

## Poachers and Poverty: Assessing Objective and Subjective Measures of Poverty among Illegal Hunters Outside Ruaha National Park, Tanzania

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### Abstract

Illegal hunters in Africa may be making rational decisions about the hunting activities they partake in. These decisions could be linked to their socioeconomic status and the livelihood opportunities available to them. In particular, poverty is widely considered the leading driver that causes a household's inhabitants to take up poaching in protected areas. Programs aiming to protect vulnerable wildlife populations by mitigating poaching have historically relied upon income-based poverty metrics in efforts to reduce regional poverty and incentivise local inhabitants to discontinue poaching activities. Because such data sets that deal with poachers directly are rare, assumptions about the role of poverty, and the extent of poverty, that drives poaching have been hard to test. This study uses a unique sample of 173 self-admitted poachers living in villages adjacent to Ruaha National Park in Tanzania to explore the influence of poverty on poaching. Results indicated high demographic and household economy heterogeneity among poaching households. Capability deprivation examined more subjective measures of poverty and revealed that poachers are strongly motivated by the need to improve their incomes, but are not necessarily the poorest of the poor.

**Keywords:** Poaching, illegal wildlife harvesting, household economies, capability deprivation, poverty

### INTRODUCTION

A critical element of effective conservation is a proper understanding of the drivers of human behavior (Milner-Gulland 2012). Theory has long suggested, for example, that incentive-based programs to mitigate poaching will not work without elevating the household economies of poachers (Adams et al. 2004). This is a basic tenet of community-based conservation that asserts that people cannot and will not conserve species—a long-term strategy—if their short-term

needs are not met (Borgerhoff-Mulder and Coppolillo 2005). Even though local people have greater incentives to manage their resources sustainably (Ostrom 1990), they simply cannot afford the luxury of conservation because they depend on those resources for their survival (Borgerhoff-Mulder and Coppolillo 2005). If households bordering large protected areas are deprived of basic necessities and lack the economic resources to procure them, it is unlikely that they will refrain from illegally harvesting wildlife (Knapp 2012).

Illegal harvesting of wildlife is done by illegal hunters, (hereafter 'poachers'), a group that has long posed a challenge for those seeking to understand the motivations behind their activities. Like most subcultures engaging in an illegal behavior, poachers operate out-of-sight to avoid detection making them exceedingly difficult for outside researchers to access. As a result, much speculation has surrounded why they act as they do. This has led a few studies to advocate for a clearer understanding of the psychology of poaching and what factors influence a poacher's decision (Duffy et al. 2016).

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One of the main contextual factors thought to be important is a poacher's economic resources, or household economy. Household economies in many societies worldwide have long been affected by the presence of large protected areas (Knapp 2015; Shetler 2007).

Conversely, household economies and the livelihood strategies they encourage have had profound effects on wildlife populations in protected areas (Knapp 2009). Human interactions with large protected areas can be harmful, neutral, or helpful to the household depending on the proximity of the park (Nuno et al. 2014), the economic livelihood status of the household (Knapp 2009), and the inclination of a household's inhabitants (Dickman 2010). Poaching is a form of interaction that can raise a household's economic status at the expense of harming local wildlife populations and the tourism that depends upon it. While poaching may aid household economies, it can significantly harm ecological communities (Sinclair et al. 2007). Poaching can undermine biological diversity (Mateo-Tomas et al. 2012) and cause significant changes in wildlife populations (Hilborn et al. 2006).

Rarely mentioned in conservation literature are the risks assumed by poachers in the process of harvesting bushmeat. While difficult to quantify, bodily injuries may result with possible ramifications on a household's income generation potential. Similarly, poachers may be captured and arrested by anti-poaching enforcement personnel. Upon arrest, bushmeat and weapons are permanently confiscated, and, depending upon a variety of factors (e.g., respondent age, species harvested, willingness to comply with enforcement), offenders may be fined and/or imprisoned. Due to the costs of housing and feeding inmates, prison sentences tend to be less than one month with longer sentences (none longer than two years) reserved for the most notorious poachers (Knapp 2012). While fines have historically been relatively insignificant, they can nonetheless exacerbate impoverished conditions that may have initially catalysed the poacher to act.

Enmeshed in these interactions is the concept of poverty. Poverty is the most commonly cited reason that rural people poach in Tanzania (Loibooki et al. 2002; Kaltenborn et al. 2005). While poverty is a multifaceted concept that suffers from high definitional diversity (Sen 1985), it is generally agreed that there are three degrees of poverty that are often referred to as: absolute poverty, moderate poverty, and relative poverty (Sachs 2005). Absolute poverty occurs mainly in developing countries and refers to a condition whereby households cannot meet their basic—or categorical needs—which are necessary for basic livelihood function. As research has suggested (Bradshaw and Finch 2003), the failure to meet such categorical needs can have ill-consequences, in this case the destruction of local wildlife populations, as households attempt to meet their needs by harvesting wildlife. Households that are not subject to absolute poverty have characteristics more akin to moderate poverty. Such moderately poor households can meet their needs, but do so in a month-by-month, or year-by-year fashion. Households dealing with absolute or moderate poverty are also likely subjected to

the third commonly recognised form of poverty—relative poverty—because such households have income that falls below the country's national average (Sachs 2006).

Poverty has often been operationalised by measuring income (Sen 1985) and comparing it to various standards. The World Bank, for example, has historically used the purchasing power parity of an income of \$1 per day (now \$1.25 a day) to quantify numbers of people in absolute poverty. Similarly, individuals earning between \$1 and \$2 per day are assessed as being in moderate poverty (Sachs 2005). In addition to income, economists have examined assets (Sen 1985) and categorised people according to the presence or absence of various goods in their respective households. These approaches have acted as suitable starting points but they often fail to ascertain the most important dimensions of poverty that are most important to the local people in question. In some contexts, for example, the amount of a household's social capital may better dictate that household's position in society. Its ability to withstand economic or ecological hardship may depend more on the social networks that the household has created rather than on the monetary income that the household earns. In times of stress, such households may rely on the goodwill of other households with which it has forged a relationship in previous times of scarcity. Income-centered or metric-centered poverty assessments do not measure the social capital of a household. This can result in more households appearing to be in poverty than actually are producing a poverty line that is potentially misleading (Sen 2008).

Due to the limited scope of these poverty metrics, economists have realised the importance of identifying the basic needs of a household, or a subset of crucially important capabilities (Sen 1980). Such capabilities are considered imperative up to certain minimally adequate levels (Sen 2008). Such levels vary between communities and between people in the same community because they depend on personal and social characteristics. This more comprehensive view of poverty refers to more than arbitrary benchmarks of income and assets alone and is referred to as 'capability deprivation' (Alkire 2008). The capability deprivation approach emphasises the extent of freedom people have to achieve various livelihood strategies and desired ends.

Using this approach, local people are evaluated in a multidimensional manner and are categorised as poor if they do not have the ability to attain certain goods or make certain choices about their futures. Similarly, others have suggested that the poor are those who are deprived of a range of capabilities, or feel deprived from the local sphere of possibilities (Alkire 2008). The strength of this approach is that it can draw on a range of datasets and extend beyond simplistic income data (Reddy et al. 2006) to incorporate qualitative and subjective data as well. In regions of rural Africa, for example, benchmarks of income and assets can appear arbitrary and imposed by foreign agencies. In such contexts, internal subjective data may be more useful. Although the utilisation of subjective poverty for analysis has been used far less widely in academic research (Bradshaw and Finch 2003), its usefulness

here is that it captures the critical role of social, political, legal, and economic institutions that are lost to traditional metric measurements (Alkire 2008).

A proper analysis of different forms of poverty's link to poaching is essential for ensuring long-term ecological function of large ecosystems. The Ruaha-Rungwe ecosystem in south-central Tanzania includes Ruaha National Park and the villages that surround it. Coupled with the Pawaga-Idodi Wildlife Management Area and adjacent village lands, the entire Ruaha-Rungwe ecosystem covers over 45,000 km<sup>2</sup> (Olson and Dinerstein 1998). It supports over a tenth of the world's populations of lions (Riggio et al. 2013 and harbors important populations of other carnivores (Abade et al. 2014). This intact carnivore guild coupled with high plant and animal richness has led the ecosystem to be considered one of the most biologically valued ecoregions of the world (Olson and Dinerstein 1998). High levels of poaching constitute a persistent threat to this ecosystem.

In rural parts of Tanzania like the Ruaha-Rungwe, poachers have historically been assumed to be poor and uneducated farmers (Loibooki et al. 2002). If this assumption is true, it suggests that the majority of their respective households are subject to poverty. Due to the longstanding linkage between poverty alleviation and conservation (Adams et al. 2004), verifying this assumption, and assessing the poverty of poachers, is paramount. But this has proven difficult. Because hunting in most protected areas has been illegal since their creation, it is challenging to locate and identify poachers (Gavin et al. 2009; Knapp 2009). If respondents are successfully identified, they are often hesitant to reveal potentially incriminating information about their socioeconomic livelihoods (Knapp et al. 2010). Others may falsely deny that they poach to portray a positive public image (St. John et al. 2010).

This study located and identified a sample of self-admitted poachers who live along the margins of Ruaha National Park in south-central Tanzania. It uses their information to assess metric-based, subjective-based, and a capability deprivation approach to poverty analysis. In doing so, it reveals a high degree of heterogeneity among poaching households and shows why simple across-the-board measures to elevate local household economies are unlikely to mitigate poaching to desired ends.

## METHODS

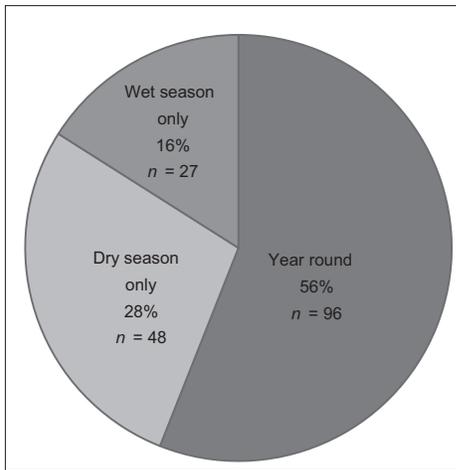
Data was collected in the months of February-April, 2015, through semi-structured interviews with 173 individuals (Figures 1-4 and Tables 1-4). Respondents identified themselves as having currently, or at some time in their past, illegally hunted inside Ruaha National Park. Exactly one year prior to this study, relationships were built with local key informants that made this study feasible. Due to the sensitive nature of poaching and the penalties it may carry for arrested offenders, respondents offered information voluntarily with an assurance of full anonymity for incriminating evidence they might disclose. No payment

of any kind was given to respondents and specific years that poachers poached were intentionally left off the questionnaire to further assuage respondent fear.

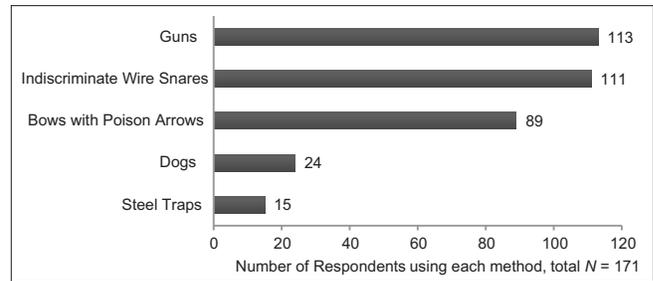
Initial pilot interviews were conducted with key informants whom were found informally as the author conducted other, less-sensitive socio-economic surveys in the villages surrounding Ruaha National Park. After several initial interviews with key informants, the study sample voluntarily came forward after being requested to do so by the previous respondent. This purposive snowball sampling technique is often used to identify difficult-to-find populations (Bernard 2006). This technique allowed interviewers to locate and approach other candidates who qualified for the research. It was assumed that respondent fear was not an issue as poachers who lacked adequate trust in the interviewers would be unlikely to appear for the interview. Similarly, it was assumed that respondents were not fabricating poaching involvement as they received nothing for their contributions.

Research was conducted in three villages each one adjoining the boundary of Ruaha National Park. Interviews were conducted in Kiswahili by four local Tanzanians who were trained by the author. Questions included objective measures related to household income and assets, livelihood strategies, and other socio-economic livelihood indicators. Other questions included more subjective measures relating to poverty and livelihood alternatives. Several subjective questions were hypothetical and asked respondents 'why' questions, 'if' questions, personal preference, and belief questions. These were included to better understand poverty as a capability deprivation, and how this form of poverty may cause or interact with poaching activities. All data were couched in qualitative contextual personal life histories and relevant anecdotes were pursued for added understanding and clarity. Since respondents kept no official records, they were asked to estimate their relevant financial information relating to income generated from poaching and other activities. Respondents were asked exclusively about their own poaching activities over the last three years.

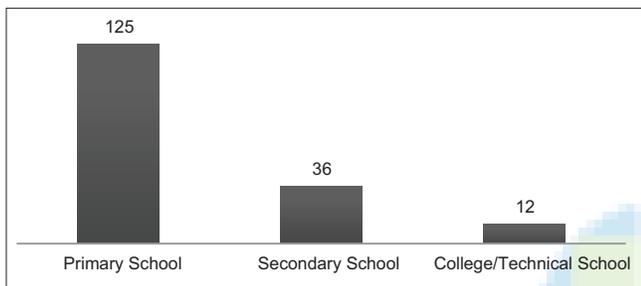
Responses were coded and analysed using the Statistical Package for the Social Sciences (SPSS) version 18.0 (SPSS Inc., Chicago). In the analysis to follow, the terms "poor" and "poverty" refer to capability deprivation that is multidimensional and includes income, assets, and subjective measures of deprivation. The terms "poaching" and "illegally wildlife hunting" are considered synonymous and refer to any hunting or wildlife harvesting that is not sanctioned by the government. At the time of research, USD \$1 was equivalent to 1400 Tanzania Shillings. While the overall sample size included 173 respondents, n-values vary because some questions were left unanswered, due to data collector error or respondent reluctance. To ease interpretation, I have presented the actual number of people (n) that each percentage figure represents. Ethical approval for this human subjects research was approved through the auspices of Houghton College.



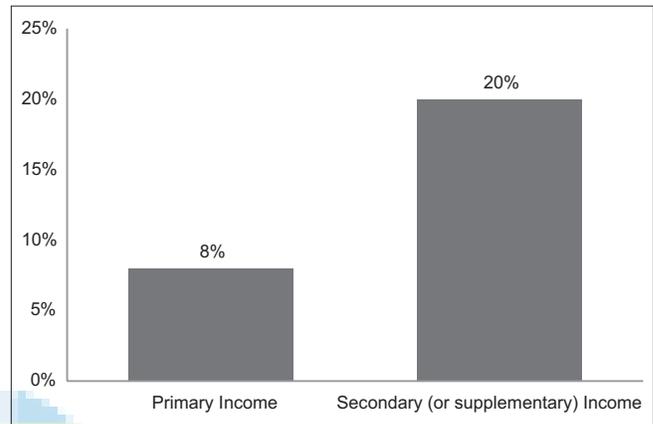
**Figure 1**  
*Seasonal frequency of poaching activity*



**Figure 2**  
*Methods of poaching*



**Figure 3**  
*Highest level of education received*



**Figure 4**  
*A greater percentage of poachers (20%, N = 34) illegally harvested wildlife to supplement their employment income compared to a very small percentage (8%, n = 14) who used poaching revenue as a sole means of primary income  $\chi^2 (1, N = 171) = 5.008, p < 0.025$*

## RESULTS

### Demographics

The ethnic demographic was mixed in the sampled villages outside Ruaha National Park. Twelve ethnic groups were represented in the poaching sample with the majority being the Hehe (45%,  $n = 78$ ), followed by the Bena (17%,  $n = 29$ ) and the Maasai (11%,  $n = 19$ ). Four out of five respondents were married, with couples having an average of 4 children. The religious identification of the respondents is depicted in Figure 5.

The sample differed significantly regarding whether or not they perceived poaching as a sin ( $\chi^2 = 28.262, p < .001, df = 1, N = 171$ ). Approximately two-thirds (67%,  $n = 80$ ) of Christians viewed poaching as a sin while Muslims were more evenly divided (48%,  $n = 21$ ).

### Seasonality, Sales, and Methods

The majority of poachers (58%,  $n = 96$ ) harvested game all year long while fewer individuals poached seasonally.

Poachers had hunted for an average of 4.1 years ( $n = 173$ ) with a median of 3 years. The longer a poacher hunted, the more likely he was to poach all twelve months rather than seasonally ( $F [2, 169] = 4.185, p = .017$ ). According to key

informants, poachers harvested bushmeat primarily to sell (not for sales of skins or ivory). In contexts in which transportation of bushmeat was problematic, it was consumed directly by the household or distributed in the local village. Many poachers (43%,  $n = 74$ ) reported they sold meat in their own village while a quarter (25%,  $n = 74$ ) sold in neighboring villages and a third (32%,  $n = 55$ ) sold further afield in undisclosed locations. A key informant reported that meat is sold to “a special boss” who regularly comes to collect. Poachers used a variety of methods in the bushmeat harvesting. Most relied on a combination of guns, wire snares, and bow-and-arrow.

### Motivations for Poaching

The obtaining of food (79%,  $n = 134$ ) and generation of income (78%,  $n = 133$ ) were most frequently cited as to why poachers poached. Cultural reasons, defined in terms of historical or contemporary ethnic importance, were far less important (6%,  $n = 10$ ). For poachers who labeled themselves poor, hunting to obtain food was paramount ( $\chi^2 = 18.749, n = 80, df = 1, p < .001$ ) followed by income generation ( $\chi^2 = 5.108, n = 1, df = 80, p < .001$ ). More than nine out of ten poachers (96%,  $n = 164$ ) insisted they would discontinue poaching if they received enough income to meet their needs.

**Table 1**

*Analysis of variance of a poacher's perception of his household's financial status (poor, moderate, wealthy) in regards to the number of children he has, and whether or not he owns a motorcycle or cattle*

	F	p	N	Degrees of Freedom
Number of children	6.38	0.002	2	169
Ownership of motorcycle	16.279	< 0.001	1	162
Ownership of cattle	5.053	0.026	1	171

**Table 2**

*Chi-square analysis of a poacher's perception of his household's financial status (poor, moderate, wealthy) in regards to the presence or absence of a tin roof and cement floor in his house's construction*

	X <sup>2</sup>	p	N	Degrees of Freedom
Presence/absence of tin roof	27.412	0.002	1	171
Presence/absence of cement floor	18.536	< 0.001	1	171

**Table 3**

*Pearson bivariate correlation analysis of a poaching household's cattle ownership with land ownership and goat ownership*

	R	p	Degrees of Freedom
Land ownership	-0.336	< 0.001	167
Goat ownership	0.619	< 0.001	167

**Table 4**

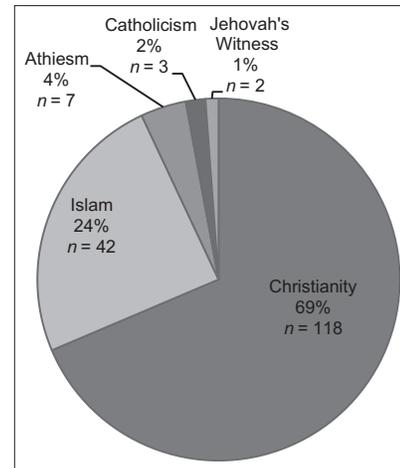
*Multiple regression analysis (R<sup>2</sup>=0.306) of a poacher's perception of his household's financial status (poor, moderate, wealthy) in regards to cattle ownership, the presence or absence of a tin roof, goat ownership, and the presence or absence of a cement floor*

	β	p
Cattle ownership	-5.75	< 0.001
Presence/absence of tin roof	-5.085	< 0.001
Goat ownership	0.267	0.007
Presence/absence of cement floor	-0.211	0.005

### Economic Status and Income Generation

Poachers were asked to account for their poaching income over the past three complete years. Many were unable to do so due to the many transactions involved and lack of accounting. For those that were able to estimate their earnings over the previous year, they earned an average of USD 201 (n = 17), with one individual earning as low as USD 14 and another as high as USD 1,429. Over half (54%, n = 93) the respondents assessed their financial status as average while fewer (46%, n = 80) labeled their households poor. Respondent perceptions of poverty revealed a nuanced relationship with regards to familial status and material assets owned.

Self-described poor respondents had poached for more years (mean = 4.4) than economically average respondents (3.5)  $F(1, 170) = 5.621, p = .019$ . Moreover, a greater percentage (63%, n = 50) of those who considered themselves poor, poached the whole year than those who considered themselves of average economic status (47%, n = 44) ( $X^2 = 6.906, n = 171, df = 2, p < .032$ ).



**Figure 5**  
*Religious identification*

Employment was linked to education as a greater percentage of respondents who completed secondary school, the equivalent of high school in western countries, were able to secure employment over their lifetimes ( $X^2 = 6.113, n = 171, df = 1, p < .013$ ). More than one-third (35%, n = 60) of the respondents had some form of outside or self-employment over their lifetimes.

A greater percentage of poachers (20%, n = 134) illegally harvested wildlife to supplement their employment income compared to a very small percentage (8%, n = 14) of whom used poaching revenue as a sole means of primary income ( $X^2 = 5.008, n = 171, df = 1, p < .025$ ).

The financial status of a respondent's household was linked to income generation from non-poaching sources. Self-described "financially average" respondents were far more likely to have received income the previous year from pastoralism, self-employment, or outside employment than were respondents who labeled themselves poor ( $X^2 = 32.300, df = 1, n = 171, p < .001$ ). Similarly, a higher percentage (44%, n = 35) of poor respondents did not earn any income from any non-poaching activities than did those who labeled themselves average (13%, n = 12). Regarding material assets, a smaller percentage of households had procured cement floors (16%, n = 27) than tin roofs (46%, n = 80). Self-described financially average households had more cattle (8.7, n = 93) than did poor households (3.3, n = 80).

### DISCUSSION

Research here supported the strong theoretical linkage between poverty and poaching. Approximately four out of five respondents acknowledged that they have poached—or currently poached at the time of this research—primarily to obtain food or income. Moreover, most respondents asserted that they would quit poaching permanently if their income could be met in another way. Given the inherent risks of poaching and how labour-intensive it is, there is little reason to doubt this is true. While it is impossible to negate the

possibility that this majority response was given in hope of development projects coming to the area, a more parsimonious interpretation suggests that the majority of poachers harvest wildlife because they are subject to poverty and cannot meet their basic needs without doing so. If this is indeed the case, poaching is unlikely to abate unless the basic needs of households in this region are met. Conservationists have long presumed poverty to be a key driver of poaching (Mackenzie et al. 2011) and sought to address it through “bottom-up” approaches.

Game-cropping and provisioning was one such approach used in the 1990s by the Serengeti Regional Conservation Project (SRCP) to elevate rural household economies outside Serengeti National Park, in northern Tanzania. The project implemented a management plan in which legally harvested bushmeat was sold to local communities. By enabling households to more cost-effectively access bushmeat, it was thought that poaching pressure might be reduced. Further research advised, however, that the project be discarded partially because paying for legal bushmeat was still more expensive than poaching it (Holmern et al. 2002). It also may have been that SRCP served as an additional revenue stream without necessarily dissuading poachers from continuing to illegally harvest bushmeat. By continuing to poach, poachers could acquire even more protein and/or income with the SRCP in place. Part of the failure of incentive-based programs like the SRCP may be attributable to the fact that not all households poach because they are poor (Nuno et al. 2014).

In our study a significant minority (20%) of respondents poach for reasons other than basic needs provisioning. Furthermore, over half (54%) of poachers view their household as economically average compared to other village residents. This likely means that while some poaching households are poor in the absolute sense, others are less poor, or moderately poor, and poach more to supplement their needs and diversify their livelihood strategies rather than relying on it as a sole or primary means of income. Such moderately poor households may be in the process of shifting out of absolute poverty towards a position of moderate poverty (Nielson et al. 2012) and are using poaching as a means of making that transition. As other research has suggested, programs that only marginally help household economies may not mitigate poaching at all, but actually intensify it by enabling more effective hunting techniques (Damania et al. 2005). Profit obtained by poachers through such programs can, for example, be used to obtain more equipment used for poaching, such as wire for making snares.

Despite the fact that financially average households tended to have better quality homes and more cattle than did self-described poor households, they poached nonetheless. Self-described average households had approximately five more cattle than poor households and a significantly higher percentage owned a motorcycle. In rural parts of southern Tanzania, a motorcycle opens up a variety of additional livelihood opportunities that are not accessible to households that lack this means of transportation. Yet, even with more

cattle and a motorcycle, these better off households poached to the same extent as poorer households. A greater percentage of financially average households had earned income in the previous year from cattle sales, self-employment, or outside employment than poorer households but still partook in poaching activities. While income from non-poaching sources partially explained why people perceived themselves as being financially average, it did not—and does not—seem to be enough to dissuade households from poaching. The fact that there are so many poachers from average, or moderately poor, households suggests that its persistence around Ruaha National Park is not entirely due to poverty. The provision of economic aid to these households is unlikely to incentivise them from discontinuing their poaching activities.

Conservationists across East Africa have attempted to link conservation and development with Integrated Conservation and Development Programs (ICDPs). Despite their popularity, most of these programs have not been nearly as successful as expected (Newmark et al. 2000). The failure of ICDPs and other incentive-based programs like the SRCP have necessitated the ongoing operation of more heavy-handed “top-down” strategies, referred to as fortress conservation, that are more enforcement-based. Enforcement measures have historically accompanied the creation of protected areas in East Africa and have had success in maintaining and rehabilitating wildlife populations (Hilborn et al. 2006). But these measures are costly to maintain (Danielsen et al. 2003) and often susceptible to corruption (Knapp 2009), especially in countries with high amounts of poverty. While successful over the short-term in protecting wildlife populations, it remains unclear what changes ongoing top-down measures exert over the long-term in tightly linked human-natural systems. If the principle income-earner for a household is imprisoned for a significant amount of time, or incurs a sizable fine, a household in moderate poverty could slide into absolute poverty. Deprived of capabilities, other household members may be pushed into poaching who otherwise would not be.

Protected areas around the world have grown significantly in recent decades and with it the idea that the needs of local people needed to be tied in to conservation agendas (Adams and Hutton 2007). The Durban Accord, agreed to at the Fifth World Parks Congress in 2003, defined this agenda stating that protected areas would be integrated with the interests of “all affected people” with benefits extending across the boundaries of protected areas (World Conservation Union 2005). While well intentioned, this ambiguous language has led to ongoing confusion about what such benefits should be (Adams and Hutton 2007) and failed to translate to local people in tangible ways. As a result, local people incurring costs of living next to large protected areas have continued to poach.

Without long-term and effective bottom-up approaches in place—and in the face of ongoing poaching—top down enforcement-based strategies have continued apace in protected areas (Vedeld et al. 2012). These strategies have often existed without support of local communities. Research has shown in a case study in Tanzania, for example, that it was

unnecessary to secure local support because the rural poor in that location were weak and unable to offer meaningful resistance (Brockington 2004). The author points out, however, that it is unwise to generalise from studies like this to other reserves in East Africa (Brockington 2004). Fortress conservation was effective in this particular reserve largely due to its unique characteristics, not necessarily shared by other reserves like the Ruaha-Rungwe.

Much like in the aforementioned case study, the Ruaha-Rungwe system is also surrounded by weak rural groups who lack a cohesive ability to resist top-down measures. But the much larger size of the Ruaha-Rungwe makes it far costlier to patrol and manage. Also different is that many of the poachers around the Ruaha-Rungwe, as this study has shown, have hunted out of necessity. While increasing patrols, arrests and penalties may curb the activities of poachers who are hunting to supplement their income, it is unlikely to affect those hunting out of necessity. This subgroup is liable to continue hunting regardless of whatever top-down costs are imposed simply because they lack alternative livelihood opportunities.

Ultimately, ongoing poaching around protected areas in Tanzania is a testament to the failure of both bottom-up and top-down approaches in curtailing illegal wildlife harvesting. Results here are somewhat equivocal. While some results align with the notion that poaching is done more out of need than desire (Loibooki et al. 2002; Knapp 2012), they also show that not all poachers are the poorest of the poor. For the poachers hunting due to necessity, it is unlikely that top-down measures will ever achieve much success in ending or mitigating poaching. This is especially true for large, heavily vegetated protected areas the size of the Rungwa-Ruaha ecosystem (45,000 km<sup>2</sup>) where anti-poaching patrols are arduous and anti-poaching resources are difficult to obtain.

Theoretically, such need-based poaching supports the continued pursuit of bottom-up approaches. But if bottom-up measures are to succeed, the critical question concerns how human needs in the villages should be met. As results here indicated, a contingent of poachers hunted to acquire an additional means of income-generation rather than out of need-based desperation. As a result, understanding how capabilities need to be extended to such households is paramount. Given the impracticality of elevating all rural Tanzanian households in multiple villages to the comparably high economic living standards of western countries, how high does a household need its socioeconomic status elevated, relative to national standards, for its members to refrain from poaching? Ascertaining the importance of relative poverty may be critical for determining what it takes for a poacher to give up his poaching activities.

Regarding the relationship between poaching and employment, it has been argued that giving poachers employment is an effective means for reducing poaching because it raises income and occupies a poacher's time (Knapp 2007). However, other research has shown that households with seasonal or full-time employment were actually more likely to poach (Nuno et al. 2014). Results here show that

a higher percentage of poachers used their poaching income to supplement their non-poaching income rather than as a sole means of primary income. This shows that increasing employment around protected areas is not a foolproof panacea to reduce poaching. As expected, this study showed that respondents with higher levels of education were more likely to attain non-poaching employment income. Because education is linked to employment, however, and employment does not necessarily reduce poaching, increasing education is unlikely to help in the short-term as well.

While household economies and livelihood portfolios were not surveyed in full, it is likely that most of the sampled households are relatively poor compared to households that are closer to more heavily settled areas and urban centers in other parts of Tanzania. Like many parts of the world, much of rural Tanzania suffers from a shortage of employment and investment possibilities. This is a likely explanation as to why only one respondent considered his household to be rich. While this may appear to suggest that even the rich poach, this poacher, informed the interview team that after poaching for six years he recently gave up the practice. He cited cultural reasons for picking up the craft but later gave it up upon learning the value of animals and the importance of maintaining viable populations in the national park. He accorded his wealthy status primarily to his impressive numbers of livestock.

Such holdings act as a safety net that help insure this former poacher's household against the unpredictability of environmental perturbation. This may be what has allowed him to wean his household off of -park resource utilization during the past three years. In other words, livestock holdings are likely to act as a mobile bank account that can be accessed whenever adverse situations arise. While livestock are liable to drought and disease and are not a risk-free investment, they may concurrently be operating as a safer means of investment with a higher likelihood of return for rural households that lack other venues. Results here seem to suggest that such a natural bank account, in a region where more modern banks are inaccessible, may be a key determinant for households to emerge out of absolute or moderate poverty conditions.

More importantly, such a case illustrates the idea of capability deprivation. One-dimensional interpretations of this household's status could be highly erroneous as the household would likely be deemed absolutely or moderately poor. The household lacked a tin roof, cement flooring, had little collective education among its inhabitants, and never received income from sources other than pastoralism. But upon building up its livestock holdings, the respondent gained the freedom to discontinue poaching and pick up other livelihood strategies, which in this case resulted in increased attention to—and success with—animal husbandry. How the respondent viewed his household trumped other simplistic measures of poverty (e.g., education level, income level, livelihood indicators) and revealed why he had ended his poaching activities. The respondent's case clearly shows the need for incentive-based programs to incorporate multidimensionality poverty assessments when attempting to mitigate poaching.

It also provides evidence that households use poaching as a transition strategy as they attempt to extend beyond their basic capabilities and become more financially secure. Once the household attained a relatively high economic status through poaching, it gained the freedom to refrain from the activity.

## CONCLUSION

The idea that poverty drives poaching is an entrenched idea in conservation literature (Adams et al. 2004; Mackenzie et al. 2011; Nellemann et al. 2014). As pointed out by others, however, this assertion has been speculative due to a lack of data (Duffy et al. 2015). This study has shed light on the complexities of motivations that cause poachers to harvest bushmeat. It revealed that poachers are difficult to categorise and as a result, require nuanced conservation strategies. Thus far, national and international agencies attempting to mitigate poaching may not have aimed at the right target. Because poachers represent a heterogeneous group, broad brush bottom-up and top-down measures have largely failed in meeting conservation goals. This study shows that bottom-up strategies focused solely on the poorest of the poor, for example, are unlikely to curtail poaching because many poachers hunt even though they consider their households to be of average financial status. Based on this, bottom-up strategies should be cast more widely to include households that are financially more well off as well.

Research into financial diaries shows that the poor do a remarkably good job of managing loans and savings (Collins et al. 2009). Poverty forces people to manage their resources as carefully as possible. Because of the inconsistency of their income, the poor must utilise saving and borrowing strategies so that they can put food on the table in difficult times. Safe investment and borrowing opportunities, as shown in the case of the rich former poacher, might better allow some households to attain basic capabilities and others to extend beyond them. As revealed by the poachers in our sample, the attainment of basic capabilities would motivate many to discontinue their illegal activities. For others, the financially better off, they need to be incentivised to an extent that will allow them to extend beyond their current capabilities.

While poverty is undeniably enmeshed in the motivations of poachers, it is a complex condition rather than a singular category (Challander and MacMillan 2014). Regardless of a household's actual income, assets, or livestock holdings, the implications of this study point toward the importance of households to feel rich, whether they actually are or not. Results were clear that how a poacher views his household affects his poaching activities. Those who considered their household to be poorer than others poached more intensively and for a longer duration. This demonstrates the importance of relative poverty (Challander and MacMillan 2014) supporting the idea that it is important that poachers do not feel poor relative to others in the village they are residing in. To feel financially better off, poachers must have the capability to pursue other livelihood strategies or improve their present one. In this regard, it may

be more instructive to regard poverty as one of several factors involved in poaching rather than the main driving factor.

Other important characteristics may be inequality (Challander and MacMillan 2014), voice, prestige, status (Sen 1999), and well-being (Milner Gulland 2012), all of which can collectively be referred to as capability deprivation (Alkire 2008). While difficult to measure, effort should be made to integrate capability deprivation into conservation strategies (Duffy et al. 2016). For more effective conservation, implementers of incentive-based programs must realise that poaching households are difficult to evaluate and must not limit their poverty assessments to simplistic single measure approaches. Strategies need to consider that poaching is done not solely out of need but also as a means of seeking and affirming identity and status (Duffy et al. 2016). As a result, programs should assess rural poverty in a multidimensional manner and widen their audience to include more than merely the poorest of the poor.

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