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Using Wikipedia page views to explore the cultural importance of global reptiles

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ABSTRACT

Modern conservation operates at the nexus of biological and social influences. While the importance of social and cultural factors is often mentioned, defining, measuring and comparing these factors remains a significant challenge. Here, we explore a novel method to quantify cultural interest in all extant reptile species using Wikipedia — a large, open-access online encyclopaedia. We analysed all page views of reptile species viewed during 2014 in all of Wikipedia's language editions. We compared species' page view numbers across languages and in relationship to their spatial distribution, phylogeny, threat status and various other biological attributes. We found that the three species with most page views are shared across major language editions, beyond these, page view ranks of species tend to be specific to particular language editions. Interest within a language is mostly focused on reptiles found in the regions where the language is spoken. Overall, interest is greater for reptiles that are venomous, endangered, widely distributed, larger and that have been described earlier. However, within individual reptile families not all the above factors predict page views. Most families contain at least one species in the top 5% of page views, but 29 families (with 1,450 species) have no 'high interest species' in them. Overall, our analyses elucidate novel patterns of human interests in nature over large geographical, cultural and taxonomic spectra using big-data techniques. Such approaches hold much promise for incorporating social perceptions in future conservation practices.

1. Introduction

Various cultural elements exert a powerful influence on how conservation attention and resources are allocated. Challenges facing species conservation projects may even be primarily social rather than biological (Kellert, 1985; Tisdell, 2014). Thus, in order to secure better outcomes for conservation management schemes – in addition to biological attributes – social and cultural variables should also be incorporated in decision making (Ladle and Jepson, 2008). Nevertheless, these attributes are often neglected in the conservation decision-making process (Gunnthorsdottir, 2001; Kellert, 1985; Stokes, 2007).

Most global and regional conservation prioritization schemes rely on quantifiable differences in the geographic distribution, population size, ecological role, and evolutionary distinctness of species (Faith, 1992; IUCN, 2014; Mills et al., 1993; Vane-Wright et al., 1991). However, species are also unequal in their contributions to human culture — in how they are perceived by, and attract attention from, humans. While a few authors have addressed this point (Cristancho and Vining, 2004; Garibaldi and Turner, 2004), the extent to which species vary in their cultural importance or impact remains very poorly studied and how these potentially affect conservation practices is mostly unknown. Nevertheless, in order for conservation actions to be fruitful they need to incorporate both traditional conservation parameters and cultural values in local to global scales of the different actors and interventions attempted.

As with other human practices, conservation may suffer from biases due to the non-randomness in human interests and affections. For example we are more interested in the well-being and prolonged persistence of big, 'fluffy', attractive animals (Gunnthorsdottir, 2001; Johnson et al., 2010; Ward et al., 1998), those with large, forward facing eyes (Macdonald et al., 2015), those who are more brightly coloured (Prokop and Fančovičová, 2013; Stokes, 2007) and preferably more phylogenetically (and thus morphologically) close to us (Gunnthorsdottir, 2001).

Reptiles as a group are usually less in the public eye when compared to the other groups of tetrapods, due to several potential biases and knowledge deficiencies. This may have great ramifications for their prolonged conservation. Reptiles comprise about 30% of all extant land vertebrate species (Meiri and Chapple, 2016, this issue), and are likely

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to have an even greater representation amongst threatened species (IUCN, 2014). Nevertheless, their representation in targeted species conservation schemes is usually much lower (Clucas et al., 2008). Here we list reptiles' representation in targeted species programs of a few global conservation NGOs, acknowledging that local conservation schemes may have different representations of reptiles. Of the World Wildlife Fund's 36 priority species or species groups, only sea turtle and 'Asian tortoises and freshwater turtles' are reptilian (http://wwf.panda.org). Of the 1,031 projects supported by the Mohamed bin Zayed Species Conservation Fund which incorporate tetrapods, only 17% include reptiles (http://www.speciesconservation.org). None of the African Wildlife Foundation's projects target reptiles (http://www.awf.org). Reptiles comprise 16% of the specific species of interest listed by the Defenders of Wildlife organization, but only 6.5% of their species up for adoption (http://www.defenders.org). While 13 of the 36 species (36%) under management by the Durrell Wildlife Conservation Trust are reptiles, only one of the 14 species (7%) up for adoption on their website is a reptile (http://www.durrell.org). Furthermore, as compared with mammals and birds, the scientific knowledge of basic biological attributes of reptiles is much lower, and thus so is our ability to develop sound conservation practices addressing their prolonged survival (Böhm et al., 2013; Meiri and Chapple, 2016, this issue). For example, while the distributions of all other groups of tetrapods has been known for a decade now (Grenyer et al., 2006; Orme et al., 2005), only recently has a parallel effort been completed for reptiles (http://www.gardinitiative.org).

Within the ~10,300 recognized species of reptiles (Uetz and Hošek, 2015) there are great differences between species in the cultural representations (i.e. appearance at all in the public sphere) and importance in various cultural roles they play. Some reptile species (e.g., venomous snakes, geckos, tortoises, crocodiles) have potent roles across an array of cultural mediums — in the pet trade, as food objects, as fictional characters, as objects of fear or aspiration, etc. (Alves et al., 2009; Alves et al., 2008; Campbell, 2009; Klemens and Thorbjarnarson, 1995). Nevertheless most species remain unknown beyond a few herpetology specialists. As such, there are potentially great differences in the contributions of individual reptile species to the various domains of human culture. If conservation hopes to preserve features such as the 'aesthetic, historical, and recreational values' of species (Millennium Ecosystems Assessment, 2005), then identifying which species contribute to those values is of fundamental importance. Previous studies have examined cultural attitudes towards particular reptile species within local contexts (Ceríaco, 2012; Ceríaco et al., 2011; Deb and Malhotra, 2001; Jones et al., 2008; Ramstad et al., 2007), yet there have been no global efforts to compare the cultural significance of reptiles. Since many conservation policies and frameworks operate globally, considering cultural value at a global scale is potentially very useful.

'Culture' is one of the most widely used terms in the English language (Taras et al., 2009). In the context of conservation, 'cultural value' is frequently applied to defining ways in which humans assign value to different species. Though useful in the abstract, it creates challenges in measuring exactly what it means and creates confusion through the various meanings of value. Here we explore page view statistics (elaborated below) extracted from the Wikipedia online digital text archive for all extant reptiles in all language editions as a measure of the prominence of an entity or idea within a given cultural context (Yu et al., 2015).

Digital text archives are an increasingly significant resource for the study of human culture and enable questions and scales of investigation that were unfeasible until recently (Aiden and Michel, 2013; Lazer et al., 2009; Schich et al., 2014). The use of these resources for studying cultural patterns relevant to conservation is beginning to be recognized but remains low (Arts et al., 2015; Correia et al., 2016). The cultural salience of reptile species could theoretically be studied in a variety of digital archives. Within this context, Wikipedia is particularly appealing for several reasons: 1) it is huge (>35 million articles in English to date); 2) it is multilingual (287 languages including 12 with >1 million articles); 3) it is open access and free to download; 4) it follows a standardized structure that groups information on a species together and thus avoids many of the challenges of unstructured text databases; and 5) a growing body of academic literature addresses aspects of Wikipedia's coverage (Giles, 2005; Halavais and Lackaff, 2008; Messner and DiStaso, 2013; Samoilenko and Yasseri, 2014), credibility (Brown, 2011; Miller and Murray, 2010; Wilson, 2014), contributor demographics (Wilson, 2014) and user dynamics (Yasseri et al., 2012; Yasseri et al., 2014).

Wikipedia also has important limitations in the results it can produce and biases in whose cultural information it reflects. Unsurprisingly, Wikipedia skews heavily towards the Global North with respect to both content generation and usage, and New Guinean, as well as, African languages are poorly represented (Graham et al., 2014). Wikipedia contributors also tend to be a highly skewed demographic from within the Global North: English-language Wikipedia contributors, for example, are primarily male, and mostly under 29 years old (Wilson, 2014). As of 2013, 4.3 million registered users made at least one edit to all of Wikipedia, but only about 130,000 registered users made more than 100 edits (Wilson, 2014). Another significant challenge in analysing Wikipedia from a cultural standpoint is that some of its contributors are not human. A proportion of Wikipedia articles are created or edited by specialized programs called 'bots'. As an example, one of the most active bots, called 'Lsjbot', has contributed various types of information to over 2.7 million articles. Results obtained from Wikipedia therefore need to be considered within this context. We therefore want to emphasize that Wikipedia should not be seen as reflecting universal values nor representing the voices of groups such as indigenous people or individuals with limited internet access.

Wikipedia provides several potential referential metrics of cultural interest or saliency of different objects, each with potential benefits and flaws. Each Wikipedia page has been created at a particular date, been edited several times by a different number of editors, has a particular length, is linked to and from other pages (within and outside Wikipedia), appears in a set of different language editions, has been viewed a particular number of times, etc. Some of these metrics are potentially very information rich. Unfortunately, many of these metrics may suffer from inherent biases due to bot activity. Therefore, for our initial exploration of these data as a source for cultural attitudes towards nature, we limited our scope of reference only to the number of page views in different language editions of Wikipedia reptile pages. We suggest that page views within a given language measure the general interest that a page attracts from the public speaking that language (with the above biases in mind). We acknowledge that page views are recorded in a way that cannot account for page queries made by bots. Nevertheless, as most page views are made by humans (http://stats.wikimedia.org/archive/squid_reports/2014-12/SquidReportCrawlers.htm) we posit that they can provide some insight as to which reptiles attract more interest in the public sphere globally.

Here, we provide a novel approach to quantify and compare one aspect of the cultural interest associated with global reptile species: the number of times individual reptile pages are viewed, in a large, user-generated, multi-lingual, online encyclopaedia. We explore patterns at the species level, as many consider species the fundamental unit of biodiversity (Wilson, 1992) and many conservation actions are designated towards individual species (Brooks, 2010). This enables us to explore i) those species that may have greater conservation value because of their higher cultural interest, and ii) cross-cultural differences in interests towards reptile species, a key attribute in unravelling many conservation challenges. We address three questions relevant to the investigations of culture and conservation: 1) which reptile species attract most cultural interest globally, 2) what biological traits characterize those species, and 3) how does the relative cultural interest in species vary across languages.

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