts in more certain terms, partly in order to better inform the formulation of conservation policies (Sutherland et al., 2004; Burns et al., 2013). It also affords organisations opportunities to legitimise conservation causes by fostering wider public awareness and support against threats of species loss (Verma et al., 2015). In this paper, we focus on the new technological monitoring and recording efforts undertaken by conservation-related organisations, examining arrangements such as digital applications used to facilitate crowd-sourced identifications of camera trap images of endangered species, and tracking and visualisation set-ups depicting movements of birds. We analyse how these endeavours unfold in practice and examine implications these practices might have for human-wildlife relations.

### 1.1. Traditional wildlife monitoring schemes

Monitoring and recording schemes, undertaken by conservation-related organisations to capture evidence on wildlife presence, abundance and movement, have characteristically been labour-intensive endeavours. With traditional methods, such as capture-mark-recapture approaches or conventional survey

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methods, organisations were reliant on staff and volunteer power, and hand-written logs for data storage. Although this reliance on such resources meant a certain degree of advantage over technological methods in terms of cost and material resource demands, it came with a number of limitations. In addition to challenges of scale due to limited spatial and temporal coverage (Catlin-Groves, 2012), and issues with recording, storage, reproduction and dissemination of data, traditional methods required arguably intrusive human presence in spaces inhabited by the wildlife being monitored (Kucera and Barrett, 2011). Further, traditional modes of monitoring brought up issues of the reliability of data gathering methods, associated with lack of training, recruitment and retention of volunteers. For example, in terms of determining presence, judging the veracity of species sightings in a non-technological way posed challenges wrapped up in questions of expertise, objectivity and reputation. In the absence of visual evidence of high quality and digital platforms for quick verification by experts and wider public, the process of turning sightings, particularly of rarer species, into data points was arduous and marked by controversy (Roberts et al., 2009).

While more traditional methods have continued to be used to capture wildlife data, there has been a perceived need to increase the quantity of monitoring schemes (in terms of numbers of species and areas covered), while maintaining the quality of observations made. Conservation organisations have therefore had vested interest in adopting methods to increase scale and improving reliability (Catlin-Groves, 2012). Consequently, these organisations have consistently adapted popular techno-scientific innovations, much like biologists and ecologists (Hebblewhite and Haydon, 2010; Pimm et al., 2014). Pioneering organisational forays using technologies to capture wildlife data focused on adapting technical sensors for conservation purposes. Prototypes of devices such as tracking collars and camera traps arguably allowed for more unobtrusive access to certain species. However, they were limited for a number of reasons, including unwieldy size and weight, and cost restrictions. First generation devices were also suspect to low reliability since they were only marginally more autonomous than traditional methods, requiring manual intervention to correct technical shortcomings such as short battery life and limited data storage. More pertinently, the operation and implementation of early technological sensors were kept largely separate from the work of volunteers and the public, not least since the processes required considerable expertise.

### 1.2. New networks for monitoring wildlife

More recently, newer digital devices have amplified the monitoring and recording capacities of wildlife organisations in distinct ways (August et al., 2015; Arts et al., 2015). The use of these technologies may best be understood in terms of the creation of networks comprised of technical sensors (Porter et al., 2009) and human and animal participants (Catlin-Groves, 2012). First, there are newer or more advanced versions of devices, such as satellite-linked tracking terminals or video-camera 'backpacks' (animal-borne sensors) attached to individual wild animals and camera-traps photographing wildlife, that operate in tandem with automating technologies such as motion detectors. These devices constitute electronic sensors that enable the collection of wildlife data without a high degree of human intervention. For example, with satellite-enabled tracking using terminals, while capture and tagging by skilled personnel is still necessary, recapture is increasingly not required for monitoring the movement of a tagged individual over prolonged periods of time. Technological development has also led to miniaturisation and increasing cost-effectiveness, allowing for the tracking of smaller species and more individuals. Power sources often last much longer, and data transmission and storage capacities have increased vastly (Seegar et al., 1996; Tomkiewicz et al., 2010). In spite of the still existing challenges and diversity of technologies used, the installation of growing numbers of such devices in the field means that organisations are now in a better position than before to observe the otherwise unobservable and more remotely collect extensive amounts of new types of data (Porter et al., 2009; Hance, 2011).

Second, the digitisation of monitoring and recording initiatives has also meant that conservation organisations have been able to combine the capacity of increasingly autonomous technological sensors with human participants. This has been facilitated by the inclusion of internet-connected digital platforms on widely available personal devices such as mobile phones and cameras, and advancements in Global System for Mobile Communication (GSM) technology and Global Positioning System (GPS) facilities.

There are three key aspects to the inclusion of the human component in digital conservation monitoring and recording networks: data gathering, data processing and engagement. First, in terms of data gathering, as Catlin-Groves (2012) pointed out, personal computing and communication technologies now make the user part of a framework for data collection (see also Ferster and Coops, 2013). Through participatory Web 2.0 facilities such as social media and 'citizen science' platforms, 'amateur-expert' naturalists (Ellis et al., 2005; Dickinson and Bonney, 2010) and ordinary members of the public contribute wildlife data, effectively becoming 'citizen sensors' (Catlin-Groves, 2012).

Second, with data processing, digital advancements have created both the need for, and opportunity to employ citizens for the analysis of large amounts of newly generated data (Kelling et al., 2015). For example, in the absence of accurate image identification technologies for processing vast amounts of image-based data captured by new technological sensors, digital platforms for crowd-sourcing become a viable means by which the presence and identity of species captured within a picture may be accurately detected by public participants (Siddharthan et al., 2016). Illustrating the inclusivity, ease, reach and speed of such technologically-mediated data gathering exercises in ideal-case scenarios, Silvertown et al. (2013) and Bonney et al. (2009) cite examples of amateurs spotting, photographing and uploading images of particular insect and avian species to publically accessible digital forums, whereupon other site users identified the submissions as being of rare species.

Third, in relation to engagement, it has been noted that projects involving the wider public, such as digital 'citizen science' platforms, have tended to revolve around enhancing public awareness of the natural world, and raising the public profile of environmental science, rather than concentrating on data generation and processing alone (Catlin-Groves, 2012; Allan and Ewart, 2015). Part of the reason for this is the ease with which data can now be translated into more easily understandable formats (e.g., images) and disseminated for consumption by non-specialists. In one sense, Zastrow (2015), for instance, highlighted how new software has changed the way species distribution and bird migration data may be visualised, pointing out that resultant maps are often used in outreach efforts (see also August et al., 2015). Creating visuals based on public data contributions thus serves to make their participation tangible. In another sense, new forms of technological engagement have also increased the possibilities for encouraging new members of the public to provide data, and for drawing them into supporting conservation causes. These networks for wildlife monitoring and recording – consisting of both electronic and human components – may thus be seen as producing new and more knowledge compared to traditional approaches (Van der Wal et al., 2015), not least since knowledge develops hand-in-glove with new technologies (Haggerty and Trottier, 2013).