Public perceptions of poaching risks in a biodiversity hotspot: Implications for wildlife trafficking interventions

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Abstract: Smart regulation designed to reduce risks from wildlife trafficking to wildlife and people requires understanding public perceptions of risk as well as the root of wildlife trafficking: poaching. This is because conservation crime is fundamentally about, and risk perception effects, human behavior. Defining and describing how different groups’ risk perceptions about poaching compare is a key component of determining what constitutes acceptable risk. To date, regulatory responses to poaching, and thus wildlife trafficking, are overwhelmingly based on experts’ risk perceptions. Here, we present insight about the local portion of the risk perception equation: How do local people rank poaching relative to other risks? What factors influence locals’ risk perceptions? What are perceptions about regulatory responses to poaching risks? We used semi-structured interviews with Malagasy (N = 49) living adjacent to the Analamazaotra Special Reserve, December 2013 to build intelligence about wildlife trafficking interventions. Cyclones were rated most and urban development rated least risky; poaching rated third highest. Attitudes about tampering with nature were most influential on risk perceptions about wildlife poaching. Most participants perceived rejection was the most common type of regulatory response. For study participants, poaching risks cannot be successfully regulated when addressed in isolation from the broader threat matrix. Insight herein helps situate poaching within the broader risk context relative to other environmental threats. Insight can be leveraged to anticipate some locals’ responses to regulation of other crime risks and conservation challenges; local perceptions can also be compared to expert perceptions of risk, inform risk communication and baseline insight for the enforcement pyramid.

Keywords: Analamazaotra; Andasibe; conservation criminology; enforcement pyramid; Madagascar; risk response

Introduction
Increased globalization of illicit trade in natural resources can threaten the efficacy of sustainable development, deprive developing economies of billions of dollars in lost revenue opportunities, and fuel socio-political conflict (Brashares, Abrahms, Fiorella, Golden, Hojnowski, et al, 2014). The widespread trafficking of wildlife and forest resources, in particular, can play a central role in financing organized crime and non-state armed groups including terrorist cells, and are increasingly seen as serious international crimes necessitating international policy interventions. Groups engaged in wildlife crime can spread collusive corruption and threaten national security interests, corporate investments,
The United Nations recently identified wildlife and timber trafficking as an international “environmental crime crisis” due to the pace, sophistication, and scale of the problem (Nellemann et al., 2014). The gravity and high policy prioritization of the issue is evidenced in part by a 2013 United States (US) Presidential Executive Order acknowledging environmental crimes (EC) undermine efforts in development assistance and threaten national security. Also, for example, in January 2015, legislation was introduced in the US to consider wildlife trafficking under federal racketeering and organized crime laws (US Senate, 2015). Finally, defense of natural resources, particularly wildlife, was the first issue whereby CITES, World Customs Organization, Interpol, World Bank, and the United Nations Office on Drugs and Crime worked together on a common goal (e.g., 2010 International Consortium for Combating Wildlife Crime).

These policy initiatives and bilateral agreements make calls for a risk management response to wildlife trafficking, including deterrence, enforcement, compliance, and prevention; activities designed to strengthen and synchronize all levels of the enforcement pyramid (e.g., persuasion, civil penalty, license revocation) (Braithwaite, 1992) but particularly coherent policy and behavior change interventions. The ability of these strategies to reduce wildlife trafficking requires better understanding of the causes and consequences of human behavior that underlie EC activities, particularly related to risk perception.

We know risk perception can influence different group’s behavioral decisions about ECs, EC crime control, and EC-related behavior change. In one study, Gore and Kahler (2012) deduced divergent perceptions in how groups (e.g., men, women, decision-makers) characterized risks to wildlife and livelihoods; however, not only were identified risks to wildlife and livelihoods dissimilar in some instances, descriptions of risks varied as well. Gendered differences in risk perceptions signaled different priorities or incentives to participate in efforts to resolve poaching-related risks. Thus, although shared goals and interests may seem to be an obvious reason for cooperative risk management in wildlife management, it is not always obvious that goals are shared. Results revealed opportunity exists to move beyond thinking about gender as an explanatory variable for understanding how different groups think about participating in EC reduction activities. In a complimentary study, Kahler and Gore (2012) explored factors influencing noncompliance with wildlife rules, including those related to poaching; findings illustrated study participants’ motivations to comply were not necessarily equivalent to participants’ motivations for non-compliance and promote thinking about these two concepts as two sides of the same coin. They found a divergence in opinion when it came to how well decision-makers have taken into account risks to livelihoods and risks to wildlife when creating anti-poaching rules. A majority (68.1%, n = 79) believed poaching risks to wildlife versus human livelihoods (41.4%, n = 48) was weighted more heavily in the decision-making process. In Kahler, Roloff, and Gore (2012), participatory field methods were used to garner intelligence from local people involved in community-based natural resource management and policing. Areas with documented poaching events did not spatially correspond to those areas perceived by stakeholders to have high poaching risks. The positive relationship between where stakeholders perceived poaching was occurring and where they believed wildlife was abundant, particularly near national park boundaries, was consistent with local perceptions that poaching activities are motivated by financial gain, meat, and trophies (Kahler & Gore, 2012). These studies indicate the necessity of identifying local prioritization of risks to livelihoods and wildlife before perceptions of risk response can be contextualized.

Although the global community appears to be in general agreement that commercial wildlife trafficking is fueling an acute need for improved risk-reducing strategies, smart regulation, and more effective enforcement, little to no insight exists about how or what local people think about the topic. Unfortunately, we know little about risk perception associated with risk responses of the phenomenon of EC; a fuller understanding is necessary to design and further strengthen smart regulations and the enforcement pyramid at all levels, as well as general initiatives related to crime prevention and enforcement. If deploying EC-reduction policies and promoting more effective sustainable development are EC regulatory objectives, it is essential to understand local people’s perception of environmental
Risk perception affects compliance behavior and therefore is essential to regulatory design. Knowledge about EC-related risk perception is crucial for improving risk communication, building capacity, designing effective institutional and regulatory systems, and evaluating interventions. This need is particularly acute in “biodiversity hotspots” or species-rich areas where rates of wildlife and forest resource exploitation surpass sustainable levels. Biodiversity hotspots are the conservation corollary to crime hotspots, and are used by the conservation community to prioritize research, resources, and policy activities (Brooks, Mittermeier, Mittermeier, da Fonsenca, & Rylands, 2002).

**Wildlife Crime in Biodiversity Hotspots**

As one of the world’s hottest biodiversity hotspots, with 75% of species being endemic (i.e., found no place else on Earth), Madagascar’s flora and fauna face numerous anthropogenic risks such as illegal logging and unsustainable commercial hunting (Goodman & Benstead, 2005; Schwitzer, Davies, Steig, Ratsimbazafy, & Razafindramanana, et al., 2013). Three-quarters of Malagasy live in poverty, only 35% have access to an improved water source, and the Gross National Income of $420 USD/year ranks Madagascar 178 of 184 nations (World Bank, 2012). Madagascar has been rated as having extremely high rates of EC and natural resource trafficking, particularly wildlife and timber products (Barrett & Ratsimbazafy, 2009; Schwitzer, Mittermeier, Johnson, Donati, Irwin, et al., 2014). Considering its relatively small land area compared to other countries, it is remarkable that Madagascar is estimated to supply 2.5% of the world’s live reptile trade and has one of the highest rated trade volumes in the world (Robinson, Griffiths, St. John, & Roberts, 2015). EC and wildlife trafficking in Madagascar are at least in part a function of extremely rare species in high demand, corruption, high poverty rates, poor governance, and prolific natural resources (Gore, 2011; Nellemann et al., 2014). In particular, especially since experiencing a political crisis in 2009, Madagascar has experienced an upsurge in magnitude and extent of illegal harvesting of endangered hardwoods [e.g., rosewood (Dalbergia spp.)] and wildlife trafficking for the global pet trade [e.g., ploughshare tortoise (Astrochelys yniphora)] (Duffy, 2010). These foreboding trends paint a bleak picture for Madagascar’s degraded environments (Tyson, 2000) and the people whose well-being depend on it (Barrett & Ratsimbazafy, 2009). Because many of the wildlife involved in trafficking originate in biodiversity-rich developing countries such as Madagascar, insights from research conducted there may have practical implications for other biodiversity hotspots around the world. In Madagascar and elsewhere, poaching can be a highly localized activity that directly feeds into the global wildlife trafficking supply chain. Indeed, wildlife poaching is the initial activity upon which trafficking is based. In contrast to other goods and services that are trafficked (e.g., guns, drugs), once wildlife is poached, the effects are permanent and irreversible – the species is either dead or the physical act of trafficking renders the individual animal unfit to return to the wild.

Reducing risks to biodiversity and local livelihoods from wildlife trafficking in Madagascar and elsewhere is a high priority (Schwitzer et al., 2013). Various institutions address wildlife crime and conservation risks in Madagascar, including the fokonolona, or a group of people living within the same village or Malagasy indigenous community (Ratsimbazafy, Gore, & Rakotoniaiana, 2013). Fokonolona may, for example, create and enforce rules and sanction offenders independently from but in concert with the federal government. Madagascar also has provincial and federal-level protected areas that may create and enforce wildlife trafficking rules.

In Madagascar, as elsewhere, many conservationists use prioritization schemes based on principles of risk assessment. For example, the International Union for the Conservation of Nature creates “Red List Categories” formulated according to an objective analysis of extinction risk ranging from “Extinct” to “Not Evaluated,” as discussed in Schwitzer et al. (2013). Biologists seek to produce more complete datasets on species depending on extinction risk, for example some reptile groups, particularly those associated with fresh water and marine habitats which are facing disproportionately high extinction risks (Böhm, Collen, Baillie, Bowles, & Chanson et al., 2013); the idea being that more cogent risk assessments will improve conservation actions. These, and most other risk management
approaches, are overwhelmingly based on expert analysis of technical intelligence or privileged access to information – not public perception. Understanding public perceptions of risk is of paramount importance to the EC equation because EC is fundamentally about public behavior and behavior is affected by risk perception (Gore, Knuth, Scherer, & Curtis, 2008). It is well known the potential for experts and publics to perceive risks differently (Lazo, Kinnell, & Fisher, 2000). Publics and experts may not consider the same general risks; for example experts may focus on risk of species extinction from wildlife exploitation and publics focus on risk of childhood malnutrition from not exploiting wildlife for protein. Or, laypeople may focus on feeling safe while using public transportation during their daily commute to work while experts focus on emergency preparedness and disaster recovery capacity (Jenkin, 2006). Experts and laypeople may hold alternative views about risks to biodiversity from trafficking, for example experts may consider population-level risks of extinction over the long-term whereas publics focus on short-term localized changes in wildlife abundance. Experts may prioritize management resources based on risk rankings whereas publics base preferences on feeling (Slovic, Finucane, Peters, MacGregor, 2004). Groups may not concur about factors influencing the causes of risk exposure nor attitudes about risk management. If not resolved, these differences may pose intractable barriers to resolving negative wildlife trafficking impacts.

In this paper, we posed three research questions based on theories of risk perception (e.g., Slovic, 2000) and designed to provide a coarse baseline about local perceptions of poaching risks vis-à-vis poaching risks delineated by experts. Our data is not intended to represent a generalized measure of public opinion, nor does it capture local motivations or behavior to exploit natural resources. We do not assume a priori that local publics consider ECs to pose risk to biodiversity, or even that publics consider biodiversity exploitation to be a crime according to the rule of law or rules in use (Robbins, McSweeney, Chhangani, & Rice, 2009). Our research questions are intended to offer preliminary insight about what local publics think about expert approaches to managing risks from wildlife poaching, an EC of highest global concern (Nellemann et al., 2014). This information can inform development and implementation of more smart regulation and different levels of the enforcement pyramid (e.g., enforcement, training and guidance, partnership formation).

Our first research question was: How do local people rank poaching risks relative to risk posed by other environmental hazards? Although experts have diverse and current sources of data upon which to base EC regulations, local people rarely have statistical evidence or police intelligence on hand when they evaluate risks (Slovic, 2000). People respond to risks they perceive, will have strong aversion to certain risks, and be indifferent to others. Rating poaching risks relative to other activities and hazards ensures conservation decisions and actions can be appropriately prioritized. Importantly, the priority given to environmental problems depends on the presence of other existential threats that are not necessarily connected to the environment (Carmi & Bartal, 2014). Conservationists and the enforcement community may rate wildlife trafficking risks as very high policy priorities, but what do local people think? Our second research question was: What factors influence local risk perceptions associated with poaching? Risk perception is a function of many factors, such as knowledge about risk exposure, feelings of dread associated with exposure, voluntariness of exposure, and catastrophic potential of exposure. Factors associated with wildlife-related risk perception are well delineated (e.g., Gore, Knuth, Curtis, & Shanahan, 2007; Muter, Gore, & Riley, 2013). Effecting factors influencing poaching-related risk perceptions through a combination of policy, communication, or education, can be a key component of successful wildlife trafficking policy. However, factors influencing expert risk perceptions may not mirror those influencing local risk perceptions.

Our third research question was: What are local perceptions about the types of regulatory responses to poaching risks? Wildlife trafficking may be addressed in myriad ways. Social organizational models of risk, based on cultural theory, provide a typology of regulatory responses to wildlife trafficking risks (e.g., Douglas, 1966; 1982). According to cultural theory, four types of people are concerned about different forms of risk and hold specific views of risk responses (Ojasalo, 2009; Thompson, Ellis, & Wildavsky, 1990). People from a hierarchical culture are concerned with risks related to law
and order and individualists view risks as opportunities unless the risk threatens the free market or their personal freedom. Egalitarians are concerned with technological and environmental risks and risks that will inflict danger on many people or future generations while fatalists do not address risk because they consider it inevitable and outside their control (Ojasalo, 2009; Rippl, 2002). In theory, these distinct approaches to risk influence how these cultural types understand nature (Thompson et al., 1990; Rippl, 2002). Thus, regulators may craft responses that embrace poaching risks as opportunities for profit or technological innovation, ignore poaching risks because they do not know how to react, reject risks in an effort to actively deter them, or adapt to risks through experimental regulations and control efforts (Douglas, 1978). Characterizing perceptions of regulatory response to poaching risks deepens insight about how local people may respond to proposed EC policies or activities designed by experts using analytical methods and intelligence (Lidskog & Sundqvist, 2013).

Methods and Analysis
Based on five years of collaborative risk perception-based research and teaching experience on poaching in Madagascar as well as social science field experiences in Kenya, Madagascar, Namibia, and the US, we used semi-structured interviews with Malagasy residents, December 2013, to answer research objectives using a five-member research team consisting of three female Americans and two male Malagasy individuals. Our study site was the broader Analamazaotra Special Reserve region of east central Madagascar (Figure 1). We selected Analamazaotra based on our collective knowledge about EC in Madagascar, permission of relevant traditional authorities, willingness of communities to participate, available research resources, and accessibility. Within Analamazaotra, we used purposeful sampling to intentionally recruit participants at least 18 years of age within eight villages who had experience with the central concepts of our research questions and achieve maximal variation to capture diverse perspectives (Creswell, 2008). Our approach was intended to capture as much detail as possible about the complex phenomena of EC in Madagascar (Creswell & Plano Clark, 2011). Interviews were conducted primarily in Malagasy with some French and English, to accommodate dialectical variation based on ethnicity, and promote high translator autonomy. Prior to commencing data collection, three Malagasy conservation researchers independently reviewed the interview guide for content validity and salience (Trochim, 2001). In-field instrument translation from English into Malagasy, which occurred during round-table discussions between the research team, resulted in a verbal consensus on translation of the questions. To maximize our capacity to conduct statistical analysis on risk-perception data, we used a visual four-point scale to measure all questions except a risk-ranking question where participants organized individually laminated and labeled photographs of environmental hazards into a meaningful hierarchy. Additional information about methods and measurement are discussed in Gore & Kahler (2015).

After defining study objectives, introducing visual aids to participants (see Gore & Kahler, 2015), discussing affiliation, anticipated research outcomes, intended use of data, and definitions of key issues in interviews (e.g., commercial poaching versus legal hunting), informed consent was obtained. Interviews had two parts, a relative risk-ranking activity where participants were asked to hierarchically arrange photographs of eight environmental risks (see Table 1 for eight environmental risks) and semi-structured interview questions. Semi-structured interview questions focused on ranking risk perceptions associated with poaching, factors influencing perceptions of risk, perceptions of responses to poaching risks, effects of poaching risks, and socio-demographics (e.g., age, ethnicity, number of children, profession, sex). Because we were interested in capturing participant opinion about expert approaches to EC management, our questions were more structured than open-ended. Responses were recorded on paper and entered into SPSS version 20 for analysis.

Summated indexes were created for risk perceptions, risk responses, and risk effects with alpha values > 0.65 (Vaske, 2008). We used nonparametric versions of a general linear model (Type III Sum of Squares) to explore variables influencing risk perception. Results cannot be generalized beyond study participants, be used for theory building, or considered a reliable estimate of EC frequency or
magnitude; results do provide a novel estimate of how participant perceptions map onto expert-based EC-related risk management approaches (e.g., Nellemann et al., 2014). Michigan State University’s Committee on Research Involving Human Subjects (IRB# x10-394) reviewed and approved methods used in this research. See Kahler (2010), Gore et al. (2013), and Gore and Kahler (2015) for additional information about cross cultural issues in conservation social science data collection and best practices used to minimize potential sources of bias.

Results
We conducted 49 interviews and encountered two refusals, indicating some participants were willing and able to say no to foreign researchers, a potential source of bias (Trochim, 2001); not all participants answered all questions. One third of respondents were female (n = 16; male n = 33, 66%); average age was 40.9 years (range = 19-77). At least six ethnic groups were denoted in our sample, with Betsimisaraka (n = 28, 56%) and Bezanozano (n = 13, 26%) most commonly represented. Respondents reported an average of 4.5 children and a range of zero to 12. The mean length of time residing in the area was 28.8 years (range = 1 -77 years). Respondents reported 13 different professions, with farmer (n = 27, 54%) and local guide (n = 5, 10%) most frequently noted.

Our first research question focused on how poaching risks rated relative to other environmental hazards of concern to risk managers. Of the eight risks presented, cyclones were rated most and urban development rated least risky; poaching was rated third most risky (Table 1). When asked about the frequency of poaching in their area, respondents (n = 47) reported a wide range of occurrence (no = 15, 30%; low = 14, 28%; middle = 7, 14%; high = 11, 22%). Respondents were not asked about specific species of plants or animals poached in the area although some volunteered examples (e.g., Madagascar boa, which is trafficked for the pet trade).

Our second research question aimed to ascertain attitudinal factors affecting poaching-related risk perception. We explored eleven exogenous factors: familiarity, worry, volition, tampering with nature, novelty, understanding, trust, management response, cause, and technology were regressed against cognitive risk perception (i.e., perceived probability or likelihood of risk), affective risk perception (i.e., perceived feeling or acceptability of risk), and environmental risk perception (i.e., summation of cognitive and affective risk perception)(see Gore et al., 2007; Muter et al., 2013; Sjoberg, 2002 for additional information on variable definition and measurement).General linear model analysis revealed varying influence of these independent variables on environmental risk perception (Sum of Squares=13.52, df=11, R2=.499, F=2.718, p<.05), cognitive risk perception, or perception of risk likelihood (Sum of Squares=13.692, df=11, R2=.434, F=2.029, p<.05), and affective risk perception, or perception of risk acceptance (Sum of Squares=15.681, df=11, R2=.550, F=3.334, p<.05). Tampering with nature was the most influential significant variable in all models tested (respectively, standardized beta coefficients=.381, p< .05; .628, p<.05; 0.351, p< .05).

Our final research question explored the ways in which respondents perceived four different regulatory responses to poaching (i.e., adapt, deter, embrace, ignore). Of the 45 respondents who answered this set of questions, the majority reported deterrence as being the most common regulatory risk response (n = 27, 54%) overall. When asked specifically about how different regulatory authorities (i.e., Madagascar National Parks, fokonolona, village, family) respond to poaching risks, deterrence was most commonly reported. The majority of respondents disagreed with the assertion that the fokonolona, village, and family ignored poaching (54% in the case of the fokonolona and 58% in the instances of the village and family). Respondents overwhelmingly disagreed that embracing risk was an appropriate regulatory response for Madagascar National Parks, the fokonolona, their village and their family (Table 2).

Discussion
Natural resource-related crimes, particularly poaching being the root of commercial wildlife trafficking, have settled into the limelight of global policy priorities. Dedicated global consortiums, bilateral
and multilateral agreements, international working groups, grant opportunities, special journal issues, and graduate school-level training on EC barely existed a decade ago. Today, EC is recognized by diverse actors as being a key driver and denouement of social conflict at a global scale (e.g., Brashares, et al., 2014). Regulation and enforcement are essential components of wildlife trafficking reduction strategies; the efficacy and efficiency of these strategies is hampered by a lack of understanding about local people’s risk perception about the topic. Characterizing public perceptions of risk associated with EC can inform the design, implementation, and evaluation of smart regulation. Further, such insight helps situate poaching within local people’s broader threat matrix. In this research, we posed three research questions about public perceptions of poaching risks. Results have implications for local conservation efforts in Madagascar and potentially management of other ECs (Milledge, 2007), particularly wildlife trafficking interventions.

The most noteworthy finding from this study is the characterization of regulatory risk responses from study participants, or the answer to our third research question. Cultural theories of risk propose individuals choose what they fear in relation to their way of life, or, the culture they belong to. Preferences for regulatory responses to risk can be tied to risk perception; four different risk-based prototypical cultures are fatalists, hierarchists, individualists and egalitarians (Rippl, 2002). Sociologists of risk acknowledge public perceptions of acceptable risk and risk regulation are cultural constructs; the selection of dangers is correlated with social organization (Douglas, 1982). Although our data did not measure culture directly, it did capture products of relational processes. Some cultural theorists agree it is possible to learn about social processes from individual-level analysis (e.g., Rippl, 2002).

Our study data are consistent with social groups tending to be egalitarian in nature. Cultural theorists tell us egalitarians have high interest in and are supportive of group efforts, but dislike social relations that are shaped by differences or hierarchic structure. That our results are consistent with this proposition is unsurprising since: (a) the Betsimisaraka, a key ethnic group represented in our sample, are considered to be one of the most decentralized groups within Madagascar (Cole & Middleton, 2001) and (b) the strong role of culture in conservation among Malagasy is well known (e.g., Jones, Andriamarovololona, & Hockley, 2008). However, we know that among decentralized groups, social relations are open to negotiation and are assumed to oppose risks that will inflict irreversible dangers on many people or future generations. As a group, egalitarians generally distrust risks that are forced on them by the decisions of a small elite of experts, scientists, or regulatory authorities (Rippl, 2002). If our results about egalitarian views on regulatory responses to risk are confirmed through replication, they suggest an important implication for regulatory approaches aimed at reducing EC such as poaching (see Rippl(2002) for discussion of strengths and weaknesses of different methods for measuring cultural types). Specifically, perceptions about risk regulation among local people may not mirror perceptions of regulators when regulators are educated and socialized to risk-related regulatory strategies in foreign countries. A lack of reflexivity in the perceptions of risk regulation among regulators and local people, just like any expert-layperson divide in perceived risk, is likely to inhibit effective deployment of effective risk-reducing strategies (Gore, Knuth, Curtis, & Shanahan, 2006). For example, lately, the transportation and logistics sector has become involved in strategies to reduce wildlife trafficking; results herein have implications for the feasibility, or lack thereof, of local people responding favorably to increased regulation of the transportation sector (Guest Blogger, 2015).

A second insight from this work stems from knowledge about cultural theory, which suggests shifting regulatory discourse away from the causes and effects of EC to the choice between regulatory authorities to better uncover the components of the EC risk function relevant to local people (Douglas & Wildavsky, 1982). Such crystallization is evidently needed, as poaching rates for myriad species continues to increase. In South Africa, for example, home to over 80% of the world’s rhinoceroses, poaching increased from less than 1 animal a month in the mid 2000s to an average of 2 animals a day in 2012 and approximately 4 in 2013; 2014 rhino poaching rates surpassed 2013 rates (South African Department of Environmental Affairs, 2014). Reorienting the risk regulation conversation may help engender persuasive effects at the local level; persuasion at this scale is foundational to the en-
forcement pyramid. For example, the egalitarian Maasai baraza of east Africa, or a meeting of respected male elders and interested members of the community, have determined seasonal grazing patterns for cattle and levied decisions for other localized issues since pre-colonial times. Compared to federal level authorities, the baraza has at times been considered to be a more effective regulatory system than federal regulatory regimes (Western, 1994).

Third, this research builds upon the risk management principle that the first issue in any policy debate about risks and their regulation is to agree on which risks are most worrisome (Douglas & Wildavsky, 1982). Clearly, extinction and its deleterious effects on ecosystems and human well-being are paramount risks to conservation scientists and criminal justice officials (Schwitzer et al., 2014). Risks to society from ineffective wildlife crime control are a central concern of criminologists (Gibbs, Gore, McGarrell, & Rivers, 2010). Although our study results are not generalizable to the region or country at large, study respondents did not rank poaching as being as risky as natural resource hazards such as cyclones. That “expert” and “layperson” perceptions of poaching risks differ in general is not surprising (e.g., Kahler, Roloff, & Gore, 2013). What is novel is that data herein offer a first attempt at defining how a key group – local Malagasy people – thinks about this issue, information that with replication can serve as a baseline for bridging the gap through regulatory policy or intervention (Jurin, Rousch, & Danter, 2010).

Our study results about risk ranking may be interpreted within the notions of observed memory (e.g., Cole, 2001) and future orientation on risk perception (e.g., Carmi & Bartal, 2014). These phenomena can play an important role in influencing perceptions of poaching-related risks relative to other threats that are more existential, tangible and proximate because risks that are perceived as being temporally closer receive cognitive precedence over others that are perceived as less urgent (Carmi & Bartal, 2014). And, how individuals and groups remember the past can influence their current and future responses to and trust in authorities. Although our study did not explicitly ask questions about Madagascar’s 2009-2013 political crisis and transitional government (see Ploch & Cook, 2012), the significant changes in food and environmental security, deforestation and degradation, and suspension of donor aid associated with the transitional government undoubtedly influenced participants’ perceptions. At a minimum, the effects of the political crisis on participants’ perceptions of poaching risks – and how local people may respond to poaching risk regulations – can be interpreted within the context of memory observed (e.g., role of colonial powers and international conservation organizations in conservation) and future orientation (e.g., weighting of poaching risks relative to the existential risks of food and environmental insecurity).

Finally, the notion of tampering with nature is increasingly relevant to understanding environmental risks such as EC; tampering with nature has been found to be a primary driver of individual’s risk perception in diverse risk regulation contexts including nuclear power (Sjoberg, 2000). Importantly, the idea may include risks being “natural” versus “unnatural”, humans and their behavior negatively affecting nature, humans disturbing the order of nature, acting in opposition to nature, or illustrating arrogance toward nature. Beliefs associated with tampering with nature have demonstrated high explanatory power when considered vis à vis issues of technology (e.g., nanotechnology, genetically modified organisms) (Sjoberg, 2000). Again, although our results are not generalizable to a broad population, they suggest tampering with nature can be locally relevant to conservation contexts such as poaching in a biodiversity hotspot. In this regard, the practical implications for managing poaching in biodiversity hotspots may be similar to managing other risks such as climate change: focusing conservation and enforcement policy on individuals’ beliefs about technology, health, and environment may be a more effective and efficient strategy for engendering behavior change than attending to other variables such as trust in decision makers tasked with managing poaching risks, controlling poaching risks through enforcement or monitoring, or increasing knowledge about risk through public education initiatives. Among our study participants, local-level institutions such as the fokonolona may be best positioned to manage poaching risks and enforce rules (Ratsimbazafy et al., 2013) because they fit within the egalitarian cultural view of risk response and study participants’ opinions about
tampering with nature. Ultimately, the relationship between social institution, risk perception, and behavior change is an empirical question that merits additional testing.

Worldwide, wildlife trafficking is the second largest form of black market commerce, behind drug smuggling and before arms (Deeks, 2006). Bleak statistics and trends portend an upward battle for the conservation criminology community in reducing negative effects of poaching and other ECs on biodiversity hotspots and people that depend on them (Golden 2009; Gutierrez-Velez & MacDicken 2008). Conservation social science can make a significant contribution to the development, implementation, and evaluation of conservation policy designed to reduce wildlife trafficking in biodiversity hotspots such as Madagascar. Defining and characterizing local people’s risk perceptions provides essential baseline data for predicting the acceptability of conservation policies, directing stakeholder engagement initiatives, and targeting resources efficiently. Coupling data about poaching-related risk perceptions with ecological assessments may also enhance outcome assessments and police intelligence by expanding the suite of criteria available for evaluation (Ferraro & Pattanayak, 2006). Risk perception effects conservation behavior and affecting human behavior is essential for reducing wildlife trafficking.

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References


Appendices

Figure 1. Map of study area within the Analamazaotra Special Reserve, east-central Madagascar

Table 1. Malagasy study participants living the Analamazaotra Special Reserve (n = 28) comparatively ranked eight environmental risks, December 2013

<table>
<thead>
<tr>
<th>Environmental Risk</th>
<th>Malagasy term</th>
<th>Mean ranking</th>
<th>t statistic</th>
<th>df</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclone</td>
<td>Rivodoza</td>
<td>5.17</td>
<td>10.817*</td>
<td>27</td>
<td>3.96</td>
<td>5.82</td>
</tr>
<tr>
<td>Deforestation</td>
<td>Tavy</td>
<td>5.12</td>
<td>9.981*</td>
<td>27</td>
<td>3.72</td>
<td>5.64</td>
</tr>
<tr>
<td>Poaching</td>
<td>Fitrandranatsyaradalana</td>
<td>5.11</td>
<td>13.427*</td>
<td>27</td>
<td>4.18</td>
<td>5.68</td>
</tr>
<tr>
<td>Fire</td>
<td>Doro-tanety</td>
<td>4.87</td>
<td>9.43*</td>
<td>27</td>
<td>3.66</td>
<td>5.7</td>
</tr>
<tr>
<td>Mosquitos</td>
<td>Moka</td>
<td>4.54</td>
<td>10.824*</td>
<td>27</td>
<td>3.7</td>
<td>5.44</td>
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<td>Kapakapa</td>
<td>4.25</td>
<td>9.836*</td>
<td>27</td>
<td>3.02</td>
<td>4.62</td>
</tr>
<tr>
<td>Erosion</td>
<td>Lavaka</td>
<td>4.09</td>
<td>10.785*</td>
<td>27</td>
<td>3.24</td>
<td>4.76</td>
</tr>
<tr>
<td>Development</td>
<td>Fandrosoana</td>
<td>4</td>
<td>8.572*</td>
<td>27</td>
<td>3.21</td>
<td>5.22</td>
</tr>
</tbody>
</table>

*p < 0.000

Table 2. Malagasy study participants living the Analamazaotra Special Reserve’s December 2013 (n = 42) attitudes about the appropriateness of different institutional responses to local poaching risks

<table>
<thead>
<tr>
<th>Risk Response</th>
<th>Madagascar National Parks</th>
<th>Fokonolona</th>
<th>Village</th>
<th>Family</th>
<th>Overall</th>
<th>t-statistic</th>
<th>df</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapt</td>
<td>16%</td>
<td>12%</td>
<td>6%</td>
<td>8%</td>
<td>5%</td>
<td>9.72*</td>
<td>29</td>
<td>4.4</td>
<td>6.74</td>
</tr>
<tr>
<td>Embrace</td>
<td>6%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>10%</td>
<td>6.536*</td>
<td>11</td>
<td>3.04</td>
<td>6.13</td>
</tr>
<tr>
<td>Ignore</td>
<td>10%</td>
<td>10%</td>
<td>6%</td>
<td>8%</td>
<td>16%</td>
<td>7.419*</td>
<td>24</td>
<td>3.12</td>
<td>5.52</td>
</tr>
<tr>
<td>Reject</td>
<td>58%</td>
<td>38%</td>
<td>36%</td>
<td>32%</td>
<td>54%</td>
<td>13.068*</td>
<td>42</td>
<td>6.35</td>
<td>8.67</td>
</tr>
</tbody>
</table>

*p < 0.000