

An interdisciplinary review of current and future approaches to improving human-predator relations

Authors

S. Pooley^{1,*}, M. Barua², W. Beinart³, A. Dickman⁴, G. Holmes⁵, J. Lorimer⁶, A.J. Loveridge³, D.W. Macdonald³, G. Marvin⁷, S. Redpath, C. Sillero-Zubiri³, A. Zimmermann⁸ and E.J. Milner-Gulland⁹.

¹Department of Zoology, University of Oxford, The Tinbergen Building, South Parks Rd, Oxford OX1 3PS, UK & Department of Geography, Environment and Development Studies, Birkbeck, University of London, 32 Tavistock Square, London WC1H 9EZ, UK.

²School of Geography and the Environment, University of Oxford, South Parks Road, Oxford OX1 3QY, UK & Oxford India Centre for Sustainable Development, Somerville College, Woodstock Road, Oxford OX2 6HD, UK.

³African Studies Centre, School of Interdisciplinary Area Studies, University of Oxford, 13 Bevington Road, Oxford, OX2 6LH.

⁴WildCRU, Recanati-Kaplan Centre, Department of Zoology, Oxford University, OX13 5QL, UK.

⁵Critical Environmental Social Science, School of Earth and Environment, University of Leeds, Leeds LS2 9JT, UK.

⁶School of Geography and the Environment, University of Oxford, South Parks Road, Oxford OX1 3QY, UK.

⁷Anthropology, Department of Life Sciences, University of Roehampton, Erasmus House, Roehampton Lane, London, SW15 5PU, UK.

⁸Conservation Science Department, Chester Zoo, Caughall Road, Upton-by-Chester, CH2 1LH, UK & WildCRU, Recanati-Kaplan Centre, Department of Zoology, Oxford University, OX13 5QL, UK.

⁹Department of Zoology, University of Oxford, The Tinbergen Building, South Parks Rd, Oxford OX1 3PS, UK.

*email s.pooley@bbk.ac.uk

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Improving human-predator relations

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Abstract

In a world of shrinking habitats and increasing competition for natural resources, potentially dangerous predators bring the challenges of coexisting with wildlife sharply into focus.

Through interdisciplinary collaboration between authors trained in the humanities, social sciences and natural sciences, this paper offers a review of current approaches and a vision for future approaches to understanding and mitigating adverse human-predator encounters.

The paper first reviews some limitations to current approaches to mitigation. Second, it reviews an emerging interdisciplinary literature, identifying key perspectives on how to better frame and therefore successfully mitigate such conservation conflicts. Third, it discusses the implications for future research and management practice. It is concluded that a demand for rapid, 'win-win' solutions for conservation and development favours dispute resolution and technical fixes, obscuring important underlying drivers of conflicts. Without due cognisance of these underlying drivers, our well intentioned efforts, focussed on 'human wildlife conflicts,' will fail.

In a world of shrinking and fragmenting habitats and increasing competition for natural resources, potentially dangerous predators bring the challenges of co-existing with wildlife sharply into focus (Chapron et al 2014). Conservationists have a reasonably full toolkit for the practical mitigation of conservation conflicts, but very inadequate toolkits for tackling their underlying cultural and social dimensions (Macdonald et al. 2010). This may be because much of the existing research on human-predator interactions has focused on conflictual relations, and specifically on 'human-wildlife conflict'. Most of the conservation-directed research has been driven by natural scientists concentrating on the biology and behaviour of predators and prey, and the impacts of predators on prey. More recently, social science methods have been appropriated to improve the human cost-benefit ratio of cohabiting with such animals (Madden & McQuinn 2015).

Even within the research that focuses on the relationships between humans and predators (rather than different groups of humans), predators and people tend to be studied separately and with different ontologies, epistemologies and methodologies (Agrawal et al 2006; Ghosal & Kjosavek 2015). Studies of the social dimensions of conservation have tended towards quantitative social science, drawing on ideas from social psychology and economics aimed at discovering and changing beliefs and attitudes influencing undesirable behaviour, often to protect wildlife rather than humans (Blekesaune & Rønningen 2010; Dickman et al. 2011; Jhamvar-Shingote & Schuett 2013; Hayman et al. 2014). Empirical studies of the roles of culture and values in human-wildlife coexistence remain rare, and the humanities have been almost entirely absent from the field.

Recently it has been recognised that although superficially conservation conflicts involve adverse human-wildlife relations, at a deeper level they usually reflect adverse human-human relations, where the viewpoints of conservationists conflict with those of other

people with apparently incompatible goals. In both cases, one party is perceived to assert its interests at the expense of another's (Draheim et al 2015; Redpath et al. 2015).

As a result there has been a series of calls for a more broadly interdisciplinary approach to human-wildlife conflicts (Draheim et al. 2015; Linnell et al. 2015; Redpath et al. 2015; Agelici 2016). Ideas about how this broader approach could be useful are still mostly conceptual or retrospectively applied. This said, over the past decade there have been some intriguing individual studies exploring human-predator interactions in novel, interdisciplinary and more integrated ways. As yet these kinds of studies are widely scattered across diverse publications and disciplines, many at the fringes of mainstream disciplinary endeavours (e.g. Marvin 2010; Álvares et al. 2011; Baynes-Rock, 2013; Ghosal & Kjosavik 2015).

This paper offers perspectives for understanding and mitigating human-predator conflicts, drawing both on ideas from an emerging interdisciplinary literature, and approaches from disciplines not previously involved in conservation conflict studies. We believe this is an exciting moment for researchers interested in conservation conflicts to collaborate, to draw on our respective disciplinary skills and expertise to develop a more integrated approach to understanding and improving human—predator relations.

The paper comprises three sections: the first reviews the limitations of current approaches to mitigating human predator conflicts; the second draws on an emerging interdisciplinary literature to identify some key perspectives on how better to reframe and therefore successfully intervene in such conflict scenarios; the third offers a discussion of the implications of these perspectives for research and management practice.

1. Current approaches to human-predator conflict mitigation

Human-predator conflicts appear superficially to be about negative impacts – mostly visible or direct costs like loss of livestock or human life on the one hand, and losses of individual wild predators (like Cecil the lion), population declines or extinctions on the other. Thus, a common response has been to build up an evidence base and develop a scientifically robust approach to understanding and mitigating these impacts (e.g. Quigley & Herrero 2005; Aust et al. 2009). Managers and ecologists have tended to make three key assumptions: that the level of damage from predation is directly related to the level of conflict; that the level of conflict elicits a response proportional to the level of damage; and that mitigation activities appropriate to the level of conflict and damage will lead to proportional increases in support for conservation (noted by Dickman 2010). However, there is good evidence to suggest that these assumptions are often misplaced (e.g. Cavalcanti et al 2010; Zimmermann 2014; Kansky & Knight 2014).

Examples of approaches tackling impacts include lethal control or translocations of ‘problem animals’, behavioural advice and technical fixes for preventing damage (Woodroffe et al 2005; Athreya 2012, McManus et al. 2015), and the development of financial instruments to offset such impacts (Dickman et al 2011). Attempts to understand the behaviour of damage-causing predators, determine the most effective methods for reducing attacks (such as guarding livestock, or providing safe water-collection points to avoid crocodile attacks), and educate local communities about employing those methods to reduce their vulnerability, have enjoyed some success (e.g. Balme et al 2009; Marker & Boast 2015). However, such interventions have also foundered in many places for a range of reasons including failure to involve local people, high opportunity costs of effective livestock protection methods, resistance to perceived infringements on freedom of behaviour (Barua et al 2013), or as a result of epistemological disagreements over what causes predator attacks (Wallace et al. 2011; Pooley 2016).

In many cases where negative attitudes to predators are expressed as objections to the damage they cause, actual damage is negligible. In some cases, it is the fear of an attack by a potentially man-eating animal (sharks are a good example) which promotes these attitudes (Neff 2012). In others, it is people's dislike of a risk they feel is imposed upon them by an external authority, for example conservation authorities reintroducing predators to a region (Dickman & Hazzah 2016). A review by Kansky & Knight (2014) suggests that intangible costs (e.g. psychological costs of danger) are the most important variable explaining attitudes to carnivores – significantly more so than tangible costs (e.g. direct monetary losses). Cavalcanti et al. (2010) concluded that human persecution of jaguars (*Panthera onca*) in Brazil was less related to the economic impacts of livestock depredation than conservationists thought, and more related to the cultural and social perceptions of potential threat, along with the enjoyment and status associated with jaguar hunting.

It has become increasingly apparent that even the best analyses and advice on impact reduction do not necessarily resolve conservation conflicts. An under-researched subject is why scientifically sound mitigation measures are so often ignored or discontinued. Evaluative research on conservation conflict mitigation efforts suggests that the superficial impacts of predation often conceal a diversity of underlying issues relating to different epistemologies, historical contexts and identity differences which are beyond the competencies of the natural sciences to resolve (Madden & McQuinn 2015; Dickman & Hazzah 2016). There are still important gaps and shortfalls in our understanding of and approaches to mitigating the more intractable of these human-predator conflict scenarios.

2. Reframing conservation conflicts

Conflict as a framework

Conservationists are actors within conflict scenarios, and conflicts arising over how to manage and interact with large predators may be human-human conflicts between people with different world views and ways of valuing predators. In some cases the killing of predators may be manifestations of deep underlying differences and perceived injustices (Dickman 2010). Or conflicts may be purely about impact and ‘pest’ management, in which case a focus on mitigation will suffice. When it comes to specific situations, it is crucial to understand what the issue really is.

A first step is to think through the actions and relations the term ‘conflict’ promotes, and what it constrains and omits. It may be preferable to talk about human-predator *relations*, with ‘conflict’ as a sub-set of relations alongside coexistence predicated on interventions to alleviate negative impacts of predators, co-adaptation where humans and predators adapt to accommodate one another, mutual avoidance, or mutual flourishing (Peterson et al. 2010; Carter and Linnell 2016).

Framing a particular encounter as a ‘conflict’ between humans and a predator species (therefore requiring a predator-focused solution) may polarise and redefine a situation. Where such encounters may have previously been experienced as ‘facts of life’ within certain social contexts, examining and trying to mitigate conflicts may lead to them being reinterpreted as unacceptable problems requiring redress by an outside organisation (the state or a conservation NGO), who are given moral and legal responsibilities for resolving the conflict. This reframing may have unintended consequences for both predators and people (Peterson et al. 2013; Redpath et al 2015). When conservationists attempt to resolve conflicts, the problem becomes identified with them. A lion becomes a problem animal associated with (and often perceived as ‘owned by’) the conservationists, rather than being perceived as a natural phenomenon (Macdonald, Loveridge & Rabinowitz 2010).

History, society and politics

Tracking the history of how particular conflicts have arisen and been framed over time can help us to understand better the legacies of local land use practises, social and political interactions and management interventions by all the relevant role players (human and non-human). This provides a more in-depth understanding of the conflicts these practises and interactions have caused, manifested themselves in, or been designed to solve (McGregor 2005; Lambert 2015; Sprage & Draheim 2015). For example, a public campaign to exterminate all crocodiles (*Crocodylus niloticus*) in Zululand, South Africa in the late 1950s was presented in the media as a straightforward response to attacks on humans by ‘marauding’ crocodiles. It was actually the result of a complex set of underlying social, economic, political and ecological drivers and events which manifested as a predator eradication campaign (Pooley 2013).

In many developing countries conservation policies are legacies of colonial occupation, and current attitudes to conservation are shaped by long histories of wildlife policies and management (Mackenzie 1988; Adams & Mulligan 2003; Beinart & Hughes 2007). This plays out in disputes over land ownership, boundaries and the use of natural resources as impacted by the creation and administration of protected areas, and over the ownership and governance of living resources by the state (West, Igoe and Brockington 2006; Barua 2014a). These legacies have polarised conflicts over predators, disempowered and excluded local people from conflict management, reduced benefits for tolerating dangerous animals, and resulted in conservation authorities avoiding responsibility for wildlife impacts outside of protected areas (Western & Waithaka 2005; Ghosal & Kjosavik 2015). This is in spite of the fact that a major function of conservation authorities in colonial times was to control such predators (Mackenzie 1988).

Perspectives from political ecology and politics are useful for thinking about how both conservationists and local communities create and enforce the kinds of human-predator relations they want (Adams 2015). Different parties have different tools, or forms of power, that they can use to negotiate and create these kinds of relations. Treves et al (2015) advocate that conservationists lobby to create regulations regarding what humans can do to predators, which can be enforced through legal-judicial means (rangers imposing fines, imprisonment or other punishments). Conservationists may use economic power to encourage humans to change their behaviour towards predators. They offer compensation for predated livestock (Boitani et al. 2011), reward payments for co-existing with healthy populations of predators (Persson et al 2015), or more indirectly, encourage locals to engage in predator-based ecotourism enterprises.

An important trend in the literature is the realisation that in many situations, particularly in developing countries, rural residents have chosen not to use the tools and forms of power of formal politics, such as lobbying and political pressure (Scott 1998). They may lack the knowledge, skills, time or resources to engage in formal politics, or they may be fearful of the consequences of doing so. Instead, they engage in hidden, everyday forms of political action to alter human-predator relations, particularly illegal killing of predators (Holmes 2007). This sends a powerful yet anonymous signal of discontent with the state of human-predator relations, particularly conservation regulations. Indeed, such conflicts may not even be about predators and conservation – rural hunters in Scandinavia kill wolves to express anger at what they see as an overbearing urban-centric state intent on wolf (*Canis lupus*) conservation (Von Essen et al 2014).

Cultures and conflicts

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Animals have a physical existence independent of humans, and for the purposes of conservation management, it is essential that we understand their physiology, behaviour and ecological relations. However, when humans' lives intersect with them, these creatures are drawn into webs of human significances. When humans think about predators, 'the real creature' includes the 'cultural animal,' and the 'real' animal cannot be revealed by stripping away its cultural accretions. Thus different cultural constructions of the wolf (for example) 'are' the wolf for different people. *Canis lupus* is the wolf of the scientists (Mech & Boitani 2003); in many northern indigenous cultures the wolf is a revered hunter who is regarded as animal kin (Laugrand & Oosten 2015); for pastoralists and livestock farmers the wolf is a destructive predator (Coleman 2004). The re-emergence or reintroduction of wolves is celebrated by many as the return of a maligned charismatic carnivore (Marvin 2012) but contested by others as the imposition of a dangerous killer on rural communities by powerful outsiders (Buller 2008; Skogen & Krangle 2003; von Essen et al 2014).

When conflicts are directly about predator impacts on people, it is useful to discover how predators and/or attacks by predators are perceived. Are predators seen as 'natural,' 'magical' or 'owned' (or all three) and if they are regarded as controlled or owned, by whom? Framing interrelations between humans and predators as conflicts can result in these animals being portrayed as the possessions, responsibilities or allies of one or other of the parties involved in a conservation conflict. How predators are viewed, and the causality attributed to attacks (e.g. normal species behaviour, metaphysical justice or bewitchment) influences who is held responsible for conflicts, and for resolving them (Álvares 2011; Von Essen et al 2014). In 2013, researchers working in Sava Region, Madagascar, could not obtain 'logical reasons for the explanations of [crocodile] attacks from locals' because 'the persons killed or injured are considered to have done something bad' (CITES 2013). This makes attributing causality and involving locals in mitigation measures challenging.

Different social groups may also have different perceptions of predators, because they have differing resilience to predator attacks – a wealthy cattle farmer can better cope with lion attacks than a subsistence pastoralist. Certain groups within communities (defined by class, gender, caste or ethnicity) are more or less likely to experience predator attacks (Gore & Kahler 2012).

The diverse ways in which particular societies, communities or individuals think about and respond to such culturally important animals can't be solely explained through quantitative social sciences approaches focussing on measuring attitudes and behaviour. These approaches typically disaggregate people into socio-economic groups like commercial farmers, communal farmers, pastoralists, agriculturalists, hunters, and other livelihood-oriented descriptions. This lumping by livelihood group results in analyses which miss some striking cultural differences, for example between people from different ethnic groups (Kansky & Knight 2014; Zimmermann 2014; Dickman & Hazzah 2016).

In a study of jaguar conflicts across the Americas, Zimmermann (2014) found a wide diversity of attitudes to jaguars, and disparities between their attitudes and their behaviour towards jaguars. Seventeen case studies across seven jaguar range countries revealed that no socio-economic factors could accurately predict how farmers perceived and dealt with jaguars. Similarly, peoples' responses to living alongside lions vary greatly across their range. While lions (*Panthera leo*) are frequently killed by pastoralists and farmers across Africa (Loveridge et al. 2010), local farmers in the Greater Gir Landscape in Western India are remarkably tolerant of the Asiatic lions (*Panthera leo persica*) that roam outside of protected areas, despite occasional predation (Banerjee et al 2013).

What comes up over and over again is the importance of the particular relationships that have developed between predators and prey and people in specific places (Peterhans & Gnoske 2001; Kruuk 2002; Baynes-Rock 2013). The fact that large predators survive at all in

some regions outside of protected areas is down to a measure of tolerance by locals that can have as much to do with local cultures as economic calculation, legal enforcement or the social engineering of behaviour by conservationists. This is not to deny the effectiveness, if not always the justice, of the latter measures in some contexts. Here, locals' apparent 'tolerance' may actually result from their incapacity to act.

Alongside stories about the persecution of predators, there are remarkable tales of long-standing tolerance of predators. Hyenas are tolerated and valued in Harar, Ethiopia because they scavenge on diseased carcasses, and are believed to kill and eat dangerous spirits or *jinn*s (Baynes-Rock 2013). In Australia, when an Aboriginal woman of the Dhalinbuy community was killed by a saltwater crocodile (*C. porosus*) in a billabong on the Cato River in Arnhem Land in July 1980, the community requested that the crocodile not be killed. When in 1988, a man was killed by crocodile in the same billabong, the Aboriginal community again chose not to have the animal killed (Webb & Manolis 1998).

However, cultures and beliefs are not static. Although the Maasai are often thought of as relatively tolerant towards lions, and traditionally hold some positive views towards them (Goldman et al. 2010), the popularity of relatively new evangelical churches has been associated with more negative attitudes towards carnivores in both Kenya and Tanzania (Dickman et al. 2014).

Examples of tolerance towards predators arise from the beliefs and behaviours of humans, but also from animal behaviour. This suggests a different kind of focus on animal behaviour, i.e. how individual animals and societies of animals have adapted to the human societies they interact with. On the one hand, there are areas where certain predators such as crocodylians, hyenas, leopards and pumas (*Puma concolor*) for example, have learned to live alongside humans with few problematic encounters. On the other hand, certain places have long been notorious for 'man-eaters,' for example Nile crocodiles along stretches of the lower

Zambezi or the Chobe in Namibia (Livingstone 1858; Stevenson-Hamilton 1917, Wallace et al 2011; Aust et al 2009), or lions in the Rufiji River basin of southern Tanzania (Packer et al. 2005).

There is speculation that predators in some of these places have developed cultures of preying on humans as a result of conjunctions of human and animal behavior and environmental conditions. Packer et al (2005) found that habitat destruction and prey depletion were influencing an increase in lion attacks on humans in southern Tanzania, but lions had learned to prey on humans after following bushpigs (*Potamochoerus larvatus*) into human settlements and agricultural areas. Behavioral studies strongly suggest that some species have culture in the sense of learned behavior passed on from parents to offspring (Berger 2008). Examples where this has been attributed to predators preying on humans include Nile crocodiles at Shesheke (Stevenson-Hamilton 1917), tigers (*Panthera tigris*) in the Sundarbans (Kruuk 2002) and lions at Tsavo (Peterhans & Gnoske 2001).

Cosmopolitan natures

In addition to specific local relationships between animals and people, another type of relationship is becoming increasingly important - the globalised, urbanised, "western" view of wildlife. The concept of cosmopolitan natures is useful for understanding these changed relations between humans and a small number of popular images of charismatic animals that circulate in global media for the purposes of both entertainment and conservation campaigns (Barua 2014b). As safari hunting gave way to photographic safaris and wildlife films, so a select group of animals ceased to be parochial and became prominent internationally through networks of trade, science and entertainment (Mackenzie 1988; Beinart & Schafer 2013; Macdonald et al. 2015). These are the culturally defined "wild" animals that many urban

people encounter in their lives and come to care for. Conservationists need to understand how the cosmopolitan natures of these cultural animals shape the economics and politics of conflict.

Conservation has become reliant on the commodification of a small number of flagship species – in advertising, on film and in the face-to-face encounters of ecotourism (Lorimer 2015). Through these processes money is raised to save tigers, elephants and lions and their habitats. But the globally circulating images of predators rarely include the experiences and conceptualisations of the people who live alongside these animals. For example, the killing of Cecil the Lion attracted very different responses from Zimbabweans living in areas where lions prey on their livestock than it did from animal lovers in the USA. Some Zimbabweans interpreted the media frenzy and resulting donations to lion conservation as evidence that ‘Americans care more about African animals than about African people’ (Nzou 2015). Similarly, the media frenzy overlooked the social, ecological and economic complexity of the trophy hunting industry in East and southern Africa, leading to political campaigns that may ultimately impact negatively on lion populations.

The global institutions and agencies that mobilise charismatic species for funding and international or national legitimacy can direct local outcomes from afar, but may have limited local legitimacy. In understanding and mitigating conflicts involving predators it is important to recognise the multiple natural knowledges that come into contact, and their potentially conflicting natures, in the globalising networks of conservation (Lorimer 2015).

3. Implications for research and management practice

Research

We have highlighted some important ways in which conceptualisations of predators and human-predator interrelations are plural and shifting, and how this plurality impacts

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responses to "conflict". But how can this new understanding feed through into changed research practices? Firstly, the kind of research approach required is inherently interdisciplinary, requiring collaboration between disciplines including integration in planning, methods and analysis (Pooley et al. 2014).

Approaches currently prevalent in conservation research often do not adequately capture the complexities of human–predator interactions. Researchers are just beginning to think more rigorously about what ‘coexistence’ and ‘co-adaptation’ actually mean (Carter and Linnell 2016). However, work in animal studies, anthropology, environmental history, and geography has sought to develop new ways of conceptualising human-animal relationships, and new approaches for studying them, which could usefully be applied in conservation (Gross & Vallely 2012; Malone et al. 2014; Hodgetts & Lorimer 2015).

An example of such a useful research framework is human-animal geographies (Philo & Wilbert 2000; Lorimer & Srinivasan 2013). This entails considering the geographies of animals’ themselves and the ways in which these challenge (or confirm) human social orderings of space. Human geographies for animals include explicit territories and boundaries (like protected areas, corridors and fences), as well as more subtle mechanisms (like lists of native species, or IUCN Red List criteria) that frame how spaces for animals are imagined and governed. Such territories and boundaries may not be recognised by, or determine, the movements and interaction of animals or the people living alongside them.

Work on human geographies of animals helps identify where and when different animals are understood to be in or out of place and thus where conflicts occur. For example, research has documented the character of synurbic species that flourish in urban ecosystems and have both positive and negative interrelations with people (Francis & Chadwick 2012). Other work considers animal mobilities (the various forms and lived experiences of animal movement) to explore how animals shape their daily, seasonal and lifecourse rhythms to

adapt to human ecologies (Lorimer 2015). This research could fruitfully complement studies by conservation scientists on how particular predators and local communities interact in space and over time (e.g. Valeix et al 2012; Elliot et al. 2014).

Multispecies ethnography uses methods from ethnography and ethology to document human and animal behaviours, sociabilities and emotional states (Kirksey & Helmreich 2010). The novelty and utility of multispecies ethnography is its focus on uncovering the detailed and multifaceted interactions between humans and animals, emphasising mutual influence rather than one-way relationships. There is great potential for developing this research making use of existing technologies for monitoring, tracking and governing animal movements (e.g. Valeix et al. 2012; Kuiper et al. 2015). This could help inform creative technological interventions to deter and perhaps train animals to avoid conflict.

Environmental history places contemporary conflicts in their historic contexts to study the ways in which human and predator histories intersect. Beinart (2003) shows how black-backed jackals (*Canis mesomelas*) benefitted from the astronomical rise in numbers of sheep in the Cape, South Africa in 1800-1930. The political power of sheep farmers enabled them to win state support for a bounty system, and poisoning, trapping, fencing and hunting clubs controlled jackals to some degree from the 1920s to the 1970s. Now, however, with more protected areas, wildlife farming and the removal of fences, jackals are making a comeback (Natrass et al. 2015). Historical perspectives can reveal these long-term shifts in balance between humans, livestock and predators and the complex causes and outcomes of management interventions. They also remind us that how conflicts are handled changes in accordance with changes in management philosophy, land use, land ownership, cultural attitudes to predators, and where traditional management is eroded or disappears (Mackenzie 1988).

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Researchers in the environmental humanities have examined the intertwined relations of wild animals and those who study them (Plumwood 2012; van Dooren 2014). Plumwood, author David Quammen (2003) and several environmental historians (Ritvo 1987; Walker 2013; Pooley 2016) have investigated how humans relate to animals which prey on them, how this problematizes boundaries between humans and other animals, and how people understand and attribute agency to such animals when they think about their lives and histories. Their work encourages self-reflexivity about why and how those engaged in conservation study and relate to such animals.

Management

This review has noted some exemplary interventions for mitigating instances of human-predator conflict (e.g. McManus et al. 2015). However, even interventions as apparently straightforward as the building of fences are socially complicated undertakings, and can significantly restructure (or reinforce) historical and existing social and political relations (Evans & Adams 2016). They can exacerbate or reignite conflicts between local people and conservationists, with potentially adverse impacts on conservation outcomes. Clearly, there are still important gaps in our understanding of and approaches to mitigating the more intractable conflict scenarios.

A notable example is the protracted conflict over the illegal killing of raptors in the UK uplands in the interests of reducing predation on commercially valuable red grouse (*Lagopus lagopus scotica*). Extensive ecological research and a number of technical solutions have all failed to mitigate this conflict. This has led to the insight that conflict mitigation on the ground requires a transdisciplinary approach involving researchers, managers, locals and other key stakeholders (Redpath et al. 2015). Such collaborations are challenging. The bitter conflict between game shooting estate owners and conservationists over the impact of hen

harriers (*Circus cyaneus*) on red grouse has not disposed either side genuinely to seek shared solutions to the problem (Thirgood & Redpath 2008).

The role of researchers is particularly fraught when moving from understanding to resolving conflicts. Should conservation scientists strive to ‘educate’ people out of what they see as mistaken beliefs about animal behaviour? Some cultural beliefs and traditions are harmful to wildlife, and should be (respectfully) challenged (Dickson et al. 2015). For example, beliefs that certain animals (like hyena) are evil, or associated with witchcraft, results in their persecution (Dickman 2016). The idea that supernatural agents are the instigators of attacks by predators may explain failures to implement sensible mitigation measures which could reduce attack incidence (Knight 2000; Pooley 2016). The use of lion and tiger bones in Chinese ‘tiger-wine’ for their alleged tonic qualities is another example of cultural beliefs which are harmful to predators (Williams et al. 2015).

However some beliefs, which researchers also regard as mistaken, may have *positive* impacts on the persistence of predators. Examples include Nepalese taboos on killing snow leopards *Panthera uncia* (Ale 1998), and the idea that spotted hyenas are valuable because they devour evil spirits (Baynes-Rock 2013). Might working with locals and their beliefs sometimes facilitate the coexistence of predators, humans and their livestock outside of protected areas? It is arguably at best inconsistent and at worst unethical to attempt to selectively convince people that some of their beliefs (those judged harmful to wildlife) are misconceived, while others (judged helpful) are true or justified. Further, for some conservation scientists, this appears to compromise the integrity of their scientific method, and suggests an element of moral relativism in elevating some cultural practises above rational criticism (Dickman et al. 2015). The situation may however not be this polarised: in many communities there will be individuals with enough education to straddle different understandings of nature.

In practice, it has proven possible to work with cultural beliefs to mitigate the killing of predators where conservationists have interacted creatively with locals whose belief systems are amenable to modification (Macdonald et al 2010). The Lion Guardians scheme in Amboseli, Kenya, redirects the energies of young Maasai men who gained social status by killing lions into achieving this status through gaining skills and income from tracking and guarding lions. The men still fulfil their protective role in the community through awareness of where the lions are, and predator-proofing livestock enclosures (Hazzah et al. 2014).

Opinions about which ideas and beliefs about wild animals and human-predator relations are justified and constructive, and which are not, reflect particular epistemologies and value systems. To co-produce knowledge about the causes and consequences of conflicts, while avoiding a paralyzing relativism, all parties need to agree on what they will accept as good evidence, collaborate to develop processes and methods to mitigate conflicts, and decide how these can be monitored and evaluated (Redpath et al 2015).

Researchers can now draw on a range of conceptual frameworks, qualitative and quantitative approaches to assess links between values, attitudes and behaviour. In particular, innovative approaches are being developed to study illegal behaviour, conflicts and the social impacts of conservation (St John et al. 2010; Harrison et al. 2015; Jochum et al 2014).

Researchers can also learn from disciplines which have targeted analogous problems within the human realm, such as criminology and peace studies. Two recent adaptations of such approaches to improve conservation conflict mitigation are Redpath et al's (2013) framework for an adaptive conflict mapping and management process, and Madden and McQuinn's (2015) tripartite levels of conflict model derived from peace studies.

The elusive win-win

Conservation science is one among many voices in conservation. Scientific arguments and evidence contribute to larger processes involving moral arguments (what ought to be done) and political arguments (what can be done). Ideally, research projects and conflict resolution processes should reflect this, and be shaped into transdisciplinary collaborations where progress is made through disciplined argument and cooperation rather than a zero sum competition over power, influence and resources.

The model of consensus-based conservation which came to prominence in the 1990s, linked to sustainable development, has proven unhelpful in ‘resolving’ conservation conflicts (Peterson et al. 2013). The focus of conservation efforts – and importantly, funding – is now frequently on ‘win-win’ scenarios, where conservation and development must both benefit from interventions. However, conservation and development often have different end goals, and true win-wins are rare. It is hard to defend protectionist conservation policies to a poverty-stricken pastoralist whose few livestock have been killed by a big cat, or to argue against the right to dissent against rational, agreed conservation policies of a woman widowed by a predator. It may be equally challenging to find win-win solutions in the face of unsustainable local uses of threatened species, though these are always the ideal solutions.

A desire for rapid, ‘win-win’ solutions focuses energies on dispute resolution and technical fixes. This limited focus obscures important, deep and long-running underlying drivers of conflicts and fundamental differences in power, vulnerabilities and values, without due cognisance of which our well intentioned efforts will fail.

Conclusion

Conservationists should widen their focus and admit the ideas, discourses and perspectives of the many disciplines and role players required to understand the drivers and consequences of what conservationists unhelpfully call human–predator conflicts (thus removing themselves

from the equation). In the best traditions of the sciences and the humanities, this is a call for robust, inclusive, bounded debate and disagreement in pursuit of better ways to think about and coexist with predators.

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