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Local perceptions of risk associated with poaching of wildlife implicated in human-wildlife conflicts in Namibia

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ABSTRACT

Human-wildlife conflict (HWC) includes how people perceive risks associated with negative interactions with wildlife. Risk perceptions are important for conservationists to understand because perceptions can influence human behaviors in response to HWC, such as tolerance or poaching specific species. Our study site, the Zambezi region of Namibia, is renowned for diverse wildlife that come into conflict with humans and are vulnerable to poaching. Our study objectives were: (1) quantify local perceptions of risk associated with species-specific HWC and poaching, (2) examine the relationship between species-specific HWC and poaching risks, and (3) characterize economic costs, benefits and perceptions of the ecological values (e.g., disease vector) of the top four species implicated in HWCs and poaching. The species that were perceived to be at greatest risk from poaching were characterized as posing high ecological risks (e.g., disease vectors) and livelihood risks (e.g., crop damage) and were economically valuable for local subsistence and trade. Species perceived to pose high risk to livelihoods were moderately correlated with increasing perceived poaching vulnerability ($r = 0.53$, $p = 0.04$, $df = 14$). All but one of the top four species most vulnerable generated greater average annual revenue from legal hunting than average annual damage to crops. However, a majority of participants stated that conservancy benefits were not equitably distributed. Quantifying and characterizing how stakeholders perceive poaching-related risks can complement risk assessment data and result in more robust conservation planning. These findings have implications for risk communication, distribution of wildlife-related risks and benefits and more nuanced management of the most vulnerable species.

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1. Introduction

Negative human-wildlife interactions [i.e., human-wildlife conflicts (HWCs)] pose risks to livelihoods and wildlife globally and have been the subject of numerous studies within the context of human tolerance for species involved in animal damage incidents (Kansky et al., 2014). Direct effects of HWC on human livelihoods range from nuisance behavior, such as reduced recreational opportunities (Messmer, 2009), to crop damage, livestock depredation (Ogra, 2008), fatal attacks on humans (Dunham et al., 2010), and zoonotic disease transmission to humans (Swift et al., 2007) or livestock (Michel and Bengis, 2012). HWC also has the potential to result in indirect effects that go uncompensated, are temporally delayed or can lead to negative psychological, health or social

consequences (Barua et al., 2013) such as increased labor burdens, fear to leave home in search of livelihood resources (Ogra, 2008) or social conflict (Brashares et al., 2014). Additionally, poaching is one form of HWC that compromises the ability of local communities to legally use natural resources to support local livelihoods (Robinson and Bennett, 2004), threatens food security (Bowen-Jones et al., 2003) and reduces wildlife available for local economic development (e.g., ecotourism, trophy hunting) (Johannesen and Skonhofs, 2005). Poaching has wide-ranging implications for conservation efforts as well because it can undermine conservation investments, educational programs, public-private partnerships, and can involve extreme violence. Reducing risks from poaching is a high international policy priority (Nellemann et al., 2014).

Accordingly, local stakeholders' concerns about HWC can influence tolerance (Kansky et al., 2014) and help predict stakeholder actions toward wildlife that negatively affect the long-term chances of human-wildlife coexistence (Carter et al., 2012). One such human reaction that can compromise human-wildlife coexistence is lethal control, legal or illegal, of the offending

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animal. Legal lethal control of animals involved in HWC is common in diverse African management contexts and is usually justified by threats to human health, safety, and economic well-being (Lamarque et al., 2009). When a problem-causing animal is killed it is generally done to maintain social accord rather than promote long-term resolution of on-going HWCs (Lamarque et al., 2009). However, illegal killing (i.e., poaching), threatens the conservation of some wildlife species (Liu et al., 2011) and carries with it a host of collateral social and ecological impacts. Wildlife populations subjected to poaching may suffer from reduction in population size, extirpation, or extinction (Woodroffe et al., 2005). For example, the retaliatory killing (legal and illegal) of large carnivores, such as the African lion (*Panthera leo*), has been found to be a major cause of their global decline (Ogada et al., 2003). Wildlife population reductions or loss from an area can result in ecosystem effects as well, such as the contemporary interruption of elephant-dependent seed dispersal in Democratic Republic of Congo due to the near extirpation of forest elephants (*Loxodonta cyclotis*) (Beaune et al., 2013).

Wildlife populations are not uniformly vulnerable to poaching (Kissui, 2008; Woodroffe et al., 2005); vulnerability may vary within and across taxa. For example, the vulnerability of Bolivian parrots (Family *Psittacidae*) to poaching for the pet trade is significantly higher for species found within 80 km of a city and animals from relatively more abundant populations (Pires and Clarke, 2011). Species biology (Kissui, 2008), distribution (Knapp et al., 2010) and interactions with human socio-economic systems vary their susceptibility to poaching risks (e.g., Liu et al., 2011). For example, retaliatory killing of carnivores in Tanzania has been found to be a function of both biological (e.g., nocturnal predation) and social factors (e.g., culture) (Kissui, 2008). Species vulnerability to poaching can also vary according to human motivations to poach. The motivations for poaching wildlife are diverse and it is likely that poachers have multiple motivations for their behavior (Kahler and Gore, 2012). Animals may be poached because of negative human attitudes about HWC (Kansky et al., 2014), avoidance of future HWCs (Sánchez-Mercado et al., 2008), or economics (Liu et al., 2011).

Reducing poaching-related risks requires understanding of ecological and sociocultural factors influencing species-specific vulnerability (Kahler et al., 2013). Ideally, such understanding would be framed according to local perceptions of risk both to and from wildlife (Kahler et al., 2013) as well as knowledge about how species are valued within the larger economic, ecological and cultural context (Remis and Hardin, 2009). This is because when human and wildlife populations overlap, interactions will influence attitudes and behavior toward wildlife as well as perceptions of the risks and benefits of individual wildlife species (Baruch-Mordo et al., 2011). Risk perceptions (i.e., intuitive judgments as opposed to expert assessments) are relevant to multiple dimensions of wildlife conservation, including HWC, and offer insight about how individuals think and behave in response to risks (Gore et al., 2009). For example, perception of wildlife-related risk can be used to measure stakeholder support for lethal or non-lethal management actions (Gore et al., 2006) and aid in predicting responses to policy (Huang et al., 2010), such as compliance with new regulations. Understanding public perceptions of risk associated with HWC can inform interventions designed to influence human behavior and reduce HWC-related risks, inform the content and format of conservation messages, and improve risk communication by better anticipating how messages may be interpreted (Gore et al., 2006).

The diversity of factors influencing stakeholder perceptions of risk associated with HWC are well known (Gore et al., 2009). The extant literature clarifies stakeholder perceptions of impacts from HWC on human livelihoods (e.g., economics, health, safety) and

how these perceptions influence acceptance of wildlife populations and their management (e.g., Schumann et al., 2012). Gaps in knowledge remain, however, in understanding factors that influence how stakeholders perceive HWC-related risks to wildlife populations and how these perceptions relate to HWC-risk perceptions to human livelihoods. This is problematic because understanding stakeholders' perceptions of HWC risks to wildlife, much like the perceptions of HWC-risks to livelihoods, could influence stakeholders' responses to HWC incidents and influence preferences for HWC policy and management. Further, perceptions of wildlife-related risks are not formed in isolation, where an individual independently assesses risk from each species. Rather, individuals are exposed to a suite of risks and benefits associated with multiple species at a time. Little research has examined wildlife-related risk perceptions of a wide assemblage of sympatric species that occupy diverse ecological niches (e.g., carnivores, herbivores). Lastly, assessments of poaching activities are known to be incomplete due to the illicit nature of these activities (Kahindi et al., 2009). Incorporating local stakeholder perceptions of the risks associated with poaching creates a more nuanced understanding about wildlife-related risks and enhances intelligence about human dimensions of wildlife conservation (Kahler et al., 2013).

Accordingly, we set the following objectives: (1) quantify local perceptions of risk associated with species-specific HWC and poaching, (2) examine the relationship between species-specific HWC and poaching risks, and (3) characterize economic costs, benefits and perceptions of the ecological values (e.g., disease vector) of the top four species implicated in HWCs and poaching. We used two community-based conservation areas (hereafter conservancies) in the Zambezi (formerly Caprivi) region of Namibia to achieve objectives. The conservancies in the Zambezi region were ideal for this case study because the region has the highest rates of HWC in Namibia (Jones and Barnes, 2006), and growing concern over wildlife poaching (Huang, 2014; Kahler et al., 2013). Additionally, conservancies maintain HWC and poaching incident records (Stuart-Hill et al., 2005) at the local level that include species-specific information. These data can be compared to residential perceptions of species implicated in HWC and poaching incidents.

1.1. HWC and poaching in Zambezi, Namibia

Namibia's Conservancy program, a community-based conservation program formed in 1996, aims to integrate communal-land residents into wildlife utilization and ecotourism development (Weaver and Skyer, 2005). Integration is enabled through devolved rights over wildlife to local communities (Barnes et al., 2002) and a legislated joint-venture management scheme between government agencies, national non-governmental organizations and rural communities (Stuart-Hill et al., 2005). The system includes a legislative basis for consumptive wildlife utilization through subsistence-based and commercial hunting and wildlife damage management and compensation procedures (Ministry of Environment & Tourism (MET), 2009). Theoretically, conservancy residents derive economic, ecological and cultural value from the consumptive use of wildlife (Barnes et al., 2002); thus Namibians living on conservancies have a vested interest to ensure that wildlife use is sustainable and maintains value.

Namibia's conservancies are widely considered successful community-based natural resource management (CBNRM) regimes in that they simultaneously conserve natural resources and provide for livelihood development (Hoole and Berkes, 2010). Literature on Namibia's conservancies often anecdotally assert that conservation success is, in large part, due to the positive effects of conservancies on local attitudes toward wildlife (e.g., Weaver and Skyer, 2005). Although many Namibian conservancies report

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