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Using Indirect Questioning to Assess Community Preference for Alternative Forms of Livelihoods Under Zambia's Community-Based Wildlife Conservation Policy

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ABSTRACT

Poaching for bushmeat is a rising problem for wildlife conservation, yet standard surveys often understate its true drivers because respondents conceal illegal behavior. We surveyed 219 households living near the Kafue National Park in the Central province of Zambia, and applied a discrete choice experiment (DCE) with a split-sample design: half the respondents answered direct questions; the remainder used an indirect questioning format that masks individual answers. Each choice set combined deterrence measures (more frequent patrols, longer jail terms) with alternative livelihood options designed to replace poaching income—agricultural-input packs, access to a community micro-credit scheme, and donation of dairy cows. The study finds that respondents subjected to the indirect questioning technique report a higher opportunity cost of providing conservation services and prefer access to a microcredit facility over other proposed alternative livelihood options. The study results also reveal marked differences on a number of conservation and livelihood related preferences between the two groups. These results suggest a hypothetical bias in standard formulation of DCE when related to illegal resource use. Accounting for this bias is essential since policies that rely solely on conventional DCE may underestimate the opportunity cost of conservation.

INTRODUCTION

Designing effective policy responses to illegal wildlife hunting is a rising concern for many national agencies responsible for wildlife conservation (Dikgang & Muchapondwa, 2017; Berhanu & Teshome, 2018; Travers *et al.*, 2019; van Velden, 2020). One key difficulty is the lack of reliable data on the true motivation and preferences of individuals engaged in poaching, given the illicit nature of the activity (Gavin *et al.*, 2009). As such, developing an effective and sustainable wildlife conservation policy requires that underlying drivers of illegal hunting, are identified and quantified as accurately as possible (Davies, 1996; Lande, 1998; Pitcher *et al.*, 2002; Ntuli & Muchapondwa, 2020). Nevertheless, the illegal nature of poaching activities pose unique methodological challenges when it comes to investigating their causes to inform appropriate interventions.

Common methods used to understand behavior in illegal activities include indirect observation (Mbaze *et al.*, 2020) or self-reporting through diaries and interviews (Gavin *et al.*, 2009). However, most of these methods are fraught with challenges like non-response and social desirability biases that reduce data validity, particularly when the subject under review is as sensitive as illegal hunting, thereby affecting the resulting recommendations (Groves, 2006; Lusk & Norwood, 2009a). For example, fear of repercussions may also cause a non-random proportion of respondents to refuse to participate partly or wholly in the survey, creating non-response biases (Fisher, 1993). Further, respondents may choose to provide dishonest answers to conform with prevailing social norms, leading to social desirability biases (Lusk & Norwood, 2011; Yadav *et al.*, 2013; Lopez-Becerra, & Alcon, 2021), resulting in under-reporting of undesirable behaviour or over-reporting of desirable behaviour (Fisher, 1993; Lusk & Norwood, 2009a; 2009b). Results of Lusk and Norwood (2010) suggest that asking respondents to predict other people's preferences instead of stating their own, may overcome individuals' incentive to either understate or overstate "willingness to pay" (WTP) values. Olynk *et al.*, (2010) also report that indirect questioning methods may yield more accurate representation of consumer values than direct questioning methods, resulting in more accurate estimates for decision making. For example, a direct question would be 'how many hunting trips can you make per month on average?' On the other hand, an

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indirect question would be 'how many hunting trips would an average person in your communities make per month?' The main assumption behind indirect questioning is that although people want to make themselves look good, they are relatively unconcerned with making others look good too (Lusk & Norwood, 2009a).

This paper is motivated by Lusk and Norwood's (2009a) use of the inferred valuation method (hereafter 'indirect questioning method' in this paper). The aim is to assess the presence and effect of social desirability and other hypothetical biases on respondent preferences when dealing with the problem of poaching. The focus is on poaching using snares (made from wires) and bows and arrows rather than firearms due to evidence pointing to poaching using such tools as having an inestimable and growing impact on large mammals alike (Damania *et al.*, 2005). Evidence from Zambia and some parts of southern Africa shown that wire snares have substantial impact on large animals including lions, leopards and young elephants (ZAWA, 2017).

Although indirect questioning methods have been used to reduce social desirability bias in marketing and other social sciences, their application has only been taken up in conservation science during the early 2000s (Burton, 1999; Noonburgy, 2007; Galvi *et al.*, 2009; Byers & Noonburgy, 2007; Lorenzin, 2005). Further, though other indirect data collecting approaches such as remote sensing for assessing deforestation rates (Linkie *et al.*, 2004) and aerial satellite data for evaluating ivory poaching (Underwood *et al.*, 2013) are increasingly being used in nature conservation, these tell us little about the characteristics of offenders or what drives their behaviour. Yet, as St. John *et al.* (2013) observe, effective conservation policy prescription require an understanding of the drivers and impacts of human behaviour. Illegal or sensitive behaviour is thus a frequent source of uncertainty affecting the development of effective management decisions thereby compromising evaluations of conservation interventions (Fisher, 1993).

In this paper, the study applied an indirect questioning technique, an ex-ante approach (Lusk and Norwood, 2009a: 2009b; Lopez-Becerra & Alcon, 2021) to mitigate biases in stated preference studies as an attempt to detect social desirability and hypothetical biases, in addition to ensuring respondent anonymity (Fisher, 1993), leading to increased willingness to answer sensitive questions. Our working hypothesis is that there will be a marked difference between the reported "willingness to accept compensation" (WTA) values for stopping poaching from respondents subjected to direct questioning and those under indirect questioning techniques. This difference is assumed to account for the social desirability and hypothetical biases.

The study also draws motivation from behavioral theories (Ajzen, 1991) relating to the prediction of behaviours that relate to sensitive activities. While collective actions based on social capital, represented by metrics of trust, reciprocity, and community involvement, are identified as important determinants in the success of collaborative institutional engagements, (Ostrom, 2000; Wagner *et al.*, 2010; Benequista, 2010; Jagers *et al.*, 2021), social desirability biases lead to departure from theory. To correct the departure, we use Discrete Choice Experiments (DCE), which are theoretically in line with behavioural change theoretical models. The models infer that intentions to perform behaviours of different kinds can be predicted with accuracy from attitudes toward the behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991) which explain the importance of inferred questioning.

Materials and methods

Study area

The study was conducted in Mumbwa Game Management Area (GMA), situated adjacent to the Kafue National Park in central Zambia (Fig. 1). Kafue National Park is the third largest park in Africa and Zambia's oldest and largest wildlife protected area. Selecting Mumbwa GMA ensured a representative sample, as its community size mirror those of other GMAs in the country.

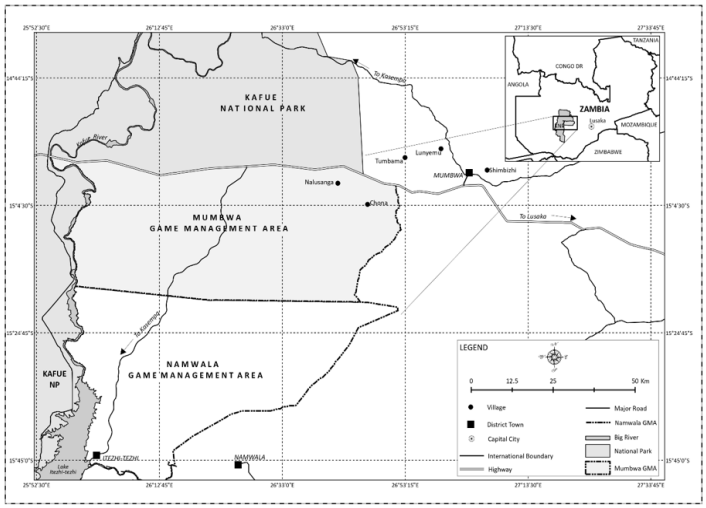

Figure 1: Map of Mumbwa Game Management Area

Under the Community-Based Wildlife Conservation policy, households living near wildlife protected areas are requested to provide conservation services such as stopping poaching and reporting any poaching activities to authorities for which they are rewarded through funded community-based developmental projects. This is in addition to other anticipated benefits from wildlife and tourism-related employment opportunities (Wainwright & Wehrmeyer, 1998; Simasiku *et al.*, 2008).

Designing the Choice Experiment

Selection of policy attributes

Attributes are proposed interventions presented as alternative forms of livelihoods to substitute poaching. To ensure that selected attributes are demand-driven, relevant and realistic, the study design was informed by four iterative focus group discussions (FGDs), with each subsequent FDG providing more information that helped refine the study questionnaire. For a detailed explanation on the attribute selection process, see (Mutti *et al.*,2023). We also reviewed literature (e.g., Moro *et al.*, 2012; Nielsen *et al.*, 2013; Kaczan *et al.*, 2013; Nielsen *et al.*, 2014; Piannar *et al.*, 2014; Costedoat *et al.*, 2016) which led to a final list of attributes and their levels presented in table 1.

Table 1: Attributes, attribute levels, descriptions and their impact on households

Attributes	Description	Levels (* = status quo)
Agro-input packs	Agro-input packs comprise 20 kg maize seeds, 300 kg of basal dressing and 200 kg of top-dressing chemical fertilisers delivered at the beginning of a growing season for two years (equivalent to 220 USD per year)	0*, 1, 2, 4 (number of agro-packs)
Cows for milking	One-off donation of cows, at in-calf stage, for milking which can later on be sold as beef, (equivalent to 160 USD each).	0*, 2, 4, 6 (number of cows)
Community Micro-credit facility	Access to community micro-credit facility to obtain small loans of up to ZMW1000 (US$50) for business start-ups. Loans will be secured through "group lending" as a form of Collateral	YES, NO*
Hunting trips (Price attribute)	Households allowed a number of hunting trips per month. This is also the price attribute	4*, 2, 1, 0
Frequency of game patrols per week	Increased frequency of game park patrols per week through recruitment of more game scouts	3*, 4, 5, 7
Minimum Jail term for poaching	Increased minimum jail term for convicted poaching offenders	3*,5,10, 15

Hypothetical scenarios

As part of an introduction to the survey, respondents were asked to imagine a hypothetical situation where donors offered to assist community members improve their livelihoods through introduction of new income-generating opportunities (Appendix A1). Simultaneously, the donors would also support government in strengthening enforcement of wildlife regulations. Respondents were further informed that the survey aimed at eliciting information for developing a donor-supported alternative livelihood intervention as an upgrade to the current community-based wildlife conservation program that failed to meet their expectations.

The sample was randomly split into two groups, one group was subjected to a questionnaire that directly asked for respondents' views, while the other group was asked to report the views of other community members on the subject of illegal hunting.

The attribute "number of hunting trips per month is used as a cost/price attribute to trade-off poaching with alternative policy interventions. The proposed payment vehicle was presented as a hypothetical donor-supported "wildlife conservation trust fund" (WCTF) jointly managed by donors and an elected local committee.

Experimental design, Sampling and Survey

Although various strategies can be employed in designing DCEs, based on choice situations to be presented to respondents, a full factorial design that includes all possible combinations of attribute levels, thereby ensuring comprehensive interaction coverage was impractical in this study due to the large number of combinations. However, the Orthogonal design we adopted ensured uncorrelated estimates by varying attribute levels independently. This drastically reduced the number of choice situations. However, it still required a design with 36 choice situations. The D-optimal design maximized statistical efficiency using prior information, requiring fewer scenarios and smaller sample sizes (Scarpa & Rose, 2008). We chose the D-optimal design for our

DCE because it led to more precise parameter estimates with a smaller sample size, which minimized respondent cognitive burden and resource utilization. This design also required a lower number of choice situations to achieve the same statistical power and efficiency, unlike factorial and orthogonal designs, which often necessitate larger sample sizes and more scenarios to reach comparable levels of precision.

After holding FGDs, we conducted a pre-survey at the end of 2019 with 50 randomly selected male respondents using an orthogonal design with seven attributes. We used the results of the pre-survey to develop a D-efficient design with 12 choice tasks using Ngene v.1.1.2 (Rose and Bliemer, 2009). The D-error of the final experimental design was 0.048. The full design of the experiment is presented in Appendix A2, and an example of choice set used in the study is illustrated in figure 2. The survey was implemented in early 2020.

Card 1		Current Situation	Alternative A	Alternative B
Number of agro- inputs Packs		0	4	1
Numbers of Cows for milk		0	8	0
Number of hunting trips per month		4 times in a month	Once in a month	4 times in a month
Access to community micro-credit facility		0	NO	YES
Frequency of game patrols		3 days a week	5 days a week	7 days a week
Minimum jail sentence for poaching		3 years	10 years	15 years
Please choose	one only	[ ]	[ ]	[ ]

Figure 2: An example of choice set

This study used face-to-face interviews with a split sample of 110 respondents subjected to indirect questioning and 109 respondents subjected to direct questioning techniques. Households were drawn from five villages; Shimbizhi, Tumbama, Lunyemu, Nalusanga and Choona, randomly selected from their respective Village Action Group (VAG) registers. The study used VAG registers prepared by the local Community Resource Boards and recognized by the ZAWA to obtain a fair representation from which we draw inferences. Based on information from FDGs, we considered poaching as an activity carried out by males above 16 years old. Consequently, we interviewed household heads for male-headed households and a male adult older than 16 years for female-headed households as these greatly influence family decision on important matters.

Data analysis

We used a conditional logit model, given its ability to analyse factors that affect consumer behaviour, such as culture, consumer psychology in addition for accounting for heterogeneity between consumers. In accordance with the random utility theory (McFadden, 1974; Lancaster, 1966), we assumed that the utility of individual n from choosing alternative j in choice situation t can be represented as:

$$U_{njt} = \boldsymbol{\beta}'.X_{njt} + \varepsilon_{njt},$$

where X_njt is a vector of observed attributes related to alternative j of the choice situation t; β^' is a vector of preference parameters explaining choices while ε_njt is the unobserved error term.

We tested the hypothesis that there could be interactions between the number of hunting trips, jail sentence and patrol frequency attributes. This is because an increase in jail sentence or frequency of patrols are likely to increase the cost of hunting trips, since the risk and costs of being caught increases (see Mutti *et al.*, 2023 for a thorough discussion of the introduction of interactions in the analysis). The number of hunting trips (price/ cost attribute) is used to estimate the cost of proposed alternative livelihoods as well as monetary welfare like marginal willingness to pay (WTP) for changes in attributes and their levels.

The utility of households was modelled as (Equation 1) :

$$U(a,c,cr,h,j,p) = ASC + \beta_{ag} \times agropack + \beta_{cow} \times cows + \beta_{credit} \times credit + \beta_{hunt} \times hunt + \beta_{patrol} \times patrol + \beta_{jail} \times jail + \beta_{jh} \times jail \times hunt + \beta_{ph} \times patrol \times hunt + \beta_{pj} \times patrol \times jail \quad (1)$$

Based on the model estimates, we calculated the willingness to accept (WTA) compensation for reducing the number of hunting trips, in form of agro-packs, donation of cows, or access to credit. As an example, for the case of agro-packs. Taking the marginal utility of agro-packs as β_a , the marginal utility of hunting trips is (Equation 2):

$$\frac{\partial U}{\partial h} = \beta_h + \beta_{jh} \times jail + \beta_{ph} \times patrol \quad (2)$$

For a given number of years in jail and patrols per week, we can calculate the WTA for agro-packs to reduce hunting trips by one unit as the marginal rate of substitution between agro-packs and hunting trips in equation (3) below:

$$WTA_{ag} = \frac{\beta_h + \beta_{jh} \times jail + \beta_{ph} \times patrol}{\beta_a} \quad (3)$$

To evaluate the possible policy consequences, we calculated WTA at the current levels of jail sentences (three years) and patrols per weeks (three days), respectively. We then evaluated the marginal effect of changing the minimum jail sentence or the patrol frequency on WTAag

$$\frac{\partial WTA_{agr}}{\partial jail} = \frac{\beta_{jh}}{\beta_a} \quad (4)$$

The same reasoning was applied for the computation of WTA for milking cows and access to credit. To estimate the variability of the results, the standard errors were computed using the Delta method. We estimated coefficients and willingness to accept (WTA) of agro-packs, cows and access to credit for reducing the number of hunting trips from the direct and indirect questioning split samples based on the second model. The same reasoning was used to calculate other WTAs and marginal effects.

RESULTS AND DISCUSSIONS

Comparison of the socio-demographic characteristics of the two samples

We first compared the socio-demographic characteristics of the two subsamples to ensure they were similar. Descriptive statistics presented in Table 2 reveal no significant differences in socio-demographic characteristics between the split samples.

Table 2: Socio-demographic characteristics

	Indirect questioning	**Direct questioning**	**t-testa**
Variable Name	Group Average	Group Average	
Age	43.25	43.38	0.79
Family size	6.8	7.1	0.97
Married	80%	94%	
Educated up to Secondary education	82%	77%	
Unemployed	83%	78%	
Own at least one animal (cattle)	34%	34%	
Engaged in subsistence agriculture (maize)	85%	94%	
Owns at least one hectare of land	96%	94%	
Reported hunting as the main source of income	87%	86%	
Reported hunting as main source of protein	87%	87%	
Reported hunting as the only form of livelihood	87%	84%	
Satisfied with form of compensation for conservation services	6%	9%	
Satisfied with the magnitude of compensation for conservation services	5%	9%	
Satisfied with the distribution process of compensation	6%	7%	

a t-test was conducted for continuous variables only

Source: Survey data 2020

Results of the discrete choice experiment

Model estimated with the pooled data, combining both indirect and direct questioning techniques are presented in Table 3. We also estimated interactions between the variables length of jail term for poaching offenders and number of hunting trips per month (jail * hunt), number of game patrols conducted per week and number of hunting trips undertaken per month (patrol * hunt),

Table 3: Parameter estimates of the conditional logit model with pooled data

	Estimate	Std.Err	Z value	Sig
Agropack	0.771	0.010	15.466	***
Cows	0.415	0.026	16.111	***
Credit	1.173	0.125	9.410	***
Patrol	-0.235	0.098	2.415	**
Jail	-0.290	0.059	4.937	***
Hunt	0.553	0.225	2.462	**
Jail * Hunt	-0.028	0.012	2.298	**

Patrol * Hunt	-0.086	0.036	2.387	**
Patrol * Jail	0.046	0.012	3.811	***
Asc	-1.471	0.338	4.351	***
No. of observations = 1328 No. of respondents =110 Log likelihood = -755.65 McFadden's pseudo R2= 0.47 AIC: 1533.31 BIC: 1590.25 No of estimated parameters = 10				

number of game patrols per week and length of jail term for poaching offenders (patrol * jail). The loglikelihood of the model is -755.65 and the pseudo-R2 is 0.47 both falling within the category of good models for a discrete choice experiment.

We then estimated two conditional logit models one with direct questioning, and the other with indirect questioning datasets. The results of the models with direct and indirect questioning data sets are presented in Table 4. and Table 5. respectively

The results for the direct questioning model show that all variables were significant with expected signs except for the variables jail and the interacting variable (patrol*jail) which are not significant. Further the interacting variable

Table 4: Parameter estimates of the conditional logit model with direct questioning data

	Estimate	Std.Err	Z value	Sig
Agropack	0.926	0.068	13.643	***
Cows	0.521	0.035	14.815	***
Credit	1.275	0.155	8.243	***
Patrol	-0.225	0.107	2.106	**
Jail	-0.034	0.092	0.368	0.713
Hunt	-0.303	-0.396	1.024	*
Jail *Hunt	-0.078	0.019	4.084	***
Patrol * Hunt	0.051	0.043	1.194	*
Patrol * Jail	0.008	0.018	0.431	0.666
Asc	-1.084	0.391	2.773	***
Observations: 1320 No. of respondents:109 Log-likelihood: -874.95 McFadden's pseudo R2: 0.3967 AIC: 1771.91 BIC: 1828.94 Estimated parameters: 10				

between number of game patrols conducted per week and number of hunting trips undertaken per month (patrol*hunt) does not have the expected negative sign, as their joint impact would reduce the motivation to poach, but is significant. In addition, the interacting variable between the number of game patrols conducted per week and length of jail term for poaching offenders (patrol*jail) does not have the expected negative signs since their joint impact would reduce the motivation to poach and is not significant (Table 4.)

Compared to the output for direct questioning model (Table 4), the indirect questioning model in Table 5. shows that all the main variables are significant with expected signs with the following exceptions; the variables jail which was not significant in the direct questioning model is now significant in the indirect questioning model, while the variable patrol which was significant in the direct questioning model is now not significant in the indirect questioning model.

Further, the interacting terms between length of jail term for poaching offenders and number of hunting trips undertaken per month (jail*hunt) which had the expected sign and was significant in the direct questioning model, has the expected sign but is not significant in the indirect questioning model.

Finally, the interaction term between number of game patrols per week and length of jail term for poaching offenders (patrol*jail) which did not have the expected sign and was not significant in the direct questioning model, it still does not have the expected signs but is now significant in the indirect questioning model. However, we cannot compare the values between the two models because they have different scale coefficients. Therefore, we next analyzed the WTA values which are comparable across models, since the scale factor disappear.

Table 5: Parameter estimates of the conditional logit model with indirect questioning data

Variable name	Estimate	Std.Err	Z value	
Agropack	0.668	0.070	9.596	
Cows	0.348	0.035	9.872	
Credit	1.118	0.076	6.345	
Patrol	-0.243	0.155	1.570	
Jail	-0.378	-0.490	4.189	
Hunt	-0.252	-0.334	1.656	
Jail * hunt	-0.007	0.015	0.499	
Patrol * hunt	-0.122	-0.153	2.291	
Patrol * jail	0.060	0.018	3.343	
Asc	-1.598	0.509	3.140	
Observations: 1308 NO. of respondents:110 Log-likelihood: -755.65 McFadden's pseudo R2: 0.47 AIC: 1533.31 BIC: 1590.25 Estimated parameters: 10				

Tradeoffs

Based on the outputs in Table 4 and Table 5, we calculated the trade-offs between reducing hunting (number of hunting trips per month) and receiving compensations (agro-packs, cows, credit). In other words, to determine compensation required to reduce the number of hunting trips per month.

First, we calculated compensation for a riskless scenario (WTA0), that we defined as a scenario with no patrols or jail terms for poaching. WTA0 can be interpreted as gross value of hunting trips, which would bring meat, etc., and have no costs other than time of the poacher. These WTA values are reported in Table 6).

Results in Table 6 suggests that participants are willing to forego one monthly hunting trip in exchange for either 0.328 agro-packs (in the case of direct questioning) or 0.827 agro-packs per year (in the case of indirect questioning). Since we know the total cost of the agro-packs (220 USD per year), the monetary equivalent would be 577 USD/per household/ years (0.328 x 220 x 4 x 2) under direct questioning and 1,456 USD/per household/2 years (0.827 x 220 x 4 x 2) under indirect questioning respectively. This would reduce hunting from the current maximum of four to zero trips per month, meaning one hunting trip would cost 6 USD for direct questioning and 15 USD for indirect questioning models respectively. This value corresponds to the value of meat, net of the cost of labor time and other perceived costs. The same calculations were made with the cows and credit compensations. All yearly compensations required to stop the hunting in a riskless environment are presented in Table 7.

Table 6: WTA for compensations under a hypothetical riskless environment

	Estimate	SE	Z	Pr(>z)
Agropack, direct	0.328	0.312	1.050	0.147
Agropack, indirect	0.827	0.455	1.818	0.035
Cows, direct	0.583	0.580	1.005	0.157
Cows, indirect	1.587	0.972	1.634	0.051
Credit, direct	0.238	0.213	1.117	0.132
Credit, indirect	0.494	0.287	1.719	0.043

Riskless environment is defined as jail sentence = 0 and no of patrols =0

Secondly, we computed the marginal effects of jail sentence and patrols on the WTA under direct and indirect questioning, based on the effect of one additional year in jail and one additional day of patrol on the WTA. Given the study hypotheses, these can be calculated at any level of jail and patrol. The results are presented in Table 8.

The results suggest significant differences in the impact of jail terms and patrols on the WTA for reducing hunting between respondents subjected to direct and those under indirect questioning techniques. One additional year in jail reduced the WTA of 1 hunting trip by 0.08 Agro-packs, i.e., 0.08*440 = 35.2 USD for the direct and 0.01*440 = 4.4 USD for the indirect questioning respondents.

The study findings show that additional jail terms would have an impact on the behaviors of those under

direct questioning (or at least on their WTA), so for the government, there is a possible discussion whether the regulator should be harsher (increase jail terms), or be nice (incentivize the farmers). If we believe the direct questioning technique, the increase on the number of patrols would not really influence the WTA. On the other hand, additional patrol days would have an impact on the behaviors of those subjected to indirect questioning. As a regulator, a direction towards being hasher through increased patrols would be feasible. But if the regulator believes in indirect questioning, then increasing the jail terms would have no impact on the WTA. Again, this shows that policies based on the two questioning techniques have different effects from the same policy instruments.

Table 7: Yearly amount of compensation required to stop the hunting in a riskless environment

Instrument	Agro-packs		Cows		Credit	
Method	Direct	Indirect	Direct	Indirect	Direct	Indirect
Units to stop hunting under current hunting levela	1.31	3.31	2.33	6.35	0.95	1.98
Unit cost in USD for 2 a year programb	440.00	440.00	160.00	160.00	100.00	100.00
Equivalent USD compensation for 2-year programb	576.87	1456.26	373.01	1015.98	95.18	197.66

a Current hunting trips per months =4

b Two-years program. Agro-pack and credit given at the beginning of each year. Cows are given only once at the beginning of the program

Table 8: Marginal effect of jail sentence and number of patrols on WTAs: A comparison of direct and indirect elicitation methods

Effect of	Policy instrument	Elicitation Method	Estimates	SEa	Sig
Jail	Agropack	Direct	-0.08	0.02	***
	Agropack	Indirect	-0.01	0.02	0.30
	Cows	Direct	-0.15	0.04	***
	Cows	Indirect	-0.02	0.04	0.31
	Credit	Direct	-0.06	0.01	***
	Credit	Indirect	-0.01	0.01	0.30
Patrol	Agropack	Direct	0.05	0.05	0.12
	Agropack	Indirect	-0.18	0.07	***
	Cows	Direct	0.10	0.08	0.11
	Cows	Indirect	-0.35	0.16	***
	Credit	Direct	0.04	0.04	0.14
	Credit	Indirect	-0.11	0.05	***

a SE were obtained using the delta method with the robust variance-covariance matrix of the conditional logit models

Discussion

Donation of agro-parks and cows, together with access to a community microcredit facility unambiguously increased household utility. On the other hand, the impact of number of years in jail for illegal hunting and number of game patrol conducted per week show different results under direct and indirect questioning approaches.

Impact of questioning technique

Enquiring about sensitive and illegal activities such as illegal hunting may cause respondents to choose to withhold information or provide dishonest answers to conform with perceived prevailing social norms and behaviours viewed favourably by others (Lusk & Norwood, 2011; 2009a). This may result in under-reporting of undesirable behaviour or over-reporting of desirable behaviour (Fisher, 1993). The comparison of direct and indirect questioning data sets outputs shows that WTAs (Table 6.) and of marginal effects (Table 8.) of jail sentence and number of patrols are different, suggesting different attitudes towards jail and patrol under the two questioning approaches.

First, under a riskless scenario (no jail sentence, no patrols) in Table 6. we obtained very different WTAs. When asked with indirect questions, the WTAs were almost three times higher (agro-pack = 0.827, cows = 1.587, credit = 0.494) than those reported by those subjected to direct questioning (agropack = 0.328, cows = 0.583, credit = 0.238). Similar results were reported by Lopezi-Becerra

and Alco (2021), who concluded that an inferred value was almost triple the conventional stated preference estimation in a choice experiment used to estimate social desirability bias.

Therefore, the difference between these values reflects the presence of social desirability bias which has been revealed by inferred questioning (Lusk and Norwood (2010, 2009a, 2009b). If we go by indirect questioning, though it might appear costly to compensate respondents under indirect questioning, this measure represents true preferences that would resolve the problem of illegal hunting. On the other hand, though compensation levels under direct questioning appear to be low, the implications are that respondents would accept compensation which is inadequate but still continue with illegal hunting. The results in Table 4, which shows the additional levels of compensation for stopping illegal hunting, reveal similar trend to that in Table 3. where the levels of compensation under indirect questioning (agro-pack = 3.31, cows = 6.35, credit = 1.98) is higher than that under direct questioning (agro-pack = 1.31, cows = 2.33, credit = 0.95). Alternatively, policy maker would need to apply more enforcement in terms of jail terms and patrolling effort for respondents under indirect questioning compared to those under direct questioning.

Second, the marginal effects of the jail and patrol attributes on WTA (Table 8.) were different under direct and indirect questioning approaches. The results under direct questioning suggests that higher jail sentence would be a good deterrent, while increasing the number of patrols would have little or no effect. On the other hand, indirect questioning results suggests that the opposite is the case (where the deterrent effect only apply to increasing the levels patrol and no deterrent effect is observed with additional jail years).

Taking the results under direct questioning technique with respect to the impact of increasing jail terms, the results are supported by FGDs that revealed that sentences for poaching offences were considered relatively shorter compared to those for other criminal offences, hence increasing jail term has an impact of reducing illegal hunting. Similarly, Lindsey *et al.* (2012; 2011) report that one of the key drivers of illegal hunting in low-income countries is the weak penal system. They add that most punishments for poaching offenders provide inadequate deterrents and often do not reflect the value of destroyed resources. In order to achieve the desired conservation results, policy makers should enhance the effectiveness of the judiciary in securing convictions with deterrent jail terms. This invariably requires addressing the increased maintenance of jails. In other words, increasing compensation to achieve conservation in the absence of increased enforcement through jail terms will not be cost effective.

Increasing the number of patrols under direct questioning technique (Table 8.), has little or no effect in reducing illegal hunting. This result finds support from Moro *et al.*, (2012) and Nielson *et al.*, (2014), who report that increasing patrolling frequency did not appear to act as a very strong deterrent effect. There are several potential explanations for this observed general low impact : First, increased patrolling frequency may not be perceived as an indicator of high risk of conviction if an increase in the probability of being caught only means more frequent payment of bribes, as such is likely to have a minor effect. Moro *et al.* (2012) in this respect further observed that more well-off hunters are likely to have the financial means to cope with the risk of being arrested. However, the positive impact of increasing the level of patrol under indirect questioning approach finds support from Jachmann (2008), who reports that patrol efficiency can vary considerably, and in some protected areas, the number of patrols may be a poor indicator of the probability of being caught while in others they may be good indicators, as the case with the attitude of respondents under indirect questioning.

If we believe in indirect questioning, increasing patrol effort will be cost effective compared to relying on compensation. Since results from the two questioning models show different attitudes towards the negative incentives, additional qualitative research would be needed to confirm the potential deterrent effect of patrols. However, overall, a more pressing problem is that of corruption, which could occur from the time of arrest or during the prosecution process leading to the failure to either secure an arrest or secure a conviction. Again, the observed differences in both the levels of WTA and marginal effects reported in Table 6. and Table 8. is attributed to the effect of social desirability bias.

Therefore, the difference in welfare values and related responses between respondents subjected to direct questioning and those indirect questioning is attributed to the effect of social desirability bias.

Opportunity for Governments to utilize wildlife conservation resources effectively

Overall, the results provide policy makers who often have limited resources earmarked for wildlife conservation, insights on how to use such resources more efficiently. This is particularly evident when comparing preferences estimated using indirect and direct questioning techniques which would help address the challenges of under-reporting of undesirable behaviour or over-reporting of desirable behaviour (Fisher, 1993; Lusk & Norwood, 2009a; 2009b). Under the conventional community-based conservation programs, decisions are either made based on general preference determination methods that do not attempt to minimize the problems of various biases associated with investigating sensitive and illegal subjects like the case of poaching.

Finally, this also provides for addressing community heterogeneity with regards to individual household preferences towards various options from which to adopt trade-offs for poaching. In addition, this method is superior over the conventional - one size fits all approaches which are typical of traditional community-

based wildlife conservation programs where household preferences often do not reflect the true values revealed by respondents due to inherent biases.

Use of Conditional logit model

There are several ways to analyse a discrete choice experiment (DCE), including among others, using a conditional logit model, a mixed logit model or a latent class model, and a nested logit model. The latter approaches are used when the assumption of independence of irrelevant alternatives (IIA) is violated. The nested logit model accounts for the possibility that choices can be grouped into subsets (nests) where alternatives within the same nest share similar unobserved characteristics, leading to correlated error terms. This was deemed irrelevant in our case since we the DCE was conducted with unlabelled alternatives. The mixed logit and the latent class approaches allow for the analysis of heterogeneity of the preferences. In this study, we chose the conditional logit model for its ease of interpretability, and because the primary focus of the study was on how the attributes of the alternatives influence choices.

Impact of protest responses

While the number of protest responses i.e. those selecting the current choice situation in this study was insignificant and therefore not further analyzed in this study, it is worth noting that where the number of protest responses is significant, it is important to consider their impact, as this analysis affects the statistical performance of the empirical models used.

Finally, with regards to other factors promoting wildlife conservation activities that were not utilized in the modelling to explain respondent preferences, the study results show that there were no significant differences in factor promoting wildlife conservation reported between two groups.

CONCLUSION

The aim of this paper was to determine whether specific questioning techniques matter in eliciting respondents' conservation-based preferences in order to minimizes response biases, when dealing with illegal and sensitive issue of poaching. The study findings show that respondents subjected to the direct questioning technique, report a lower willingness to accept compensation (WTA), compared to those subjected to indirect questioning technique. Therefore, the study findings show that questioning techniques matter when eliciting respondent preferences when dealing with sensitive subjects. In the case of this study, it would be cost effective to use an indirect questioning in order to minimise the impacts of hypothetical biases.

While establishing wildlife protected areas is a critical component of conservation efforts, inadequate consideration of the true needs of those living adjacent to such resources, due to poor preference elicitation methods limits conservation policy effectiveness. In other words, unless communities living in game management areas receive benefits that are equivalent to or exceed the cost imposed on them for providing conservation services, any conservation policy intervention implemented on them is bound to fail. This study therefore has demonstrated the presence of social desirability bias through the application of the proposed methodology.

Results from the proposed method and the models we used suggest that the questioning techniques implemented in the study present useful insights in informing policy. We therefore recommend that future studies evaluating policy options to respond to poaching problems may consider implementing the indirect preference elicitation approach and applied on much larger sample sizes. Possible, future areas of study could consider investigating procedures that enable researchers to measure the magnitude of the actual prevalence of a sensitive behaviour experimentally. Specifically, those that would estimate the magnitude of sensitive behaviours on the aggregate level. This can then serve as an external criterion to produce strong evidence concerning the validity of the questioning techniques under scrutiny.

Limitation of the paper

One of the limitations of this paper is that the method adopted for the study will only help estimate the private losses to households (foregone food or/and income from poaching) due to the required change of activities (from poaching to conservation) but not the value of the gain in the public good (restored biodiversity, increased eco-tourism potential, etc.). Secondly, investigating compensation options that could specifically address wildlife-caused damages could have added another dimension to the study. The impact of institutional arrangements on the implementation of our proposed policy interventions would provide more insights. Finally, a much larger sample size would be preferred for DCE studies. These limitations therefore suggest areas for further research.

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