

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Global Ecology and Conservation

journal homepage: www.elsevier.com/locate/gecco

Assessing the potential for a levy-based system to replace revenue from trophy hunting in South Africa

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ARTICLE INFO

Keywords:

Lion
Trophy hunting
Willingness-to-pay
Van Westendorp
Gabor-Granger
Conservation
Local livelihoods
Animal welfare

ABSTRACT

Trophy hunting is a contentious practice often associated by the public with charismatic African megafauna, especially lions (*Panthera leo*). Public pressure could potentially end trophy hunting in the near future, which many stakeholders argue could lead to negative impacts, including on species conservation and on the livelihoods of communities that depend upon it as a source of income. We investigated the potential for replacing revenue currently generated by trophy hunting in South Africa with levies - a "lion protection fee" - on international travellers to that country. Our approach recognised tourism as a source of funds for conservation action, and the influence of lions as a charismatic, flagship species. We surveyed 907 respondents who had previously visited South Africa, or would consider visiting in the future. We used van Westendorp and Gabor-Granger direct pricing methodologies to assess whether the willingness of potential visitors to pay for wildlife protection could be sufficient to compensate for any loss were trophy hunting to be banned. Our findings indicated substantial support for the proposition of being charged a "lion protection fee": 84.2% of respondents stated that it was a "great" or a "good" idea. A minority (7.5%) had a negative view but only two of these respondents (0.2%) indicated a pro-trophy hunting attitude. Willingness-to-pay was sufficient that, under predicted 2023 numbers of tourists, daily fees could be set at a price acceptable to both overseas (\$6–7 USD) and southern African tourists (\$3–4 USD), and generate funds at least equalling, but potentially exceeding, those currently generated by trophy hunting (\$176.1 million US per annum). We conclude that, in principal, revenue from trophy hunting in South Africa could be fully replaced by a subsidy to stakeholders as a payment for conservation action, funded by a modest levy on international tourist visitors.

1. Introduction

Wildlife is hunted for many purposes, including subsistence, wildlife population management, cultural and recreational reasons (Di Minin et al., 2021). Trophy hunting - in which hunters target specific individual animals in order to keep body parts as "trophies" (e.g. Lindsey et al., 2007) - is a distinct practice and increasingly at the centre of a number of contentious debates, within both the academic literature and the wider media and society in general (Yeomans et al., 2022; Batavia et al., 2019). While trophy hunting occurs for

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<https://doi.org/10.1016/j.gecco.2023.e02656>

Received 20 July 2023; Received in revised form 21 September 2023; Accepted 23 September 2023

Available online 25 September 2023

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many species globally, in public discourse it has become particularly associated with charismatic African megafauna, and especially lions (*Panthera leo*) (e.g. [Yeomans et al., 2022](#)). One notable inflexion point in the debates around trophy hunting has been the shooting and killing in 2015 of a lion in Zimbabwe, known as “Cecil” ([Macdonald et al., 2016](#)). This event, for example, has been associated with a marked change in the quantity and tone of media articles in the UK, which have become more numerous, and more critical of trophy hunting in general ([Yeomans et al., 2022](#)). [Yeomans et al., 2022](#) found that among articles published between 2010 and 2020, the overall sentiment was largely anti-trophy hunting (63.1%, comprising 84.2% of tabloid articles and 42.2% of broadsheets). Broadsheet articles typically adopted a more nuanced position, but only 3.5% of articles overall were pro-trophy hunting ([Yeomans et al., 2022](#)). The exact level and causes of public opposition to trophy hunting remain largely unquantified, but are clearly substantial. As an example, a survey of 10,687 European Union citizens, drawn from across Denmark, Germany, Italy, Poland and Spain and weighted to be nationally representative of key demographics, revealed that a mean of 84% of respondents were either somewhat or strongly opposed to “the trophy hunting of wild animals found in Africa” ([Humane Society International, 2021](#)). These attitudes appear to be rooted in ethical discomfort with hunting for sport (e.g. [Lindsey et al., 2007](#)). For example [Batavia et al., 2019](#) identify the act of wildlife “trophy” taking as a key source of ethical discomfort and public opposition, describing the action as “morally indefensible” and “a violation of duty and common decency”.

One evolving consequence of the prominence and tenor of the discourse around trophy hunting is that global policy surrounding trophy hunting is increasingly heavily shaped by media and public sentiment - and many academic authors have raised concerns that policy decisions may fail to represent relevant research and science findings ([Parker et al., 2020](#); [Bauer et al., 2017](#); [Dickman et al., 2018](#); [Macdonald et al., 2017](#)). There exists a growing probability that trophy hunting could be effectively ended in the near future in response to public pressure (e.g. [Parker et al., 2020](#)). This could occur through being banned in-country (as occurred e.g. in Kenya in 1977), or becoming financially unviable due to trophy import bans (e.g. as currently being debated by the UK government) or declining international markets ([Lindsey et al., 2012](#); [Fears, 2017](#), cited in [Parker et al., 2020](#)).

Under current conditions – i.e. without measures to address any unintended consequences – many researchers and policy makers are concerned that the ending of trophy hunting could result in negative impacts, including on species conservation and on the livelihoods of communities that depend upon it as a source of income ([Macdonald et al., 2017](#); [Naidoo et al., 2016](#)). They highlight that revenue generated by trophy hunting currently provides an incentive for rural communities and private landowners to support conservation, and this financial incentive could be lost were trophy hunting to end ([t Sas-Rolfes et al., 2022](#)). [Mokgalo \(2022\)](#) gives as an example the negative impact on Community Based Organisations (CBOs) of the 2014 ban on hunting tourism in Botswana. During 2012 two separate organisations had incomes of US\$225,000 and US\$224,560, respectively, and between them employed 152 local residents - but during 2014/15 the mean revenue across all CBOs had declined to US\$130,00, representing a 43% decline in revenue from the previous years, with concomitant financial and societal impacts on local communities ([Mokgalo, van der Merwe, 2022](#)).

Some hunting revenue may be able to be replaced by ecotourism ([Di Minin 2013](#)). Ecotourists, however, typically travel only to relatively accessible areas ([Balmford et al., 2015](#)). In Botswana, for example, only 22% of the Northern Conservation Zone has intermediate or high potential for photographic tourism ([Winterbach et al., 2015](#)). A minimum of 1394,000 km² of sub-Saharan Africa is used for trophy hunting, a greater area than currently encompassed by national parks ([Lindsey et al., 2007](#)). If financial incentives for conservation were to fall, a perceived risk is that local communities and private landowners may turn to alternative sources of income, such as poaching of wildlife ([Mokgalo, 2022](#)) or transformation of natural habitats to other forms of land use (e.g. agriculture) that provide higher return on investments but with considerably lower conservation value ([Di Minin et al., 2013](#)).

From the above arguments, if global policy is heading towards ending trophy hunting and the international community wishes to avoid any unintended negative consequences on the conservation status of many species and/or the risk of further impoverishing communities currently coexisting with biodiversity, then alternative forms of income to replace lost hunting revenue should be explored (e.g. [Parker et al., 2020](#)).

In this paper we investigate the potential for replacing revenue currently generated by trophy hunting in South Africa. Our approach recognises that tourism is frequently cited as a potential source of funds for conservation action (e.g. [Moorhouse et al., 2015](#); [Moorhouse et al., 2017](#); [Ballantyne et al., 2009](#); [Ballantyne et al., 2011](#); [Higginbottom, 2004](#)) and that repeated public polls of citizens of northern hemisphere nations have demonstrated majority support for the ending of trophy hunting (e.g. [Vinogradova, 2021](#); [Humane Society International, 2021](#); [World Animal protection, 2022](#)). A recent example of the latter, commissioned by the IUCN Sustainable Use and Livelihoods Specialist group (SULi) found that among 2164 UK adults, 64% supported a ban on trophy hunting if it decreased threats to wildlife conservation, and 58% supported a ban if it would positively impact marginalised rural communities - but conversely only 42% supported the ban if it would increase threats to wildlife conservation, and 39% if it would negatively impact marginalised communities ([Vinogradova, 2021](#)). These findings imply that, as an example, UK citizens’ motivation to ban trophy hunting is partially contingent upon good outcomes for both conservation and local communities. The aim of our investigation is to discern whether inbound tourists to South Africa would be sufficiently willing to pay levies of sufficient size to compensate for lost revenue, and thereby aid conservation goals, were trophy hunting to be banned in that country.

We selected South Africa because it is one of the best-known trophy hunting destinations, is currently reviewing its position and approach to conservation and sustainable use of wildlife ([Creecy, 2022](#)) and because the total value of trophy hunting to the South African economy has previously been estimated ([Saayman et al., 2018](#)), and so represents a known quantity. [Saayman et al. \(2018\)](#) determined that during 2016 trophy hunters spent US\$214.851 million on hunting expeditions to South Africa. This figure, however, included the costs of transport to South Africa (estimated as US\$5096.50 per hunter, revenue which accrues to the hunters’ country of origin), which must be excluded to determine the magnitude of exogenous spending accruing to the South African economy. This resulted in an estimated spending stimulus of US\$176.1 million ([Saayman et al., 2018](#)). [Saayman et al. \(2018\)](#) further subjected this figure to an income multiplier (the total changed income arising from a change in spending in the economy, e.g. through increased

demand for goods and services from people whose personal income has increased), resulting in a total figure of US\$341 million. Since the additional income should theoretically result from any source of exogenous income, however, we adopt the figure of US\$176.1 million as the target that would require compensating-for were trophy hunting in South Africa to cease. We use the above estimate in preference to a similar estimate provided by TREES (2017), cited by van der Merwe et al. (2021), of US\$153 million, because the above estimate is larger, and therefore provides a conservative test.

Here we employ two direct pricing methodologies to create an initial test of whether levies on inbound visitors to South Africa could represent a source of revenue sufficient to compensate for that lost were trophy hunting to be banned in South Africa.

2. Methods

2.1. Study approach and assessing willingness-to-pay

We employed market survey techniques to assess willingness-to-pay to end trophy hunting among international respondents who are likely to travel to South Africa for leisure purposes. To present respondents with a simple message, and leverage the appeal of a charismatic species, we framed our study questions around benefits that would accrue to lions from ending trophy hunting. We adopted this approach since lions are the animal most readily recognised as being trophy hunted, especially since the killing of Cecil (Yeomans et al., 2022).

Payments to permit the protection of lions by ending trophy hunting represent a novel product that in effect travellers to South Africa would be asked to purchase. At present the utility of this product is unknown, as is the price travellers would be willing to pay for it. We employed two well-established direct willingness-to-pay methodologies to derive initial prices for protecting lions by ending trophy hunting (see below for full text provided to survey participants): the van Westendorp Price Sensitivity Meter (Van Westendorp, 1976), and the Gabor-Granger pricing method (Gabor and Granger, 1977). van Westendorp's Price Sensitivity Meter permits estimation of price preferences for product innovations (Reinecke et al., 2009; Kim et al., 2012). It involves describing the novel product to respondents and asking them to state prices at which they would deem the product to be, respectively, "too expensive", "acceptably expensive", "acceptably cheap" (or "good value") and "too cheap" (Van Westendorp, 1976). The resulting data are traditionally analysed graphically by inspecting intersections of cumulative distribution functions, but given criticism of the method's lack of a theoretical foundation and its hypothetical nature (Weinrich, Gassler, 2021), we employ the Newton-Miller-Smith extension (Newton et al., 1993) to permit construction of demand curves that reveal purchase intention by price, and relative revenue index, as recommended by Shan (2021). This extension asks respondents to rate how likely they would be to purchase the product at the "acceptably expensive" and "good value" price points, on a likert-type scale (Lipovetsky et al., 2011).

The Gabor-Granger method presents respondents with a series of prices and for each asks respondents whether they would be willing to purchase the product. Each respondent is shown a randomised starting price: if unwilling to purchase they are shown the next lowest price, if willing they are shown the next highest higher price. The resultant data permit the construction of a demand curve for the product (Lipovetsky et al., 2011).

2.2. Survey design

We constructed a short survey with the a priori intention of collecting full responses from 1000 frequent travellers who had visited, or intended to visit, South Africa. We stratified the sample across the 10 principal countries from which tourist visitors to South Africa originate, dividing respondents between five countries from within the African continent (Botswana, Eswatini, Lesotho, Mozambique, Zimbabwe) and five from overseas countries (France, Germany, the Netherlands, the UK and the USA) (Statistics South Africa, 2019). Samples from the Netherlands proved prohibitively costly to collect, and so overseas samples were limited to France, Germany, UK and USA.

Potential respondents were asked two initial screening questions to exclude those who had not visited South Africa recently and who would not consider doing so in the near future. These questions asked, respectively, "Which of these countries have you visited for leisure purposes, and stayed over for at least 1 night, in the last 2–3 years?" "And which would you consider visiting in the next few years?", with options for each being "Australia", "Argentina", "Cambodia", "China", "South Africa", "Spain", "None of these".

Respondents who did not pick South Africa for either question were asked "You haven't said you have visited South Africa, or would consider visiting South Africa for leisure purposes. Why would you not visit South Africa? Please select as many of the reasons below as apply to you personally", with options of "I'd be concerned about my safety", "The history of apartheid puts me off", "The trophy hunting there puts me off", "It's too expensive to visit", "It's too far to travel", "I've never considered it as a leisure destination", "Some other reason (Please write in below)". Following this question these respondents took no further part in the survey.

Respondents who picked South Africa for one or both questions, were retained and asked initial questions regarding their age, sex, and occupation, and which activities they would anticipate pursuing if they visited South Africa. Following these initial questions respondents were presented with an introductory statement that read:

"In South Africa, trophy hunting (e.g. where guests pay to hunt and kill a lion) contributes US\$176 million to the economy every year. A total ban on trophy hunting in South Africa would protect lions by preventing them from being hunted and killed as trophies anywhere in the country. Such a ban could be funded by introducing a "lion protection fee", which would be added to visas of incoming tourists. The fee would be charged for each day each visitor stays, up to a maximum of 6 days. After this no further fee would be charged. The purpose of this survey is to gauge what daily fee prospective visitors to South Africa would feel to be acceptable."

Respondents were then asked five survey questions.

Q1 asked: “Firstly, how do you feel about the idea of a lion protection fee like this?” with response options of “It’s a great idea, I would actively support it”, “It’s a good idea”, “Not sure”, “It’s not a very good idea”, “It’s a really bad idea and I would actively oppose it”.

Q2 was open-ended, asking for respondents’ reasons for their selection in Q1: “Why do you say that? Please tell us as much as you can about your reasons, in the box below.”

Q3 comprised the four van Westendorp questions: Q3a: “Thinking about the daily fee, at what price in US dollars would this additional fee be expensive but it wouldn’t stop you visiting South Africa?” Q3b: “At what price would the daily fee be so high it would stop you visiting South Africa?” Q3c: “And at what price would the daily fee be good value, given that it will protect lions in South Africa?” Q3d: “And at what price would the daily fee be so cheap that you wouldn’t believe it would do anything to help protect lions in South Africa?”. For each, respondents were asked to enter an amount: “Please write in US dollars below”.

Q4 comprised the two questions of the Newton-Miller-Smith extension. Q4a: “If the daily lion protection fee was [respondent’s Q3a response], how likely would you be to visit South Africa?” and Q4b: “If the daily lion protection fee was [respondent’s Q3c response], how likely would you be to visit South Africa?”. For both, available response options were: “I would definitely visit South Africa”, “I would probably visit South Africa”, “I don’t know”, “I would probably not visit South Africa”, “I would definitely not visit South Africa”.

Q5 comprised questions for the Gabor-Granger pricing method: “If the daily lion protection fee was [price] how likely would you be to visit South Africa?”, where the initial price shown to respondents was randomly selected from \$3, \$6, \$9, \$12, \$15. Response options were: “Yes, I would still visit South Africa” and “No, I would not visit South Africa”. If a respondent stated they would visit, they were shown the next highest price point, and if they stated they would not, they were shown the next lowest (representing a double-bound dichotomous choice model).

Following the main survey, respondents were asked three further questions regarding their household composition, occupation, and ethnicity. The survey was designed in collaboration with, and conducted by, market-research professionals (Touchstone Partners Limited, <http://www.touchstonepartners.co.uk>) who coordinated respondent recruitment through proprietary market research panels. Panellists were familiar with surveys but not contacted so frequently as to have become unrepresentative of the wider population. Respondents from France, Germany, the UK and the USA received the survey online, conducted in their respective native languages with prices in US dollars. Respondents from African countries received the survey through face-to-face interviews, conducted by professional local surveyors, with prices estimated in local currency and converted to US dollars for analysis.

2.3. Statistical analysis

Analysis of respondents’ level of support for the idea of charging lion fees was conducted using ordinal logistic regression (implemented in Program R; [Christensen, 2022](#); [Christensen, 2015](#)) with a response variable derived from respondents’ answers to create a five-point Likert-type scale.

van Westendorp price estimates and estimates from the Newton-Miller-Smith extension estimates were derived from a combination of two separate analytical approaches. Accepted price range, optimal price point, price with optimal trial rate and price with optimal revenue were estimated using the *pricesensitivitymeter* package implemented in Program R ([Alletsee, 2022](#)). Purchase intentions at the optimal trial rate and optimal revenue prices were estimated using the Van Westendorp Simulator Analysis, published by Sawtooth Media ([Anderson, 2022](#); [Sawtooth Media, 2023](#)).

3. Results

3.1. Overview, and reasons given for wishing to visit or avoid South Africa

We received full responses from 907 respondents, comprising 504 from southern African countries (Eswatini 100, Botswana 100, Lesotho 106, Mozambique 99 and Zimbabwe 99) and 403 from overseas countries (France 100, Germany 102, UK 101 and USA 101). Reasons given for visiting South Africa among overseas respondents primarily centred on wildlife and beach holidays: 79% safari, 71% visiting the coast, 42% whale watching, with more minor attractions being 26% apiece for the garden and wine routes. Reasons for visiting South Africa among African respondents were: 52% visiting friends and relatives, 47% visiting the coast, 41% safari tourism, with more minor attractions of watching or participating in sports (15%), whale watching (14%) and the wine route (12%).

Excluded respondents (those who stated that they had not recently visited South Africa and who did not intend to do so in the near future) were primarily from the four overseas countries (2315 responses), with only 91 respondents from the five southern African nations being excluded. Due to small sample sizes we do not present conclusions from these latter respondents. The principal reasons overseas tourists gave for not visiting South Africa were fears for personal safety (mean 33.2% of respondents, range 29.3–36.5% across individual countries), that South Africa was too far (mean 33.6% of respondents, range 27.2%–37.5%), that the trip would be too expensive (mean 31.3%, range 23.3%–35.0%), and that they had never considered South Africa as a holiday destination (mean 30.9%, range 26.5–34.6%). The two considerations founded on ethical stances were more minor considerations for respondents: a mean of 11.8% (range 7.8–18.9%) were put off by the history of apartheid, and a mean of 12.8% of respondents (range 11.5–15.0%) stated that they were put off by trophy hunting in South Africa.

3.2. Level of support for lion protection fees

Of the 907 respondents asked “how do you feel about the idea of a lion protection fee like this” 764 (84.2%) stated that it was either “A great idea, I would actively support it” (481 respondents, 53.0%) or “A good idea” (283 respondents, 31.2%). A further 75 respondents (8.2%) stated that they were “Not sure”. A minority, 68 respondents (7.5%), stated either that “It’s not a very good idea” (46 respondents, 5.1%) or “It’s a really bad idea and I would actively oppose it” (22 respondents, 2.4%).

Levels of support for a “lion protection fee” varied with respondents’ country of residence. Of the 68 respondents with a negative view, 53 were from one of the five southern African nations (17 Eswatini, 16 Zimbabwe, 10 Botswana, 8 Lesotho, 4 Mozambique) while 13 were from one of France (4), Germany (3), the USA (3) and the UK (3). The highest levels of support were found among respondents from the USA, with 94.0% of respondents being in favour of the fee (71.0% “a great idea”, 13% “very good” idea). Levels of support were similarly high in France (92% in favour), Germany (92%) and the UK (91%) (Fig. 1) (Wald test for effect of country, with USA as the reference level, $Z < 1.224$, $P > 0.113$ for each of these countries). Levels of support were lower across African nations: 88.9% in Mozambique, 76.0% in Botswana, 75.7% in Zimbabwe, 74.5% in Lesotho and 71.0% in Eswatini (Wald test for effect of country, against USA as the reference level, $Z > 3.606$, $P < 0.000311$ for each of these countries; Fig. 1). Overall 10.9% of respondents from within Africa and 3.2% of overseas respondents had a negative view of the proposition.

The most frequently stated reasons for the negative view of imposing fees on visitors were that such a fee would be unfair (25 responses, example statements: “If I visit specifically for any other business why would I be paying for the protection of lions. The government must protect its wildlife without putting the burden on visitors”; “It’s not fair for tourists to pay for them. Instead they should just charge lots of money to anyone seen killing a lion”; “It’s not my duty to protect other people’s animals”). The next most frequent reason was that the fee would put visitors off travelling to South Africa (17 responses, example statements, “we’re living in a critical economy status therefore the thought of having to pay extra money for such would hinder the thought of visiting the country. The hunting should be totally banned without having to pay any fee for it”; “If anything, it will decrease the number of genuine tourists while the bad guys still enter and leave the country”; “If the fees were too high, the tourists will not visit in large numbers. And if the fees are too low the revenue will not be enough also. In addition, I understand the lions being hunted are carefully selected, more especially the old ones.”).

A minority of respondents cited financial reasons for disliking the fee proposition (nine respondents, e.g. “Will strain my finances unnecessarily”; “Unnecessary financial pressure on us”), and reasons predicated on a belief that the fee would be ineffective (five respondents, e.g. “The lions would still be hunted even if it [sic] not for trophy hunting”). Four further respondents appeared to have misunderstood the proposition, all providing responses that were supportive of protecting lions (e.g. “Because [sic] you will be supporting the endangerment of the animal and also it will lead to its extinction. We need to protect”; “I hate and detest the killing and shooting of animals and wildlife for sport. Especially since most of them are becoming extinct.”). The reasons given by another four respondents were uncategoryisable (e.g. “Not paying for that”; “Is not good”). Only two respondents (0.2% of the sample) gave reasons that indicated support for lion hunting (e.g. “It is good for the economy and it helps keep the lions minimal”; “Lions hunt other animals but are not hunted. Keep the circle of life moving”). Of all respondents with a negative view of the proposition, therefore, only 4.1% (0.2% of the total sample) held this view due to being actively pro-trophy hunting.

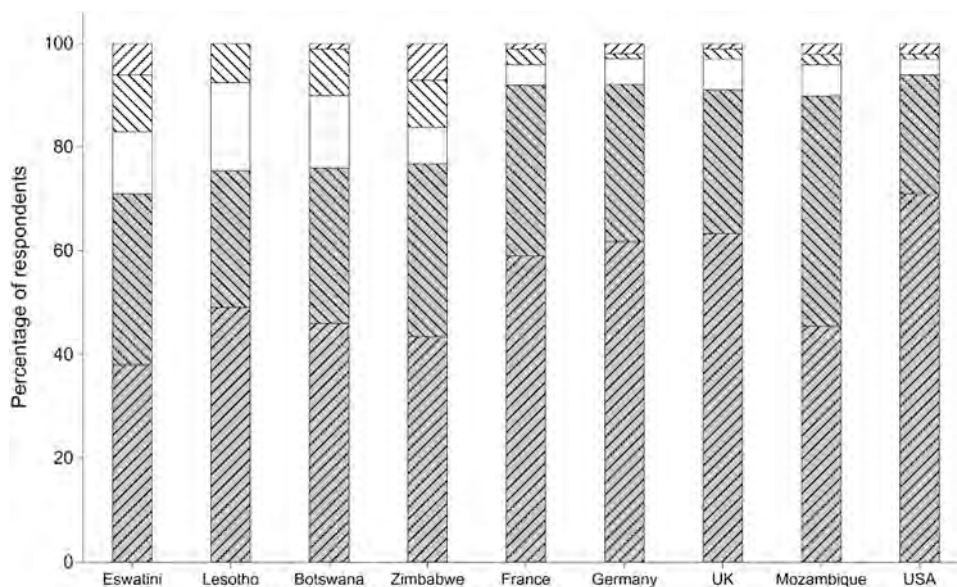


Fig. 1. Respondents’ attitudes towards the proposition of a “lion protection fee”. Bar sections, bottom to top, represent: “a great idea” (shaded, hashed), “a good idea” (shaded, hashed), “not sure” (unshaded, unhashed), “not a very good idea” (unshaded, hashed), “a bad idea” (unshaded, hashed). Countries are arranged by increasing agreement with the proposition, for clarity.

3.3. Van Westendorp price and total revenue estimates

Mean prices provided by respondents for “lion protection fees”, within the four van Westendorp categories, varied between countries (MANOVA, effect of country on “too expensive” “acceptably expensive” “good value” and “too cheap”, in all cases $F > 30.0847$, d.f. = 8, $P < 0.00001$; Table 1). Mean estimates for the daily price that respondents would deem “too expensive” ranged from \$14.64 (Eswatini) to \$69.07 (USA) (Fig. 2). Mean estimates for the price deemed “acceptably expensive” ranged from \$6.51 (Eswatini) to \$47.30 (USA). Similarly mean estimates for prices deemed “good value” and “too cheap” ranged from \$3.60 and \$1.30 (Eswatini) to \$32.65 and \$15.48 (USA) (Fig. 2). For comparison, the monthly minimum wage for a skilled worker in Eswatini is \$31.2 (Foreign Connect, 2023), while in the USA the federal minimum wage is \$7.25 an hour (Statista, 2023a), equating to \$1000.50 per month for those working the national average number of hours (Statista, 2023b).

Focusing on the “acceptably expensive” and “good value” prices - upon which the Newton-Miller-Smith extension is based, and which are likely to approximate the limits of the acceptable price range (Lipovetsky, 2011) - the highest prices were provided by respondents from the USA (“acceptably expensive” \$46.35; “good value” \$32.00) and Mozambique (“acceptably expensive” \$45.27; “good value” \$36.22). Moderate estimates were provided by respondents from the UK, France, Germany and Zimbabwe (“acceptably expensive” range \$27.92-\$30.44; “good value” range \$15.82-\$19.02). The lowest estimates were provided by respondents from Lesotho, Botswana and Eswatini (“acceptably expensive” range \$5.60-\$18.40; “good value” range \$3.09-\$11.50) (Fig. 2).

Optimal price points for each country were provided via the Newton-Miller-Smith extension implemented in the pricesensitivitymeter package, in program R. Estimates for the price with optimal trial rate (i.e. that optimises the percentage of the population likely to purchase the product) ranged from \$2.04 (Eswatini) to \$55.47 (Mozambique) (Table 2). Estimates for the price that optimises overall revenue from a population ranged from \$29.16 (Eswatini) to \$70 (UK) (Table 2). Purchase intentions were derived via van Westendorp Simulator Analysis (Sawtooth Media, 2023; Anderson, 2022). At the optimal trial rate price, purchase intention for each country ranged from 36.88% (Zimbabwe) to 52.9% (Botswana); at the optimal revenue price purchase intentions ranged from 4.99% (Eswatini) to 39.21% (Mozambique) (Table 2).

Asked to assess whether they would visit South Africa at the “acceptably expensive” price point they had provided, a mean of 89.0% of respondents (range across countries 81.8–95.7%), indicated that they would either “definitely” or “probably” visit. At the “good value” price point this figure was 93.5% of respondents (range across countries 91.0–95.8%). Revenue indexes (maximal revenue per person, calculated as optimal revenue price point * percentage purchase intention) ranged from \$1.46 (Eswatini) to \$21.75 (Mozambique) (Table 2). Across the entire sample, ignoring differences between countries, the optimal revenue price was \$48, with a purchase intention of 21.3%, yielding a mean maximal revenue per person of \$10.23.

3.4. Van Westendorp and Gabor Granger estimates of effect of fee price on willingness to travel

We used two separate measures of willingness-to-travel to South Africa in response to different daily fees. Figs. 3a and 3b respectively present the van Westendorp and Gabor-Granger estimates of the mean proportion of the surveyed population from each

Table 1

Effect of respondents' country of origin on the four van Westendorp price categories, showing: a) MANOVA results, and; b-e) univariate ANOVAs for the categories “too expensive”, “acceptably expensive”, “good value” and “too cheap”.

a)		Source	Num / den df	F-vale	P
MANOVA		Age	4, 881	5.7940	< 0.001
		Sex	4, 881	16.8294	< 0.001
		Country	32, 3536	16.4368	< 0.001
		Education	4, 881	1.9013	0.1082
b)		Source	df	F-vale	P
Too Expensive		Age	1	0.2904	> 0.5901
		Sex	1	11.2195	< 0.001
		Country	8	30.0847	< 0.001
		Education	1	4.881	0.0274
c)					
Expensive but acceptable		Age	1	0.0023	0.9620
		Sex	1	18.635	< 0.001
		Country	8	32.259	< 0.001
		Education	1	2.0201	0.156
d)					
Good value		Age	1	1.0497	0.3059
		Sex	1	32.9684	< 0.001
		Country	8	35.6081	< 0.001
		Education	1	1.0252	0.3116
e)					
Too cheap		Age	1	12.6714	< 0.001
		Sex	1	65.1865	< 0.001
		Country	8	46.668	< 0.001
		Education	1	2.1065	0.147

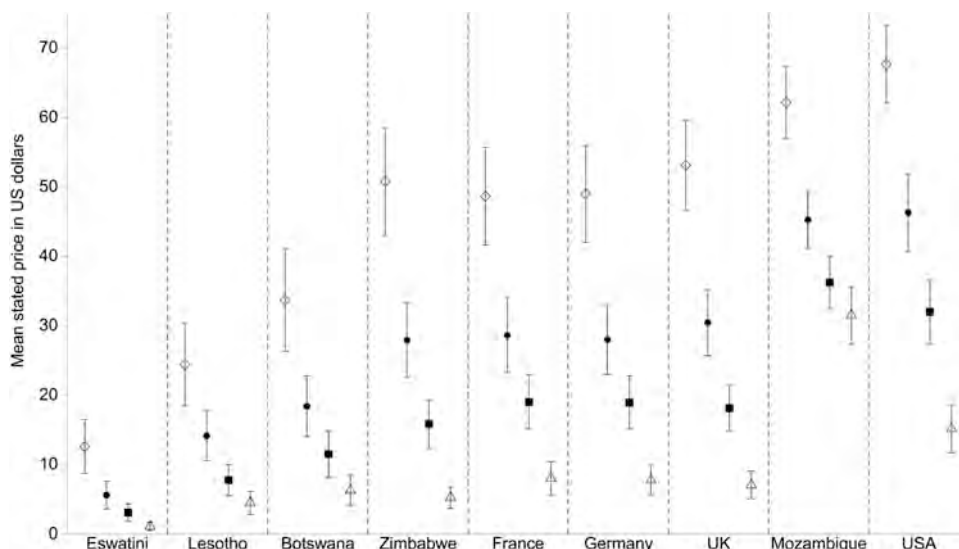


Fig. 2. Mean van Westendorp stated price values for daily lion protection fees: “too expensive” (open rhomboids), “acceptably expensive” (shaded circles), “good value” (shaded squares) and “too cheap” (open triangles) estimates, by country. Error bars represent standard errors.

Table 2

van Westendorp and Newton-Miller-Smith estimates from each country. All prices are in \$US to the nearest whole dollar. Columns suffixed with 1 represent Newton-Miller-Smith estimates derived from pricesensitivitymeter package in R. Those suffixed with 2 represent Newton-Miller-Smith estimates derived from van Westendorp Simulator Analysis, Sawtooth Media (Anderson, 2022; Sawtooth Media, 2023).

Country	van Westendorp		Newton-Miller-Smith				
	Accepted price range	Optimal price point	Price with optimal trial rate ¹	Price with optimal revenue ¹	Purchase intention at optimal trial rate price ²	Purchase intention at optimal revenue price ²	Maximum revenue per person (revenue index)
France	5–25	10	7	65	48.7%	16.3%	10.59
Germany	5–25	10	14	49	42.9%	21.3%	10.43
USA	20–50	35	30	68	48.6%	24.7%	16.80
UK	5–30	12	16	70	44.3%	13.2%	9.22
Botswana	3–16	8	40	38	52.9%	15.8%	6.09
Eswatini	1–4	3	2	29	40.1%	5.0%	1.46
Lesotho	1–9	5	2	43	44.0%	11.0%	4.76
Mozambique	42–59	51	55	55	39.2%	39.2%	21.75
Zimbabwe	5–41	10	17	45	36.9%	23.2%	10.43

country who propose to visit South Africa if charged a daily fee ranging from \$3 to \$15.

Fig. 3a presents van Westendorp estimates of purchase intention (proportion of survey population travelling to South Africa) at price points of \$0, \$3, \$6, \$9, \$12 or \$15 for daily fees. At the \$0 baseline (no fee), estimates of the percentage of the population intending to travel ranged from 94.2% (Botswana) to 86.2% (Zimbabwe). At a price of \$3, travel intention for respondents from all countries was within 2.3% of baseline except for those from Eswatini (27.4% lower), Lesotho (17.2% lower) and Botswana (5.8% lower) (Fig. 3a). Similarly, at a fee \$6, travel intention for respondents from all countries remained within 5.8% of baseline except for those from Eswatini (59.9% lower), Lesotho (38.7% lower) and Botswana (15.5% lower) (Fig. 3a). At a fee price of \$9, travel intention for respondents from all countries remained within 8.8% of baseline, except for those from Eswatini (59.9% lower), Lesotho (38.7% lower) and Botswana (15.5% lower). At a fee of \$12, travel intentions were substantially lower than baseline (range 15.4–74.8% reductions) for all countries except the USA (1.7% lower), Mozambique (7.2% lower), and the UK (10.8% lower) (Fig. 3a).

Fig. 3b presents the Gabor-Granger estimates of intention to visit South Africa with fees of \$3, \$6, \$9, \$12 and \$15. At \$3 per day (the baseline for these estimates), the percentage of respondents proposing to visit was greater than 90% for all countries except Botswana (88.0%) and Eswatini (84.0%) - with Mozambique (99.0%) and the UK (98.0%) having the largest proportions intending to visit (Fig. 3b). At a fee of \$6, intention to visit remained high among respondents from USA, Mozambique, UK and Germany (declines of 0.0%, 2.2%, 4.0% and 4.9%, respectively), intention declined moderately for respondents from France, Zimbabwe and Botswana (9.0%, 9.1% and 10.0% declines, respectively) and intention declined substantially for respondents from Lesotho and Eswatini (declines of 19.8% and 33.0%) (Fig. 3b). With a \$9 fee, only respondents from Mozambique and the USA maintained a willingness to visit of greater than 90% (96.0% and 93.0%, representing declines of 3.0% and 4.0% from baseline, respectively), with respondents from Germany and the UK demonstrating moderate declines in intention to visit (9.8% and 9.9% respectively), and substantial declines in

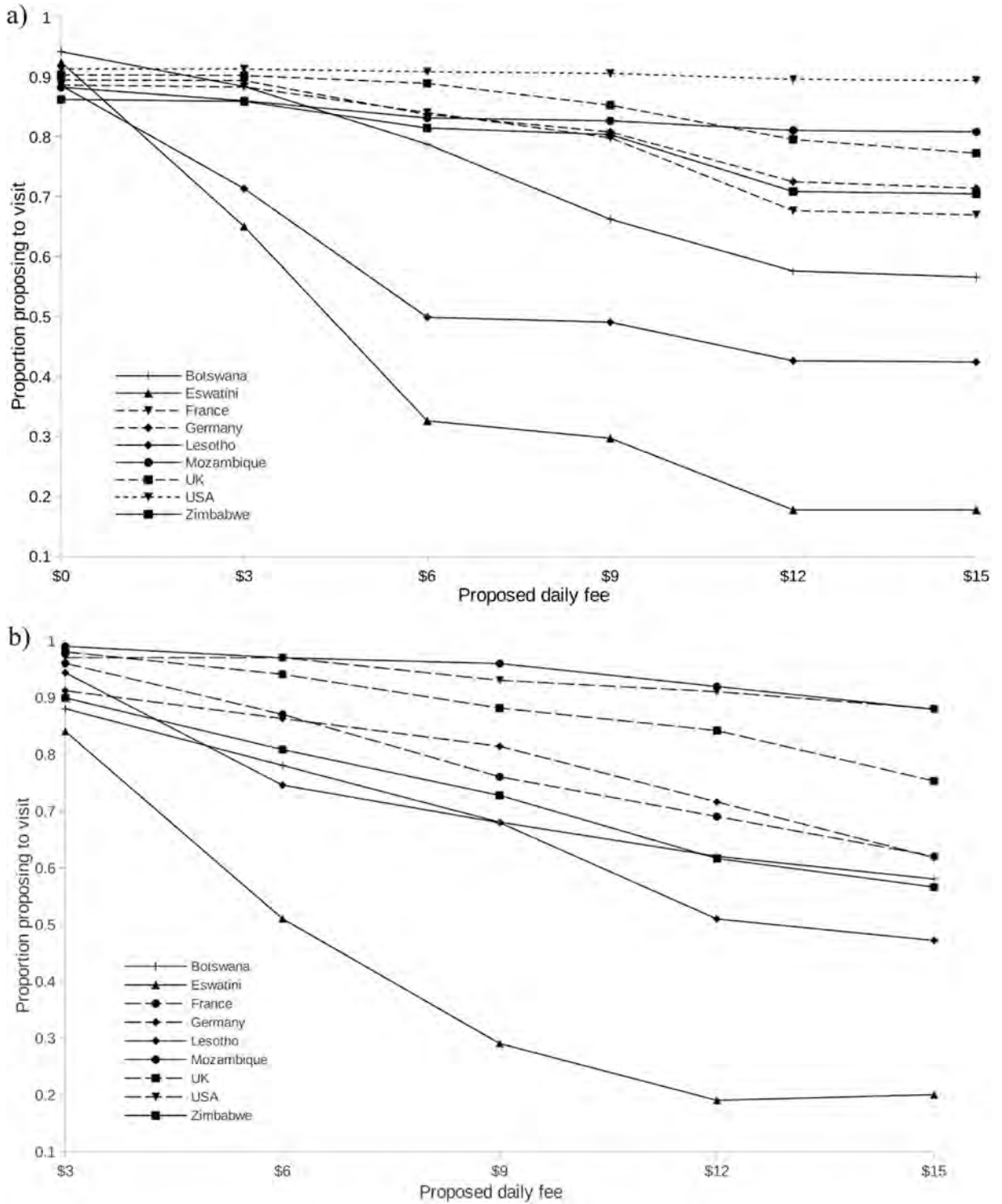


Fig. 3. Levels of acceptance of different values of daily lion protection fees, by country. Acceptance is estimated: a) using van Westendorp methodology, and; b) using Gabor-Granger methodology. Both demonstrate the proportion of respondents intending to visit South Africa at each fee level.

intention to visit evident among respondents from Zimbabwe (17.1% lower), Botswana (20.0%), France (20.0%), Lesotho (26.4%) and Eswatini (55.0%) (Fig. 3b). With a \$12 fee travel intentions were substantially lower than baseline for all countries (range 13.9%–65.0%), with the exception of respondents from the USA (6.0% lower than baseline) and Mozambique (7.1%).

3.5. Trends in tourist numbers and modes of travel

Recreational visitors to South Africa are categorised by Statistics South Africa as same day visitors (those who arrive and leave in the same day) and tourists (those who stay for at least one night) (e.g. [Statistics South Africa, 2019–2021](#)).

In the four years prior to 2020 (2016–2019, inclusive), numbers of tourists were approximately constant, ranging from 10.04 million to 10.23 million (Table 3). In 2020 and 2021, due to the impact of COVID-19, these figures were 2.8 and 2.26 million, respectively, rising to 5.7 million in 2022 (Table 3). The percentage of tourists arriving from overseas (ignoring the years 2020–21, which are likely to be unrepresentative due to Covid restrictions) also remained approximately consistent, ranging from 25.2% to 26.4%, such that in the years 2016–2019 between 2.5 and 2.7 million of all tourists arrived from overseas (Table 3) by air (90.1%), road (9.3%) or sea (0.6%) ([Statistics South Africa, 2016–2019](#)). The remaining tourists arrived from Southern African Development Community (SADC) countries (Table 3) by road (93.3%), air (6.6%) or sea (<0.1%) or from “other” African nations, by air (91.1%), road (8.8%) or sea (<0.1%). Overseas tourists stayed in South Africa for a median duration of six days whereas SADC tourists stayed for a median duration of two days ([Statistics South Africa, 2019](#)).

Trends in numbers of same-day visitors parallel those of overnight tourists (Table 3). From 2016–2019 numbers ranged from 4.53 to 5.08 million, dropping to 1.08 and 0.41 million in 2020 and 2021, respectively, before rising to 1.42 million in 2022 (Table 3). Virtually all day visitors (99.1%) visit on holiday, and the vast majority (94.7%) travelled by road, with the remainder arriving by air (5.2%) ([Statistics South Africa, 2017–2019](#)).

During 2022, numbers of tourists to South Africa increased every quarter from 1.05, 1.25, 1.60, 1.81 million (Supplementary Table 1). No such differences in tourist numbers per quarter were evident in the four years prior to 2020 (Supplementary Table 1). That the increasing numbers during 2022 plausibly reflect growing confidence among travellers post Covid during 2021. These observations underpin our below modelling of daily fee scenarios. We model two scenarios: one in which future visitor numbers will return to their pre-COVID (2019) levels, and one in which future visitor numbers fail to increase further than those observed in the last quarter of 2022.

3.6. Daily fee scenarios

In Table 4 a-d we present eight potential fee structures, all of which generate \$176.1 million (matching the annual income from trophy hunting) through charging fees from travellers to South Africa. We modelled two future scenarios for traveller numbers. These are intended to be illustrative, not exhaustive. In Scenario 1 (Table 4a,c) numbers of international travellers to South Africa return to their 2019 peak ([Statistics South Africa, 2019](#)). Scenario 2 (Table 4b,d) assumes that international traveller numbers will not increase any further than witnessed in the last quarter of 2022, and traveller numbers are accordingly calculated by extrapolating the relevant figures for October–December 2022 up to a full year (pre-pandemic years showed no variation in visitor number between quarters). Under each scenario two broad approaches were taken to modelling potential fees: Table 4 a,b present daily fees applied only to visitors travelling for leisure purposes, while Tables c,d present flat-rate fees, charged as departure taxes on all foreign travellers.

Under Scenario 1, Table 4a demonstrates that the target of 176.1 million could be reached by charging tourists to South Africa modest daily fees: \$3 per day for tourists originating from within the African continent and \$7.40 per day for overseas tourists. An increase to \$4 per day for within-Africa tourists would result in the fee for overseas tourists being reduced to \$6.14. Table 4c demonstrates that charging departure taxes for all international travellers could exceed the target amount if land and sea travellers paid a flat-rate tax of \$6 and air passengers paid a flat-rate tax of \$33 (equating to a fee of US\$5.50 per day, assuming a six day visit). Alternatively if departure tax were only applied to air passengers, the required level would be \$51 (equating to a fee of US\$8.50 per day).

Under Scenario 2 Table 4b demonstrates that the target of \$176.1 million could be reached by charging \$4 per day to within-Africa tourists and \$10.18 per day to overseas tourists. Increasing the charge for within-Africa tourists to \$6 per day would reduce the daily charge required of overseas tourists to approximately \$8. Table 4d demonstrates that departure taxes could exceed the target amount if land and sea travellers paid a flat-rate tax of \$7 while air passengers paid a flat-rate tax of \$49 (equating to approximately US\$8 per

Table 3

Trends in numbers of tourists (overnight visitors) and same-day visitors to South Africa between 2016 and 2021, inclusive. Statistics are drawn from [Statistics South Africa \(2016–2021\)](#).

Year	Number of tourist visitors	Of which arrived from overseas	Number of same day visitors	Source
2016	10,044,163	2531,046 (25.2%)	5077,165	Statistics South Africa (2021)
2017	10,285,197	2715,292 (26.4%)	4690,478	Statistics South Africa (2017)
2018	10,472,105	2672,146 (25.5%)	4532,279	Statistics South Africa (2018)
2019	10,228,593	2612,519 (25.5%)	4568,879	Statistics South Africa (2019)
2020	2802,320	661,030 (23.6%)	1084,263	Statistics South Africa (2020)
2021	2255,699	377,804 (16.7%)	408,162	Statistics South Africa (2021)
2022	5698,062	1450,671 (25.5%)	1643,734	Statistics South Africa -I) (2022a)

Table 4

Illustrative, non-exhaustive fee structures that would permit the target revenue of US\$176.1 to be raised from travellers to South Africa if: a) visitor numbers return to 2019 levels and only leisure visitors are charged; b) visitor numbers remain at the level of the last quarter (Q4) 2022, and only leisure visitors are charged; c) visitor numbers return to 2019 levels, and all travellers are charged a departure tax, and; d) visitor numbers remain at Q4 2022 levels, and all travellers are charged a departure tax.

A								
	Number	Days in country	Variant A Daily charge (USD)	Total charge per person (USD)	Revenue (USD)	Variant B Daily charge (USD)	Total charge per person (USD)	Revenue (USD)
Same day visitors	4536,180	1	3	3	13,608,540	4	4	18,144,720
SADC tourists	7616,074	2	3	6	45,696,444	4	8	60,928,592
'Other African' tourists	159,950	5	3	15	799,750	4	20	799,750
Overseas tourists	2612,519	6	7.40	44	115,995,266	6.14	37	96,226,938
B								
	Number	Modal days in country	Variant A Daily charge (USD)	Total charge per person (USD)	Revenue (USD)	Variant B Daily charge (USD)	Total charge per person (USD)	Revenue (USD)
Same day visitors	2310,501	1	4	4	9242,004	6	6	13,922,160
SADC tourists	5161,872	2	4	8	41,294,976	6	12	62,775,888
'Other African' tourists	122,492	5	4	20	2449,840	6	30	3674,760
Overseas tourists	1884,108	6	10.18	61.08	126,433,888	7.95	47.7	95,727,192
C								
	Number	Air and Road Taxes Tax per person (USD)		Revenue (USD)	Air Taxes Only Tax per person (USD)		Revenue (USD)	
Air Departures	3458,421	33		114,127,893	51		176,379,471	
Road Departures	10,514,533	6		63,087,198	-		-	
Sea Departures	70,635	6		423,810	-		-	
		Total		177,638,901	176,379,471			
D								
	Number	Air, Road and Sea Taxes Tax per person (USD)		Revenue (USD)	Air Taxes Only Tax per person (USD)		Revenue (USD)	
Air Departures	2660,100	49		130,344,900	67		178,226,700	
Road Departures	6476,952	7		45,338,664	-		-	
Sea Departures	55,776	7		390,432	-		-	
		Total		176,073,996	178,226,700			

day). If departure tax were only applied to air passengers, the required level would be \$67 (equating to US\$11.17 per day; [Table 4d](#)).

4. Discussion

Our aim was to establish the potential for revenue from tourists and/or foreign travellers to South Africa to match that lost were trophy hunting to end in that country, which required assessing travellers' willingness-to-pay to protect wildlife. Our approach was to frame the issue around benefits to lions, as a well-recognised flagship species, and to employ two well-known and commonly-used pricing models, van Westendorp and Gabor-Granger models, to create initial estimates of price-ranges and likely revenue, given that the appeal of the proposition /product was unknown a priori.

Taken in isolation, the van Westendorp price estimates for daily fees indicate considerable potential for fees from travellers to South Africa to meet the target of \$176.1 million. The optimal price point (the price at which sales and market share are maximized; [Van Westendorp, 1976](#)) estimates for overseas countries, for example, range from \$10 to \$35 per day ([Table 2](#)). Taking the lower bound of this range, given a modal stay of six days for 2612,519 overseas tourists (assuming a return to 2019 tourism figures; [Statistics South Africa, 2019](#)), this price point would yield \$156.75 million, requiring only \$20 million to be sourced from 7.6 million SADC tourists. This latter figure would represent fees of \$1–1.5 each from these tourists per day (assuming a modal stay of two days), which is likely to be acceptable for the vast majority ([Figs. 3a, 3b](#)). Similarly, estimates of the mean maximum revenue per person per day, taken only from respondents from overseas countries (USA, UK, France and Germany), was \$11.76 ([Table 2](#), averaged across all these countries). Given a modal stay of six days, for 2612,519 tourists, this would equate to approximately \$184.3 million in revenue from overseas visitors alone. An approach that only seeks to optimise revenue per tourist from fees could therefore meet the target of \$176.1 million only from overseas tourists, by charging each individual a day rate of, respectively \$65, \$49, \$68 and \$70 for France, Germany, the

USA and UK (Table 2).

At the optimum price point, however, the mean intention of overseas visitors to travel to South Africa ranged from 44.3% to 48.7%, indicating that half would be deterred from travelling at these fee levels. And at the optimal revenue price overseas respondents' mean intention to visit South Africa ranged from 13.2% to 24.7%, indicating that a maximum of only one quarter of the typical number of visitors would be willing to travel to the country. The loss of these proportions of tourists clearly makes fees set at either the optimal price-point or optimal revenue price-points unworkable in practice, given the substantial contribution that exogenous revenue makes to South Africa's economy (e.g. Saayman, 2018).

In practice, therefore, any fees would require widespread acceptance among travellers, and to be set at a level that does not negatively influence the number of visitors to South Africa. Acceptance for charging fees to tourists for "lion protection" was high across the entire sample (an overall mean of 84.2% of respondents stated that such a fee would be a "great" or a "good" idea). Acceptance was, however, higher for overseas respondents (with levels of high acceptance ranging from 91% to 94% across the four overseas countries) than for respondents from African nations (range 71%–76%) with the exception of Mozambique (88.9%) (Fig. 1). These national differences are reflected in the willingness-to-travel estimates, which show that for any price greater than \$3 the highest proportions of respondents stating they would travel to South Africa were from the four overseas nations and Mozambique, and the lowest proportions were among respondents from Botswana, Eswatini, Lesotho and Zimbabwe (Fig. 3b). The lowest rates of acceptance for fees, and lowest proportions of respondents willing to travel at a given fee, were from respondents in Eswatini and Lesotho (Fig. 3b). This is expected given that both of these countries are entirely geographically enclosed by South Africa, making travel to and from South Africa far more of a necessity than for other countries.

We employed two techniques to estimate how willingness to travel to South Africa varied with fee price. The Newton-Miller-Smith (NMS) extension to the van Westendorp method permits interpolation of purchase intentions at different price points, from respondents' estimated willingness to purchase at the "acceptably expensive" and "good value" prices, whereas the Gabor-Granger pricing method provides a dichotomous choice ("yes" or "no" to visiting South Africa) at each price point, permitting a direct estimate of the proportion willing to travel. The two techniques yielded similar, but not identical, estimates for willingness to travel under each price-point.

Relative to the Gabor-Granger estimates the NMS-derived purchase intentions represent substantial underestimates at lower, but not higher prices. As an example, at a price of \$3, NMS estimates of expected proportion travelling were 65.0% and 71.3% for Eswatini and Lesotho, respectively, while the remaining countries ranged from 85.9% to 91.3%. At this price the respective Gabor-Granger estimates were 84.0%, 94.3% and 88.0–99.0%. By contrast at \$9, NMS estimates yielded percentages of 29.6%, 49.0% and 66.2% for Eswatini, Lesotho and Botswana, respectively, with the remaining countries ranging from 79.8% to 90.6%. The respective Gabor-Granger estimates were similar (29.0%, 67.9%, 68.0%, and 72.7–96.0%; Fig. 3a,b), while at this price the NMS estimates were higher for Zimbabwe (80.4% versus 72.7%) and France 79.87% vs 76.0%). Such discrepancies at the lower prices complicate the use of these estimates for price setting. Both indicate that travellers from Lesotho and Eswatini are the most sensitive to prices, echoing the low acceptance of fees revealed in the above analysis. For these countries the NMS estimates suggest that fees at any level would risk disincentivizing unacceptable proportions of potential travellers. When directly asked if they would travel at a fee of \$3, however, 84.0% and 94.3%, respectively, of these respondents indicated that they would. We therefore suggest that \$3 might prove to be an acceptable upper limit of fees for these travellers. Raising fees to \$6, however, would risk deterring substantial proportions of travellers from southern African nations (Fig. 3b), e.g. for travellers from Zimbabwe, Botswana, Lesotho and Eswatini, increasing fees from \$3 to \$6 would lead to an additional 9.1%, 10.0%, 19.8% and 33.0%, respectively, being deterred from travelling. A similar trend is revealed by the NMS estimates, in which at \$6 these four countries have the lowest acceptance rates of those surveyed (Fig. 3a). By comparison, for overseas travellers, and travellers from Mozambique, raising the fee to \$6 resulted in negligible decreases in likelihood of travelling in both the NMS and Gabor-Granger estimates: only respondents from France demonstrated a significant decrease in intention to travel, from 96.0% of respondents intending to travel down to 87.0%, and only in the Gabor-Granger estimate (Fig. 3a,b). Among overseas respondents the size of the effect of raising the fee to \$9 differed between the NMS and Gabor-Granger estimates. Using the NMS estimates, percentages of overseas respondents, and those from Mozambique, willing to travel at \$9 were a maximum of 4.2% lower than at \$6 and a maximum of 8.8% lower than at \$0 – indicating high tolerance for fees set at this level. Using Gabor-Granger estimates, however, the percentage of French respondents willing to travel at \$9 was 20.0% lower than at \$3, with means of 76.0%, 81.4%, 88.1% and 93.0% of French, German, UK and USA respondents stating they would intend to travel.

Taken overall our data suggest that a maximum daily fee for southern African travellers would be \$3 (with the exception of travellers from Mozambique) while the upper limit for a fee on overseas tourists is likely to lie between \$6 and \$9, above which substantial impacts on visitor numbers would occur. An argument in favour of setting the fee towards \$9 for overseas travellers is that 2315 overseas respondents were excluded from the survey at the screening stage due to not recently having visited South Africa, or wishing to visit, of whom 12.8% cited the presence of trophy hunting as a reason. For approximately a quarter of these respondents it constituted the sole reason. Such respondents are currently unwilling to visit South Africa but could be incentivised to do so were trophy hunting banned. It is therefore plausible that the loss of overseas visitors deterred by the imposition of fees at \$9 (range 4.0%–20.0% across different countries; Fig. 3b) could be at least partially compensated-for by travellers who previously would not have considered visiting. This possibility is reinforced by the existence of 56 (6.2% of the sample) respondents in our survey who indicated *higher* probabilities of visiting South Africa at the "acceptably expensive" price-point than at the "good value" price point (i.e. who indicated that they wished to pay higher, not lower, daily fees to visit if doing so protected lions). All of these respondents indicated high agreement with the fee proposal, and while they represent a small proportion of respondents, serve to underline that many visitors base travel-related behaviours on ethical, not just financial, considerations (e.g. Chen, Tung, 2014; Moorhouse, 2015, Moorhouse, 2017).

Our findings indicate the clear potential for modest visitor fees from international tourists to match any revenue lost to South Africa from the ending of trophy hunting. A major consideration, however, is that required income per traveller, and therefore fee structures, are highly sensitive to changes in visitor numbers. [Table 4a](#) shows that if visitor numbers return to pre-pandemic levels then fees can be set at a price that is likely to be acceptable to both overseas (\$6–7 USD) and southern African visitors (\$3–4 USD) and charged only to leisure visitors. By comparison, [Table 4b](#) demonstrates that if visitor numbers fail to increase from the last quarter of 2022, then the level of fee necessary to match the \$178.1 million USD may exceed the acceptability threshold of some visitors ([Fig. 3a,b](#)), requiring \$10 for overseas visitors ([Fig. 3b](#)).

Due consideration will be required to establish how administration of our recommended fees could be adopted in practice. A number of mechanisms exist that could be employed. As an example, 22 countries currently charge a tax on tourists, which is either added as a direct fee (e.g. Italy charges \$3.26–7.21 USD per person per day, Belgium \$8.15 USD and Bhutan charges \$247 per day, but which also covers accommodation and expenses) or as an additional percentage to hotel bills (e.g. Germany and the USA charge 5% and up to 17% of the total hotel bill, respectively), or levied as a tax on departure ([Wego Travel, 2023](#)). Such departure taxes may represent a practicable solution. They are currently charged by at least 38 countries globally, including the UK, Canada, China, Mexico, Cambodia ([Wikipedia, 2023](#)) and while in some countries they are synonymous with tourist taxes ([Wego Travel, 2023](#)) in others they are charged on all foreign visitors, irrespective of the reason for travel. Departure taxes are typically charged to air passengers and incorporated into the price of the air fare, with the price varying widely, depending on the country levying the tax, the destination (local versus long range destinations) and the class of passenger (e.g. economy versus business class). Taxes from the UK range between \$16 and \$240, from Sweden between \$6.50 (for European destinations) to \$43.10 (long range destinations) and from the Philippines between \$8 and \$54. Some countries charge the tax only to foreign nationals (e.g. Mexico, Indonesia, China), some to all air passengers (e.g. Japan) and some only to their own citizens (e.g. Iran) ([Wikipedia, 2023](#)). Such taxes on foreign travellers in South Africa could be justified as a “wildlife conservation tax”, using lions as an emblematic species. Acceptance of this framing is likely to be high, given the popularity of banning trophy hunting if doing so would provide conservation benefits (e.g. 64% of UK respondents supporting a ban on trophy hunting if it decreased threats to wildlife conservation; [Vinogradova, 2021](#)), and given the strength of global public sentiment (e.g. 84% of international tourists in a recent survey agreed that the South African government should prioritise wildlife-friendly tourism over trophy hunting; [World Animal Protection, 2022](#)). It is beyond the scope of this paper to discuss in depth how such revenue should be collected and handled, but we note that it will only fulfil its intended function if it provides benefits to all stakeholders currently involved in trophy hunting. We therefore recommend that the funds should be collected, managed and disbursed by bodies created to ensure that the funds are employed for their stated purpose.

Under a return to 2019 visitor numbers lion levies in the form of departure taxes of \$6 to all foreign visitors leaving by land or sea and \$33 to air passengers could replace revenue from trophy hunting ([Table 4c](#)). The corresponding daily fees would be likely to fall well within the tolerances of all overseas visitors. Alternatively, if only air travel were subject to a departure tax, this would require a flat fee of \$51 from overseas visitors. From our data, fees at this level would result in, respectively, 20%, 9.8%, 9.9% and 4.0% decreases in the proportions of French, German, UK and USA tourists willing to visit, respectively. But as above, it is plausible that these decreases could be at least partially compensated for by increased visits from travellers previously deterred by trophy hunting. If visitor numbers remain at 2022 levels, plausible scenarios for deriving the requisite revenue could require land / sea visitors being charged \$8 (\$4 per day) and air travellers being charged \$50 (\$8.33 day). If only air travellers were taxed, the required charge would be \$67 (\$11.17 per day, equivalent), which is likely to deter significant proportions of travellers.

Visitor numbers are unlikely to remain at 2022 levels (which are 60.0% of the peak numbers of tourists and same-day-visitors witnessed in 2019), with no future increase. The expectation during 2023 is that they should increase to 80–95% of pre-pandemic levels ([UNWTO, 2023](#)). Scenarios in [Tables 4a](#) and [4c](#) are therefore likely to be the most representative of future trends, suggesting excellent scope for recouping revenue loss from trophy hunting through charging manageable fees to visitors to South Africa.

4.1. Limitations and risks

Our study has a number of limitations. First although the van Westendorp price sensitivity meter is widely employed to establish optimal pricing of a new product with unknown appeal to the relevant consumers, it has been criticised on the basis that it remains unclear whether it provides accurate measures for willingness-to-pay, or how it is linked to classical willingness-to-pay measurement approaches, either empirically or theoretically ([Kloss and Kunter, 2016](#)). Both van Westendorp and Gabor-Granger methods require directly asking potential consumers about hypothetical products, raising the potential for a hypothetical bias to arise because the respondent feels little connection to their immediate situation (they will neither pay for nor receive the product), which could lead to overestimates of willingness-to-pay ([Werthenbroch and Skiera, 2002](#)). [Kloss and Kunter \(2016\)](#) however, demonstrated that van Westendorp’s optimal pricing point reproduced the measurement results of the incentive-aligned (non-hypothetical) Becker-DeGroot-Marschak mechanism, providing a measure of empirical evidence supporting the accuracy of van Westendorp prices, albeit for a single product.

Second, typical applications of van Westendorp and Gabor-Granger pricing models seek to locate maximal revenue for a product, but in this case it was necessary to concurrently optimise for traveller numbers, requiring us to locate maximal revenue such that traveller numbers were not compromised. In the absence of any established or objective statistical method for defining a cut-off at which impacts of fees on numbers of travellers would be considered unacceptable, the maximum acceptable daily fees we derived (\$3 for African travellers and \$6–9 for overseas visitors) were necessarily based upon descriptive examination of the data. In addition the results of the two methodologies for deriving purchase intention at each fee price diverged considerably at lower prices and there exists no a priori basis for indicating which was likely to be more reliable. The NMS estimates (which were interpolated from among

respondents' travel intentions, indicated on a five-point scale across a range of "acceptably cheap" and "acceptably expensive" prices) were typically underestimates relative to the Gabor-Granger estimates, in which respondents directly indicated whether they would be willing to travel or not at the price point. Where such disagreements occurred our approach was to assume that positive indications of wishing to travel would be reliable, given that consumers typically wish to avoid additional costs. On the subject of what would constitute an acceptable decline in intention to travel, this judgement is necessarily arbitrary. We chose a cut-off of 85% of respondents stating they were willing to travel as being acceptable because: a) approximately 13% of those who did not wish to travel to South Africa cited trophy hunting as a reason, and so much of the 15% may be recouped from a newly-incentivised subset of a potentially large population, and; b) it is plausible that travel intention would have been less than 100% even in the absence of a fee. Respondents selected on the basis that they had previously travelled to South Africa may not have wished to do so again. As such an 85% willingness to travel may not represent a decrease of 15% from the maximum.

Third our sample size was limited to 100 respondents per country, selected to represent the demographics likely to travel to South Africa from the nations that comprise the largest numbers of visitors to South Africa (e.g. [Statistics South Africa, 2019](#)). With these sample sizes we cannot categorically state that our respondents are truly representative of potential travellers from each country. However, we argue that the selected respondents are nonetheless likely to provide a good representation of the travelling demographic within each country. Overseas respondents considering travel to South Africa primarily travel for extended vacations in which the costs of the travel, accommodation and activities (principally safari tours and coastal holidays) are likely to be substantial ([Fourie et al., 2018](#)). As an example, a ten-night trip from the UK, including flights, could cost \$2634 US ([Fourie et al., 2018](#)). In this context "lion protection fees" (e.g. in the form of a \$51 departure tax) may represent a minor addition to the overall cost. [Fourie et al. \(2018\)](#) demonstrated that visitor spending in South Africa was directly linked to the types of activities perused, with the most money being spent by those who visited natural attractions. As a result, respondents from southern African countries - who were more likely to travel for short vacations to see friends and family - and especially those from Lesotho (entirely enclosed within South Africa) and Eswatini (sharing three borders with South Africa) would be less likely to spend as much during their visit. Moreover cost of living in South Africa is higher than that of Eswatini, Lesotho and Botswana (\$1819 per month for a family of four, versus \$1375, \$1662 and \$1685, respectively), slightly lower than that of Zimbabwe (\$1959) and substantially lower than that of Mozambique (\$2332; [Numbeo, 2023](#)). The cost of living for these southern African nations relative to South Africa correlates with the percentage acceptance of different fees ([Fig. 1](#)), and speculatively the relatively high cost of living in Mozambique may at least partially explain the high willingness-to-pay for lion protection fees among respondents from this country. Finally, the results of our study necessarily represent an initial proof of concept, but have not been tested in real-world applications. We chose a market survey, using mixed-methods (online and face-to-face) as an initial test of whether potential tourists would accept "lion protection fees", reasoning *sensu* [Moorhouse et al. \(2020\)](#) that if the fees proved unacceptable to consumers in the abstract they would be less likely to appeal in real-life, when the costs are more likely to be felt to be significant.

For the revenue generated to result in beneficial conservation and livelihood outcomes (or at least to result in no net loss of conservation status of South Africa's wildlife, and no loss of income for local communities, while serving the intended outcome of allowing trophy hunting to be ended), it will be necessary for the money to be made available in the form of subsidies to South African landowners and communities - in particular those who currently make an income from running trophy hunting concessions - accompanied by a binding directive to conserve wildlife and equitably distribute income among local communities who would otherwise be disenfranchised by the ending of an important source of income. The mechanisms by which such directives are enforced, and their effectiveness assessed, and which body(/ies) should be responsible for raising and disbursing levies are issues that will require further, detailed consideration, especially given current low levels of public trust in institutions and representatives in South Africa ([Moosa and Hofmeyr, 2021](#)).

Given the involvement of private landowners, a proportion of whom are involved in "canned hunting" operations, a potential risk is disagreement from some stakeholders in the global trophy hunting debate who may take a negative view on what could be seen as the "rewarding" of previous participation in trophy hunting. Our response is that subsidies for wildlife conservation are routinely granted to landowners - some of whom may be relatively wealthy - in many nations, and this approach is justified on the basis of the existence of benefits for both wildlife and people. Prominent examples are the \$500 million US agreed in COP26 for the protection of DR Congo's forests ([UNDP, 2021](#)), and the proposed farm subsidies in the UK that would permit farmers to be paid for a range of biodiversity measures ranging from £537 a hectare for creating fenland out of lowland peat to £10.38 for establishing plots for skylarks (*Alauda arvensis*) ([Gov.uk, 2023](#)). In the South African context, if such subsidies could facilitate the ending of trophy hunting while obviating the risk of disenfranchising local populations or the wide-scale conversion of land in South Africa to agriculture, then even if unpalatable to some we argue that it represents a practicable approach that could have real world benefits. Here we use South Africa as a case study, but note that this approach also has the potential to be more widely applied in other countries where trophy hunting occurs. In many of these countries trophy hunting concessions are granted in zones surrounding formally protected national parks or nature reserves ([Lindsey et al., 2012](#)). Funds subsidising management operations in such (former) hunting areas may therefore be expected to yield considerable conservation value. The applicability of our approach in these countries (e.g. Botswana, Zimbabwe, Zambia), would, however, depend upon their respective annual revenues from trophy hunting, and anticipated numbers of international tourist arrivals - which we were unable to assess within the current study. These considerations aside, within South Africa, we draw attention to the potential for a levy-based system to contribute towards the financial costs associated with ending the commercial captive lion breeding industry [a recent policy move announced by the South African Department of Forestry, Fisheries, and the Environment (DFFE) ([Creedy, 2021](#))]. In light of this potential, we recommend that similar research focused on investigating these aspects should be considered as a valuable next avenue of inquiry.

5. Conclusions

The tenor of the current global debate surrounding trophy hunting is such that there exists a growing probability that trophy hunting could end in the near future in response to public pressure – which, unless measures are taken to address unintended consequences, could give rise to negative impacts, including on species conservation and on human livelihoods. Such consequences could be avoided or ameliorated if the benefits currently generated from trophy hunting revenue were able to be replaced through other means. Our findings indicate that, given likely future trends in visitor numbers to South Africa, a modest levy on visitors could entirely replace revenue that currently accrues from trophy hunting, while resulting in negligible changes in visitor numbers. The levy would work by leveraging the popularity of lions as a flagship species, to bring an effective, and responsible, end to trophy hunting across all species currently trophy hunted in South Africa. While it cannot be the place of this paper to establish the form such levies should take – and in appreciation that there are a number of different approaches (see Table 4a-d) - our results indicate that, for example, a departure tax of \$51 on air travellers should be sufficient to replace the entire revenue from trophy hunting. This approach has the advantage of being within the tolerance (\$8.50 per day) of overseas travellers and avoiding taxing visitors from southern African countries (who typically arrive by road and who were more resistant to paying a “lion protection fee”). Irrespective of the ultimate form in which the fees are raised, our study provides an initial indication that the vast majority of potential foreign travellers to South Africa, and especially those from overseas countries, would willingly accept paying additional, modest, fees if these would protect lions by ending trophy hunting. Our study therefore provides a basis for further exploration of this approach as a potential mechanism for beginning the process of phasing out trophy hunting without causing unintended negative consequences for wildlife and livelihoods.

Ethics statement

Participant recruitment and consent, and initial data processing were conducted by Touchstone Partners Ltd, in adherence to the Market Research Society code of conduct (<https://www.mrs.org.uk/pdf/MRS-Code-of-Conduct-2019.pdf>). Subsequent data analysis standards were overseen by World Animal Protection, in full accordance with the British Sociological Association Statement of Ethical Practice (BSA 2017).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Two authors are employed by the animal welfare organisation World Animal Protection (NDC holds the position of Head of Animal Welfare and Research; AE is Wildlife Research Manager). Our results pertaining to this study were in no way influenced by our own personal views on animal welfare.

Data Availability

Data will be made available on request.

Acknowledgements

The study was conducted in close collaboration with Tim Baker, Jon Darby, Rob Bates and Marie Screene of Touchstone Partners Ltd., for whose expertise and professionalism throughout we are extremely grateful.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.gecco.2023.e02656](https://doi.org/10.1016/j.gecco.2023.e02656).

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