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Authors: George Holmes, Thomas Aneurin Smith, Caroline Ward

“Fantastic beasts and why to conserve them: animals, magic and biodiversity conservation”

George Holmes, University of Leeds, UK

Thomas Aneurin Smith, University of Cardiff, UK

Caroline Ward, University of Leeds, UK

Abstract

There is a broad set of human beliefs, attitudes and behaviours around the issue of magical animals, referring to both mythical animals not recognised by science and extant animals which are recognised by science but have magical properties which are not. This is a broad issue ranging from spiritual beliefs around mythical animals living in Malagasy forests, to cultural heritage associated with the Loch Ness Monster in Scotland. Beliefs and behaviours around magical animals can have positive and negative impacts on biodiversity conservation goals. Yet so far, the discipline of conservation biology has not adequately considered magical animals, neglecting to account for the broader knowledge from outside the natural sciences on this issue, and taking a narrow, utilitarian approach to how magical animals should be managed, without necessarily considering the broader impacts on conservation goals or ethics. Here we explore how magical animals can impact on conservation goals, how conservation biology and practice has thought about magical animals, and some of the limitations of current approaches, particularly the failure to consider magical animals as part of wider systems of belief and culture. We argue that conservation needs to seriously consider magical animals and their implications for conservation.

Keywords: conservation, ethics, Madagascar, magic, spirituality, snakes, Tanzania

Introduction

In 2013, a court case protested against a proposed new highway in Iceland because it would cross the habitat of a valued species (The Guardian, 2013). In 2015, 350,000 tourists visited a site in Scotland primarily because it is inhabited by a rare, endemic animal (ASVA, 2016), supporting a thriving ecotourism industry. Hyenas (*Crocuta crocuta*) in Ethiopia are tolerated because they provide vital provisioning ecosystem services benefitting local communities (Baynes-Rock, 2013). In Madagascar, by contrast, some snakes are persecuted because they provide ecosystem disservices, harmful to human health (Tingle, 2012). These are seemingly straightforward conservation stories, where human-animal interactions produce benefits and costs for both biodiversity and human beings. Yet there is an often-overlooked complexity to these cases, with important implications for conservation outcomes. The species involved are either not recognised by science, or the properties of these species which local people resent or value are not recognised by science. The Icelandic protesters were protecting the habitat of *Huldufólk*, or elves. Ecotourists in Scotland were seeking the Loch Ness Monster (*Nessiteras rhombopteryx*). The Ethiopian hyenas provided the ecosystem service of eating evil spirits. The Malagasy snakes harm humans and cattle by transforming into sharp spear-like forms and dropping from trees. This paper argues that conservationists must take magical animals seriously, because they have important positive and negative implications for many species and habitats. As demonstrated below, magical animals have been neglected and oversimplified within conservation, likely due to a lack of training in relevant disciplines, and an overly utilitarian view of human-animal relations, and this has harmed the ability to conserve species.

The paper begins with a brief typology of magical and mythical animals, before outlining the complexities and diversity in beliefs on magical and mythical animals across the global South and North. It then explores how magical animals impact upon broader conservation goals, and how they compare to other spiritual and similar issues in conservation, followed by a critique of existing

conservation literature on magic. Two case studies of magic animals in Madagascar and Tanzania illustrate in detail some of these trends in two countries with significant conservation activity, and the inadequacies of how conservation has approached magical animals. It concludes by exploring ways to understand the conservation implications of magical creatures.

Magic, animals and contemporary human societies

Magical animals are complex. They are found worldwide, although beliefs are locally specific and dynamic. They blur boundaries between magic, spirituality, culture, tradition, and politics. We discuss here two kinds of magical animals: mythical species not recognised by science, such as the Loch Ness Monster and Icelandic elves, and extant-but-magical species which are recognised by science but have properties which are not, such as spirit-eating in Hyenas, or spear-like behaviours in snakes. This joint focus is justified for three reasons. Firstly, both are associated with protection of species and habitats, in many locations including in Western/'modern'/'scientific' societies and cultures. Secondly, whilst zoologists would distinguish between mythical and extant-but-magical, local people treat them in very similar, if not identical, ways, as we show below. From the perspective of studying human culture and behaviour, the divisions between when a creature is regarded as extant, mythical or as 'heritage' can be somewhat artificial. Thirdly, both have been neglected within mainstream conservation literature. Here we define conservation as activities to preserve biological diversity and its associated values and services.

Concern for magical animals, and a broader assemblage between the spiritual and the ecological, is not confined to indigenous communities of the global South (Abrahams, 1994). Societies of the global North remain suffused with magic, spiritualism, witchcraft and the occult (Comaroff & Comaroff, 1999). There are degrees by which individuals in all societies may hold the supposedly dissected worldviews of the scientific and the spiritual, magical or religious, evidenced by the persistence of the fantastic (including magical animals) in popular culture (Rountree, 2002), and in

major and minor religions, cults and witchcrafts (Moore & Sanders, 2001). Beliefs in magical animals are dynamic, and can transcend from the spiritual or mystical to become cultural heritage (Comaroff & Comaroff, 1999), such as the Loch Ness Monster, Welsh Dragons and the Beast of Bodmin Moor in the UK, Trolls in Denmark (Karrebæk & Maegaard 2015) and various lake-dwelling monsters across the globe including the Kanas Lake Monster in Xinjiang, China (Wang et al. 2010), and in northern Europe including the Seljordsormen (Norway), the Lagarfjót Worm (Iceland), and the Storsjöodjuret of Sweden, the latter briefly given protected status by the Swedish Environmental Protection Agency but later revoked by the Swedish Parliament (Sandelin 2014). Alongside these notable mythical creatures are more general magical associations with extant species, for example black cats and magpies (Peltzer, 2003). Ongoing shifts are partly due to syncretic religions appropriating pagan, folk and indigenous worldviews around magical creatures, both historically in Europe, and ongoing in Africa, India and elsewhere (Chandran & Hughes, 2000; Frascaroli, 2013; Ormsby & Bhagwat, 2010). Magical animals can be powerful political tools in struggles over biodiversity and natural resources, as identity and culture associated with magic animals is re-worked as a political project. Icelandic *Huldufólk* are a synecdoche of the agrarian, rural, traditional past in a country which has rapidly and relatively recently transitioned into an urban, industrial, globally connected society – even recent ‘sightings’ of *Huldufólk* describe them wearing traditional farming dress, rather than modern clothing. As such, arguments about defending their habitat can be more about defending ideals of past landscapes and traditions, and less about a sincere belief in the existence of elves (Hafstein, 2000). Such arguments are particularly powerful given the place of *Huldufólk* in Icelandic culture. In Sikkim, India, the Lepcha people have harnessed their spiritual worldviews in an ethnic-nationalist project, allowing them to (re)construct their indigenous identity around sacred forest and species protection (Arora, 2006). Particularly indigenous cultures were re-positioned at the expense of others by laying claims to sacred species as under the care of particular groups.

Magical animals, conservation rationalities and the conservation of non-magical biodiversity

For conservationists, interactions between humans and magic animals can be categorised according to how they benefit or harm extant biodiversity, although as demonstrated below these can overlap and interact in complex ways. Firstly, some species are tolerated or encouraged because of a belief in their magical properties. In Accra, Ghana, vultures are associated with magic, and therefore harming them is seen as bringing bad luck (Campbell, 2009). This leads to demonstrable differences in attitudes and behaviours towards vultures between those who hold these beliefs, and those who do not. Such beliefs are least likely to be held by younger men, who tend to have a formal, western-informed education, although rising scavenger numbers may strengthen magical beliefs (Campbell, 2009). The spread of nationalised formal education, conversion to major religions, and heightened immigration to certain communities have all reduced the efficacy of local worldviews and associated magical creatures (Metcalf et al., 2009), although witchcraft and spiritualism appear to be rising in modern Africa (Kohnert, 2003). The survival of large predators outside of protected areas is down to their acceptance or tolerance by local communities, forged by place-specific circumstances in which spiritual beliefs may play a key part (Pooley et al 2017). In Kombulcha, Ethiopia, hyenas are tolerated and encouraged, despite many instances of hyena attacks on humans, particularly children. Hyenas are believed to bring supernatural messages through their howls, eat evil spirits, and thus protect local human beings. These magic beliefs coexist alongside recognition of more conventional ecosystem services, such as hyena predation on crop-raiding herbivores, and these collectively underpin attitudes towards hyenas (Baynes-Rock, 2012). Local beliefs in the magical properties of hyenas pre-date Islam, and only survive because of the incompleteness of people's conversion to Islam. In some areas of Brazil, a belief that dolphins can magically transform into human beings underpins local attitudes and behaviour, and ultimately their conservation in these places (Alves & Rosa, 2008), although, as explored below, closely related beliefs have also led to

negative outcomes for dolphins. A belief in magic animals can benefit extant species by acting as an 'umbrella' species, whose conservation protects other animals occupying the same habitat, as with the *Huldufólk*.

In other instances, beliefs in magical animals are incidental to conservation goals. Some groups in the Serengeti, Tanzania, see certain animals as sacred totems, with spiritual connections to these groups. As such, hunting them should only be done following specific procedures and rituals to prevent bad luck. Whilst such beliefs towards elephants prevented some groups from partaking in ivory poaching, it was not sufficiently widespread to have a significant impact (Kideghesho, 2008 – see also Kaufmann, 2014, described below). In East Africa, such beliefs have been weakened by decades of colonial and postcolonial suppression of traditional spiritual activities, and the spread of Christianity.

A belief in the magical properties of animals can impede their conservation, and magical animals are sometimes actively persecuted. Owl species across the Caribbean are sought out and killed because they are associated with evil spirits in several strands of syncretic voodoo (Wiley, 1986). Such beliefs are rarely recognised within literature on human wildlife conflict. In other cases, a belief that certain species possess magical properties leads to unsustainable rates of harvest, such as dolphins and several species of reptile in some areas of Brazil (Alves and Rosa, 2008, Alves et al., 2009).

Conservationists propose solutions such as captive breeding and promotion of alternative, sustainable, magical products. Persecution or harvesting rates of extant-but-magical animals may increase with increased access to better technology, or integration of communities into commodity chains (Dickman et al 2015). Impediments to conservation can be less direct – in some parts of Papua New Guinea, communities argue that some species will never become extinct because the villagers know magic spells to make the species return to that area (Bastyte et al., 2011).

Whilst magic animals have rarely featured in the conservation literature, there are other parallel issues which feature more prominently. A focus on magic animals both extends and illuminates

problems within this literature. Firstly, there is research on religion and conservation, such as associated with the Society for Conservation Biology's Religion and Conservation Biology Working Group. This largely focuses on established mainstream religions, and on broad interactions between environmental ethics and religious beliefs (e.g. McDaniel, 2002). Instead, we focus on relatively marginal religious beliefs, on particular species rather than broad attitudes, and on instances where spiritual or magical beliefs have transformed into cultural heritage, yet still exert an influence on human behaviour and on conservation outcomes, a blurrier definition of spiritual dimensions of nature.

Secondly, there is substantial work on sacred sites and other culturally and spiritually protected areas set aside from resource use, which are increasingly recognised for their contribution to conservation (Anthwal et al., 2010; Ormsby & Bhagwat, 2010). Sacred sites are relatively straightforward for conservationists to comprehend – as defined territories with norms and rules of resource (non) use, they closely resemble other forms of protected areas, and can be included in the IUCN's definitions and databases of protected areas (Borrini-Feyerabend et al., 2004). Sacred sites are often analysed using concepts and approaches typically used for understanding protected areas and common pool resources. This overlooks the complexities of the spiritual beliefs underpinning these areas, their past evolution and possible future directions, to the extent that implies such sites owe their existence to a conservation ethic, not a spiritual one (Kibet, 2011; Salick et al., 2007). The literature emphasises sacred sites' positive contribution to conservation, rather than negative consequences. By contrast, magical animals are less easy for conservationists to conceptualise using dominant conservation concepts. We focus on the positive and negative implications of magic animals for conservation, and on the rationalities and beliefs underpinning human relations with magical animals, in order to understand their dynamics and possible futures.

Finally, there is a slimmer literature on the implications of taboos, customary prohibitions on resource use, for conservation (Virtanen, 2002). As with sacred sites, this literature understands

taboos using institutional approaches typically used for conceptualising common pool resources, and tends to assume such resources are protected by a conservation ethic, not a spiritual one (Byers et al., 2001; Kideghesho, 2009). It also focuses on taboos within 'traditional' societies (typically meaning indigenous groups in the global South), rather than the diversity of societies represented within cases of magical animals. Where this literature does consider sacred sites in the global North, it focuses largely on forest sites and their past religious significance rather than contemporary society (Chandran & Hughes, 2000; Frascaroli, 2013). Literature on taboos by definition focuses on instances of non-use of resources, whereas our focus goes beyond this to include wider relations with magical and spiritual aspects of nature, and on antagonism between humans and nature, and persecution of biodiversity.

This demonstrates that studying magical animals has great potential to strengthen and broaden the literature on spiritual aspects of biodiversity conservation. Yet several problems regarding how conservation has previously conceptualised spirituality and magical animals need to be addressed. Firstly, conservation is primarily about "modifying human actions to minimize their negative impacts upon biodiversity" (St. John et al., 2013: 344), yet within conservation, humans are mostly seen as rational decision makers or '*homo economicus*'. This means 'irrational' spiritual and magical beliefs are often absent from conservationists' understanding of threats to biodiversity, such as human wildlife conflict. For example, research on human-predator conflicts in the Caribbean (e.g. Turvey et al., 2014) has viewed persecution of owls and mongooses through the lens of rationality, even though mongoose persecution is an economically rational response to predation of chickens whereas owls are persecuted because they are considered evil spirits. The natural science bias of conservation often leads to an approach where emotion is considered to be anathema to rational decision making (Nelson et al., 2016). Secondly, relatively few conservationists have been trained in social science or humanities disciplines that deal with 'irrational' aspects of human beliefs and behaviours, despite the many calls for an interdisciplinary conservation science which values methods and inputs from outside the natural sciences (Bennett et al., 2016; St. John et al., 2013).

Here the expanding literature on the environmental humanities, rarely explored by conservation, is relevant (Sorlin, 2012). Magic animals have been examined by social science and humanities disciplines such as ethnoecology (Alves 2012), environmental history (Pooley 2016), and social anthropology (e.g. Knight 2000). Whilst this literature is too complex to summarise here, it yields detailed, place-based explorations of humans and their relationships with biodiversity, focusing on what makes sense to local people rather than to scientific conservationists, keenly attuned to uncovering the often hidden details and rationales behind human behaviour through qualitative methods such as ethnography.

Thirdly, combining the previous two points, with few exceptions (e.g. Dickman et al. 2015, Pooley, 2017, Aisher and Damodoran 2016) the conservation literature has given inadequate treatment to the complex social and cultural context, or the ontological system, in which magical animals are situated. Conservation may have an overly simplistic view of how to manage magical beliefs, promoting those seen as beneficial to conservation and repressing those that are not (Colding & Folke, 2001; Kibet, 2011). This utilitarian view isolates beliefs in magical animals from other forms of belief and knowledge, rather than seeing them as part of a broader, complex, dynamic worldview. For example, the literature on sacred sites and resource taboos tends to rationalise their protection by local societies either as providers of local ecosystem services (it is rational to consider spaces as sacred, therefore requiring conservation, because they provide direct ecosystem service benefits), or that worship or persecution of magical creatures plays an important role in maintaining the associated social system, the logic being it is rational to promote social integrity around cultural rituals and norms (Anthwal et al., 2010; Rutte, 2011). This contrasts with the vast humanities literature exploring societies and their worldviews around magic, witchcraft and spiritualities in depth. This complex literature has identified how beliefs in magic are part of broader rationalities, and explores their role in social, cultural and political life. For example, magical animals may be considered alongside scientific explanations in people's understandings of phenomena (Stambach, 2000). In South Africa and Tanzania witchcraft has been recognised by the state through law, and

through state practices that officialise witch-finding (Kohnert, 2003; Mesaki, 2009). Occult practices which harness the harmful properties of magical creatures, such as witches using snakes to attack their victims (Bjerk, 1969), can have real negative effects on the social fabric of local societies (Eves & Forsyth, 2015).

Yet instead of seeing magic and spirituality as part of a broader system, conservation interventions have tended to pick out individual aspects of beliefs or culture to either strengthen (if considered pro-conservation) or weaken and change (if considered anti-conservation). These simplistic practices lack attention to local realities, nullifying the rhetoric behind 'local' and 'participatory' forms of conservation (Dudley et al., 2009; Verschuuren, 2006). Treating spiritual worldviews on magical animals as forms of environmental management, without considering the broader system in which these aspects occur can cause problems and backfire, as illustrated below. For example, conservation management attempts to officialise sacred landscapes in Australia and Canada have problematically fixed boundaries around previously fluid sacred areas (Byers et al., 2001; Schie & Haider, 2015;). As Manfredo et al. (2016) argue, changing values also requires changes in the broader structures and societies in which those values are embedded. Alternatively, Dickman et al (2015) argue that promoting or manipulating conservation-friendly spiritual beliefs can undermine science-based conservation activities.

Finally, promoting or suppressing individual aspects of beliefs or culture, can have unforeseen long-term consequences for human wellbeing and culture as well as biodiversity, as explored in the cases below (see Dickman et al., 2015). There is an ethical conundrum in conservationists' utilitarian approach of promoting those aspects of culture and belief benefitting conservation goals, whilst suppressing those that don't. Conservationists are fearful of accusations of cultural imperialism when criticising the spiritual and cultural practices that are harmful to biodiversity, particularly in the global South (Dickman et al., 2015). A broader debate on how conservation treats cultural practices is required.

The next two sections illustrate the issues around magical animals in two countries of high conservation value – Madagascar and Tanzania. They show how the issues raised above interact in specific locales, how they affect conservation goals, and conservationists' attempts to manage them. Whilst distinct, they demonstrate the complexity of the issue, and the problems with conservation interventions on magical animals.

Madagascar:

Beliefs surrounding magical and mythical animals in Madagascar are often interlinked with local *fadys*, a system of informal institutions making certain behaviours taboo, and a strong part of Malagasy culture. Breaking *fadys* risks supernatural retribution, affecting individuals or leading to wider consequences (Scales, 2012). *Fadys* can be extremely localised and may differ between neighbouring villages. Many lemur species are believed to be the spirits of Malagasy ancestors, therefore it is *fady* to kill these species (Jones et al., 2008). Other species are associated with negative beliefs, such as the aye-aye (*Daubentonia madagascariensis*). Aye-ayes are considered a harbinger of evil, its appearance predicting death or sickness of someone in the village - the Malagasy expression "*Mangatabmo hita, miseho tsy tsara*" translates as "*If (the aye aye) is seen, there will be evil*" (Simons & Meyers, 2001). Another belief is that aye-ayes sneak into houses and murder the sleeping occupants using their long middle fingers to puncture the victims aorta (Goodman, 2015; Piper, 2007). In order to prevent bad luck, the aye-aye must be killed and displayed on roadside poles. On occasions entire villages have been abandoned after an aye-aye sighting (Simons & Meyers, 2001; Goodman, 2015). Reptiles are also linked to magical or spiritual beliefs. The zebu killing snake or *fandrefiala* (genus *Ithycyphus*) is believed to be able to straighten its body, dropping out of trees like a spear, killing people and livestock. Its characteristic red tail is said to be caused by bloodstains (Tingle, 2012).

The *kalanoro* are “*beneficent spirits that often inhabit rivers or caves; they tend to be envisioned as women with very long hair and fingernails who eat crabs, have reversed feet (heels in front, toes in the back), and are very short like dwarves*” (Golden & Comaroff, 2015a: 4). Belief in their existence is widespread throughout Madagascar, although explanations of their role varies, from kidnapping children, luring people into being lost in the forest, advising on medicinal plants and herbs, or dictating *fadys* to individuals through visions or dreams (Hobbs, 2001; Golden & Comaroff, 2015b; Mattheeuws, 2008). If the forest is destroyed or degraded, it is believed the *kalanoro* would disappear (Golden & Comaroff, 2015a).

Fadys can protect particular species (Lingard et al., 2003; Randrianandrianina et al., 2010), and are often promoted as exemplifying how conservation can align with tradition, following calls for integration of traditional knowledge, practices and beliefs within conservation (e.g. Infield & Mugisha, 2013). The historically low prevalence of bushmeat hunting in Madagascar, compared to other tropical countries, has been linked to *fadys*, as *fady* species are eaten less frequently (Jones et al., 2008; Jenkins et al., 2011). *Fadys* have been promoted to prevent extinction of the critically endangered radiated tortoise (*Geochelone radiata*) (Nussbaum & Raxworthy, 2000). In one conservation project, villages with strong *fadys* protecting tortoises were ‘rewarded’ with school buildings, in the hope this would encourage neighbouring villages to strengthen their cultural beliefs (Hudson, 2013; Lingard et al., 2003).

However, an assumption that beliefs are and will always be conservation-friendly risks oversimplification, as Kaufmann (2014: 329) states, “*Malagasy taboos are directed at something very different from conservation: namely, at pursuing a structured relationship with their ancestors*”. Golden & Comaroff (2015b) found although *fadys* were more strictly adhered to than wildlife protection laws, they were too heterogeneous between and within communities to provide any real protection. The radiated tortoise *fady* illustrates the dangers of misinterpreting behaviours related to beliefs; local people themselves would not harm tortoises due to fear of spiritual retribution,

however they would not stop 'outsiders' from harming or removing tortoises "*since it did not involve anybody bound by a rule that forbade harming the animals*" (Kaufmann, 2014: 328). Rapid immigration, economic development, failed harvests or high levels of poverty and malnutrition, may weaken adherence to *fadys* (Kaufmann, 2014; Jones et al., 2008; Jenkins et al., 2011). Concern *fadys* may be eroding, or do not protect species as hoped, has led to calls to increase enforcement of wildlife laws (e.g. Jenkins et al., 2011). However, this highlights a false assumption that culture remains static throughout time; whereas beliefs may be fluid and can erode, strengthen or evolve (Golden & Comaroff, 2015b). Uptake of Western religions, such as Christianity, does not appear to have affected belief and adherence to *fadys*; despite potential conflicts (Golden & Comaroff, 2015a).

Fadys and other beliefs can also have negative conservation impacts. *Fady*-related killing of aye-ayes is listed as a key threat to their survival (IUCN, 2014). Negative *fadys* linked to snakes and chameleons have not been studied in depth, but could also represent a threat to certain species. In these cases, beliefs are considered as an obstacle to conservation efforts, and education a solution to remove these irrational perceptions. For example Glaw et al (2008) in reference to the aye-aye : "*More efforts to sensitize the natives for the protection... would be desirable to reduce the threatening of this exceptional primate species*". This response contradicts the call to integrate traditional practices and beliefs into conservation, and the ethics of this 'picking and choosing' of cultural beliefs has been questioned (see also Dickman et al., 2016). Keller (2009) states: "*If only things such as fady and 'sacred forests' are promoted as valuable 'culture' in the conservation literature, this may give rise to the suspicion that what we are really dealing with is an unsettling attempt to use 'culture' simply in order to better sell to the Malagasy what they might, in fact, not want*".

Tanzania:

Snakes have symbolic importance across diverse cultures. In some, snakes are worshipped and revered, whilst others, particularly those influenced by monotheistic religions such as Christianity, regard snakes as materialisations of Satan (Sunseri, 1999). Across Africa, snakes are commonly considered to be magical creatures (Bjerk, 1969; Sunseri, 1999). Although literature on sacred sites has supposed connections between the sanctity of species and habitats with their ecosystem service benefits for local people (Kibet, 2011; Salick et al., 2007), the snake as a magical creature challenges this - snakes are not easily recognisable to humans as beneficial ecologically, often regarded as dangerous and, as magical creatures, may be regarded as 'good' and 'evil'. In East Africa, snake-human encounters are common (Nonga & Haruna, 2015), and can be dangerous for both sides. Snakebites are an important cause of morbidity and mortality among rural dwellers (Maregesi et al., 2013), and encounters may cause psychological harm. Yet coexistence with snakes does bring benefits to humans, including snakes killing unwanted insects and rodents, whilst humans may take measures to preserve snake habitats.

In Tanzania snakes are worshiped and protected as ancestral spirits, and persecuted and killed as embodiments of evil and ancillaries to witchcraft killings. The diversity of the magical properties of snakes is partly due to Tanzania's ethnic diversity, with 120 different tribes. Tribes typically have their own languages, sets of worldviews and cultural traditions, and within tribes there is further diversity between clans and villages, whilst different tribes inhabit diverse geophysical, climatic and ecological areas (Kideghesho, 2009), leading to encounters with a diversity of species in specific ecologies and landscapes. Despite this diversity there is some commonality. Many tribes have sacred natural sites, typically forests, such that across diverse rural areas sacred and ritual sites are significant as habitats for species, including endemic or endangered species (Mgumia & Oba, 2003; Smith, 2016). It is also typical for ethnic/tribal groups to regard species of animals and plants as spiritually significant, although there is considerable diversity (Kideghesho, 2009).

There is limited research on the magical properties of snakes in Tanzania and the consequences for conservation. Nonga and Haruna's (2015) study in Monduli District, Northern Tanzania, with a significant Maasai population, reported frequent snake killing due to snakes being evil, causing misfortune, and being associated with witchcraft. Conversely, for the Zaramo of coastal Tanzania, snakes can be the personification of the god Koleo, who, in one oral tradition, appears to women as a snake and asks for them to marry him (Sunseri, 1999). For other ethnic groups in northwestern Tanzania, species of snake including pythons, puff adders, the black mamba and cobras are associated with specific clans as their animal symbol, affording this animal protection (Kideghesho, 2008; 2009). Bjerke (1969) shows how, for the Zinza, snakes are both ancestor spirits and evil spirits, to be protected or killed depending on the spirit that the snake is.

Smith completed research in 2015 across six villages in Mbozi District, western Tanzania. These villages are traditionally those of the Nyiha people, although most are now ethnically plural. Each village has its own sacred natural sites, mostly forests, containing the burial grounds of previous chiefs. The living chief (*abamwene*) and his assistants have powers to contact ancestral spirits inhabiting forests, and who often appear as snakes. Intruders from other villages have found '*snakes in their pockets*' during forest ownership negotiations, whilst local trespassers have found '*big snakes on their buckets*'. Pythons are the spirits of dead chiefs, contacted by living chiefs and elders should they be concerned about intruders or other wrongdoings. The ancestral chiefs take the form of pythons, sometimes unnaturally large in size. According to local chiefs '*the python is the owner of the site... the one protecting it... people fear that if they clear the site, the python will migrate to another area... [and] the area will face difficulties with rainfall*'. It is in the villager's interests to maintain the habitat of the python to keep the spirits of their ancestors accessible to the living chief. The python-chief also serves as a conduit to other gods to pray for rainfall or other matters affecting the village. However, this constellation of beliefs is under pressure. Politically, chieftainship was abolished by the post-independence government in 1961, replaced by elected village officials. Chiefs

retain a spiritual role, yet this too is undermined by Christianisation and incomers from other tribes who do not share Nyiha worldviews, a situation common in Western Tanzania (Smith, 2016).

Studies of snakes as magical creatures often follow the utilitarian approach, recommending local people should be educated to learn the importance of snakes for habitats (if worldviews regard snakes as evil), or conversely that taboos protecting snakes need reinforcing and enforcing by some external body, typically the state (Colding & Folke, 2001; Kideghesho, 2009). These conceptualisations of snake-protection understand these worldviews as emic supernatural beliefs that reinforce taboos, or 'automatic sanctions' (Colding & Folke, 2001). For others they are 'invisible systems of local resource management' (Kideghesho, 2008), offering a 'way in' for conservationists to appropriate local worldviews (Kideghesho, 2009). More in-depth anthropological and sociological studies do recognise that the meaning and purpose of magical creatures have changed and are changing. For the Zinza, Bjerck (1969) identified in the 1960s that the beneficial beliefs associated with some spirits are rapidly disappearing such that they are viewed as demonic beings. A number of studies (Bjerck, 1969; Sunseri, 1999) claim Christianisation has contributed to the perception of once benign or beneficial spiritual creatures as 'evil', or that Abrahamic traditions have replaced mystical ties between snakes and sexuality, fertility and rainfall with satanic associations.

To suggest that snakes as mystical creatures are of value to the species conservation ethos is simplistic at best, and contradictory at worst. Studies of traditional knowledges, sacred natural sites and conservation (Blicharska & Mikusiński, 2014; Ormsby & Bhagwat, 2010) typically ignore the complexities within cultural groups and across diverse groups within states. In the case of the Nyiha in Mbozi, suggestions by some that traditional institutions, in this case local chiefs, should be 'empowered' to enforce local regulations (Kideghesho, 2009), is politically sensitive given that the state has deliberately shifted power away from hereditary chiefs to democratically elected village governments. To give chiefs officialised spiritual authority would undoubtedly anger those who do not adhere to traditional worldviews, whilst giving them powers over forest protection would

undermine local village governments. Snakes are ambiguous and complex magical creatures, both good and evil in different geographical, ethnic and spiritual contexts, and to entangle them with existing conservation management would be equally complex.

Conclusions

This paper demonstrates that magical animals can have positive and negative consequences for conservation, and that the relationship between magical animals, human beliefs and behaviour, and extant biodiversity is complex. It has also shown that current views of magical animals within conservation are inadequate. Beliefs in magical animals are often ignored, and where they are acknowledged, they are often treated as isolated issues to be tackled individually based on their direct impact on conservation goals, rather than considered as part of a complex system or worldview. In response, we argue that conservation needs to interrogate the interaction of magical animals, extant animals, and biodiversity conservation goals. It should consider the breadth of magical animals, from those that are mainly spiritual to those such as the *Huldufólk* or Loch Ness Monster which are becoming, or have become more political or cultural in nature, recognising the fuzzy boundaries around such categories. It should see these animals as part of broader systems, be it of cultures, rationalities or belief systems, and acknowledge that beliefs and values around magical animals are dynamic. Such an endeavour would require disciplines beyond natural sciences, including anthropology, ethnozoology, history, theology and others. Doing so will require scientifically trained conservationists to engage with new methodologies, particularly those involving long term studies and qualitative data, which generate locally specific understandings rather than universal theories, and which embrace human irrationality. Here approaches such as multispecies ethnography, which studies the entanglements of human and non-human life, could be useful. Multi-species ethnography can combine both ethological studies of animal behaviour with ethnographic studies of human behaviour, values, culture and belief, combining the material and the

social, often grounded in locally specific human-animal relations (Pooley et al 2017, Aisher and Damodoran 2016). As such, it is well placed to understand the complexities of interactions between humans, extant and magical biodiversity (e.g. Baynes-Rock 2013). Ultimately, by understanding human interactions with magical animals, conservation could create successful co-existence between humans and non-humans.

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Author Contributions

The paper was conceived by GH. GH and TAS led writing on the main sections. TAS wrote the Tanzania section, CW the Madagascar section. All authors contributed to refining and editing.

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Biographical sketches

George Holmes is Associate Professor in Conservation and Society at the University of Leeds. His research focuses primarily on the interaction of protected areas and local communities, particularly contests over the social impacts of conservation, and on the political economy of conservation, including private protected areas. He has conducted extended fieldwork in the Dominican Republic and Chile.

Tom Smith is a Lecturer in Human Geography at Cardiff University. His research has included work on environmental education and young people's involvement in conservation in Tanzania and the UK, spiritual beliefs and witchcraft in conservation, abstract notions of environmental value, and urban housing in Kenya. He has also conducted research in the UK on technology and roaming in national parks.

Caroline Ward is PhD candidate at the University of Leeds. She is conducting research into changes in protected area governance in Madagascar, and their interaction with ecosystem services and local livelihoods