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Putting yourself in an animal's shoes - empathy and intangible benefits drive tolerance towards wildlife in Namibian communal conservancies

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ABSTRACT

Many wildlife species are threatened due to persecution and intolerance of people to sharing landscapes with them, especially in mixed use landscapes where both people and wildlife struggle to thrive together. Understanding the factors that promote human tolerance is therefore critical, but progress is hindered by a lack systematic syntheses of studies. The Wildlife Tolerance Model (WTM) is one attempt to provide a framework based on a systematic synthesis of the large body of work in this field. Here we apply the WTM in communal conservancies in the Zambezi region of Namibia, an important wildlife corridor in the Kavango-Zambezi Transfrontier Conservation Area and one of the few case studies where communities receive monetary benefits from wildlife. Using path modeling, we examined the drivers of tolerance towards five problem species and compared these results with other WTM studies to examine the role of monetary benefits and whether some variables consistently drive tolerance across different species and contexts. Empathy and perceptions of intangible benefits towards a species emerge as consistent drivers of tolerance for all species in Namibia and most other WTM studies but are rarely measured in the literature. Monetary benefits are often presumed to promote tolerance for wildlife however we found only an indirect effect where monetary benefits drive intangible benefits and thus have a "crowding in" effect. These results are encouraging as they suggest tolerance can be promoted indirectly through monetary benefits but also that monetary benefits, for example from trophy hunting are not essential to promote tolerance.

1. Introduction

Transfrontier Conservation Areas (TCA) are proposed as a tool for landscape-level conservation strategies in the face of rapid biodiversity loss and landscape transformation. TCAs may be especially important for large mammals in Africa as the small size and number of protected areas are insufficient to ensure their future (Cant-Salazar and Gaston, 2010; Craigie et al., 2010). A TCA is "a component of a large ecological region that straddles the boundaries of two or more countries encompassing one or more protected areas as well as multiple resource use areas" (SADC, 1999). In addition to biodiversity and cultural heritage conservation TCAs aim to improve the livelihoods of communities through sustainable use of biodiversity. This is assumed to promote coexistence between people and wildlife in multi-use landscapes where large mammals can potentially impact people negatively (Stoldt et al., 2020; Virtanen et al., 2020; Pozo et al., 2021; Blackie, 2022). Managing tradeoffs and promoting tolerance for sharing the landscape with large mammals are therefore key challenges for the sustainability of such initiatives (Carpenter, 2022). We define tolerance as the willingness to absorb potential or actual costs from wildlife, and see it as one component of coexistence, which we define as the willingness of communities to share the landscape and tolerate possible costs from wildlife while ensuring sustainable wildlife populations.

The Kavango-Zambezi Transfrontier Conservation Area (KAZA) is a large TCA in southern Africa that has the potential to safeguard some of the last remaining free movement of iconic African wildlife such as elephant (*Loxodonta Africana*) (Naidoo et al., 2018), zebra (*Equus quaaga*) (Naidoo et al., 2016a, 2016b, 2016c) and African wild dog (*Lycaon pictus*) (Hofmann et al. 2021). The landscape is a mixture of land-use types consisting of 72 % wildlife management areas and 28 % for agricultural use, rangeland, and development (KAZA, 2015). While each of the five member countries implement community based natural resource management programs (CBNRM) to increase benefits and offset the costs of living with wildlife, negative wildlife impacts are a key

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challenge (Drake et al., 2021, Pozo et al., 2021, Blackie, 2022) and could determine the sustainability of KAZA (Stoldt et al., 2020, Carpenter 2021) and other TCAs. Therefore, understanding the factors that promote tolerance and coexistence are key research priorities. Namibia is a KAZA member country considered to have the most progressive policy framework in place to promote coexistence with wildlife (Nuulimba and Taylor, 2015). This involves creating an enabling environment for communities living on communal lands to establish conservancies with self-governing institutions to utilize 100 % of proceeds from wildlife to provide benefits to communities, including offsetting monetary costs from wildlife damage (NACSO, 2022; Vehrs et al., 2022). After 30 years of the program, with 86 conservancies covering 20 % of land, increases in wildlife populations and N$150 million in revenue generated in 2019 (NACSO, 2022), managing costs from wildlife remains a key challenge. While many studies in Namibia have reported these costs (Nattrass, 2020, Salerno et al., 2020, Tavolaro et al., 2022), few have tried to determine the drivers of tolerance (but see Stormer et al. 2019), possibly since it is generally assumed that monetary benefits promote tolerance

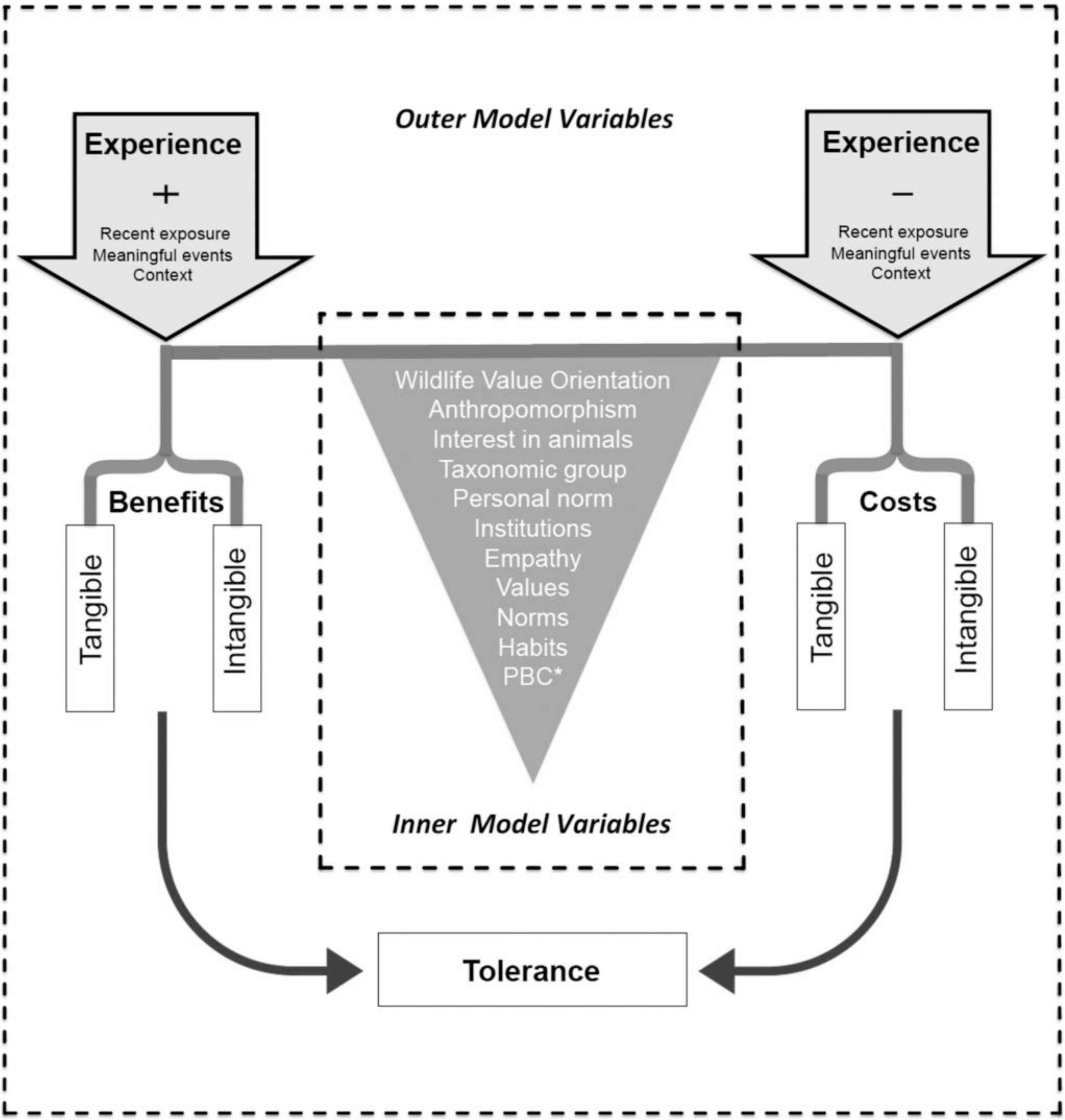


Fig. 1. A diagram of the Wildlife Tolerance Model (WTM). The two-tiered model consists of an *outer and inner model.* In the *outer model*, *tolerance* is determined by the net perceived *costs* and *benefits* of living with a species based on the extent to which a person *experiences* a species. The *inner model* consists of an additional eleven variables that impact on tolerance. The order of *inner model* variables in the triangle is random. *PBC=Perceived Behavioral Control. For model hypotheses see Table 1.

and coexistence (Gandiwa et al., 2013; Mannetti et al., 2019). We therefore chose conservancies in the Zambezi region of Namibia as our study site to understand the drivers of tolerance towards five mammalian species that typically cause problems for people in the region. These were kudu (*Tragelaphus strepsiceros)*, lion (*Panthera leo*), hyena (*Crocuta crocuta*), elephant (*Loxodonta africana*) and baboon (*Papio ursinus*). A second aim of the study was to contrast this case study with our other case studies, in particular the Zambian case study (Kansky et al., 2021) which shares similar cultural and environmental conditions, is also part of KAZA and has a CBNRM program, but unlike Namibia members do not receive monetary benefits from wildlife and are not compensated for wildlife damage. This allows us to examine the effect of monetary benefits on tolerance and the idea that these are necessary to promote tolerance.

1.1. Wildlife tolerance model

We used the Wildlife Tolerance Model (WTM)(Kansky et al., 2016) as our theoretical framing (Fig. 1, Table 1). The model identifies a suit of variables that predicts the drivers of human tolerance to damage-causing wildlife. It can be applied across a variety of species in different cultural contexts, and this allows cross species and cross-cultural comparisons. This is important as many similarities in drivers would allow development of common strategies to promote tolerance for many species in multi-use landscapes such as TCA's. The WTM consists of an outer model and an inner model (Fig. 1, Table 1). In the outer mode the first hypothesis is that experience of a species drives perceptions of costs and benefits of living with a species. The second hypothesis is that perceptions of costs and benefits drive tolerance. Experience consists of two components; (i) recent exposure to a species operationalized as how often you see it or signs of it in the last year, and (ii) number of positive or negative meaningful experiences in total a person has had with the species. Benefits and costs are separated into tangible and intangible. Tangible refers to the monetary costs and benefits while intangible refers to non-monetary values. For example, Intangible costs refers to negative psychological costs such as stress and worry while Intangible Benefits refers to the positive emotions or cultural values attached to a species. The inner model consists of 11 variables that are predicted to have direct impacts on tolerance or have a mediation effect through perceptions of costs and benefits. For example, empathy - people higher in empathic concern for a species will perceive relatively more benefits than costs and therefore be more tolerant than those lower in empathy (Table 1). To date the WTM has been applied in eight countries with 12 different species by our research group. In a forthcoming publication we compare our findings from these studies (Kansky forthcoming). However, unlike most of these studies, and due to its well-known CBNRM program that provides direct monetary benefits to community members from wildlife (NACSO, 2022), Namibia provides a unique opportunity to examine the impact of monetary benefits on tolerance. This is important because a key assumption in wildlife based CBNRM is that monetary benefits can "buy" tolerance and promote coexistence (Muchapondwa and Stage, 2015; t' Sas-Rolfes, 2017; Cretois et al., 2019). However few studies have empirically shown this to be the case, especially since monetary and non-monetary benefits are mostly aggregated in surveys (Kansky and Knight, 2014). This case study also provides a unique opportunity to examine whether monetary benefits "crowd in" or "crowd out" intrinsic values for wildlife. Intrinsic values could be people's moral commitment towards nature conservation or their non-use values (Rode et al., 2015). The erosion of the intrinsic value of nature may undermine long term conservation efforts (Gómez-Baggethun and Ruiz-Pérez, 2011; Muradian et al., 2013). Motivation Crowding Theory (Frey and Jegen, 2001) suggests that people who are intrinsically motivated to engage in an altruistic behavior – for example donating blood – because they feel an inherent satisfaction or personal conviction, may feel discouraged to do the behavior if they are offered external rewards such as money. In this way the extrinsic reward causes

Table 1
General description of the variables from the Wildlife Tolerance Model (WTM) and the hypotheses that were tested. See Kansky et al., 2016 for more details of the WTM.

Outer model variables	Description	Hypotheses
Exposure	Interaction frequency and spatial proximity of an individual with a species.	Higher exposure leads to higher perceptions of costs and less benefits
Negative meaningful events	Negative emotionally charged experiences, such as traumatic encounters with the species, which may have occurred at any time during an individual's lifetime.	Larger numbers of negative experiences leads to higher perceptions of costs and less benefits
Positive meaningful events	Positive emotionally charged experiences, such as an unforgettable meaningful nature experience with wildlife, which may have occurred at any time during an individual's lifetime.	Larger numbers of positive meaningful experiences leads to lower perceptions of costs and more benefits
Tangible costs	Direct costs incurred from living with wildlife such as monetary loss through livestock or crop loss due to wildlife.	Larger perceptions of tangible costs leads to lower tolerance
Intangible costs	Non-monetary psychological costs such as stress and fear as well as opportunity cost.	Larger perceptions of intangible costs leads to lower tolerance
Tangible benefits	Monetary income from each species such as from trophy hunting, selling of meat or tourism.	Larger perceptions of Tangible Benefits leads to higher Tolerance
Intangible benefits	Non-monetary benefits from each species such as the positive emotions from living with wildlife, cultural value, meaning, learning or spiritual value of wildlife.	Larger perceptions of Intangible Benefits leads to higher Tolerance
Tolerance	Tolerance is measured through 5 parameters: 1) acceptance of monetary costs, 2) extent of acceptance of proximity to wildlife, 3) extent of acceptance of different wildlife behaviors in different contexts before it should be killed, 4) extent of acceptance of emotional stress from different amounts of wildlife damage and 5) extent of acceptance for different wildlife population size	N/A
Inner model variables		
Interest in wildlife	General interest in wildlife such as reading and watching movies about wildlife and learning about animal behavior	The more a person is interested in wildlife the more tolerant they will be
Institutions	Perceptions of support, trust, and competence (skills, knowledge, communication) in organizations that are involved with wildlife.	Individuals who have negative perceptions of wildlife organizations will be less tolerant
Wildlife value orientations	Value priorities in relation to wildlife. Two dimensions are Domination who believe wildlife are primarily for human benefit and Mutualism who believe wildlife as deserving rights.	Individuals who prioritise mutualistic WVO will be more tolerant compared to individuals who prioritise utilitarian WVO
Values	Self-transcendent, universalism values in relation to nature and the preservation of the natural environment	Individuals prioritising Universalism values towards the natural environments will be more tolerant
Empathy	An ability to feel compassion when imagining a wildlife	People with low empathy will be less tolerant

(*continued on next page*)

Table 1 (*continued*)

Outer model variables	Description	Hypotheses
	species in distress or having problems	
Tangible costs -all	Direct costs incurred from ALL wildlife species such as monetary loss through livestock or crop loss due to wildlife.	Higher Tangible Costs from ALL wildlife species in the landscape will lead to lower Tolerance for the five target species
Intangible costs -all	Non-monetary factors such as stress and fear, which result from direct and indirect interactions with ALL wildlife and opportunity cost.	Higher Intangible Costs from ALL wildlife species in the landscape will lead to lower Tolerance
Tangible benefits-all	Monetary benefits from ALL wildlife species such as the income from hunting and tourism and the monetary value of meat	Higher Tangible Benefits from ALL wildlife species in the landscape will lead to higher Tolerance
Intangible benefits-all	Non-monetary benefits from ALL wildlife species such as the positive emotions from living with wildlife, cultural value, meaning, learning or spiritual value of wildlife.	Higher Intangible Benefits from ALL wildlife species in the landscape will lead to higher Tolerance

a "crowding out" effect of the intrinsic motivation (Ryan and Deci, 2000). Conversely, a "crowding in" effect may result when the external reward (money) reinforces the intrinsic motivation (Rode et al., 2014). Better understanding the effects of financial incentives is thus critical (Chan et al., 2017), especially in light of critiques and controversies over the utilitarian approach of wildlife management in Africa (Sullivan, 2005; Dickman et al., 2019; Chapron and Lopez-Bao, 2019).

1.2. Tolerance, acceptance and coexistence

Interest in the concepts of tolerance, acceptance, and coexistence in relation to human-wildlife interactions has been increasing (König et al., 2020, Knox et al., 2020) with recent commentaries and reviews highlighting the multiple ways which they are defined and measured (Bruskotter and Wilson, 2014, Dressel et al., 2014, Frank, 2016, Brenner and Metcalf, 2020, Knox et al., 2020, Whitehouse-Tedd et al., 2021). Some argue this multiplicity of definitions and lack of shared understanding hinders comparisons across case studies, preventing our ability to build on previous research and synthesize findings (Kansky et al., 2014, Bruskotter et al., 2015, Brenner and Metcalf, 2020, Glikman et al., 2021, Knox et al., 2020). Others disagree arguing that tolerance should be tailored to the context of each case study as each operate within complex systems (Glikman et al., 2021). Glikman et al. (2021) believe both approaches have a place in the study of human-wildlife interactions, and we concur with this approach.

The Wildlife Tolerance Model (WTM) (Fig. 1) was an attempt to contribute to the first approach - to provide a standardized model that would allow cross species and cross-cultural comparisons of tolerance and its drivers (Kansky et al., 2016), especially in the face of the scarcity of comparative studies and a systematic synthesis of the factors driving variation in tolerance (Balasubramaniam et al., 2021). Since the publication of the WTM in 2016 and the two meta-analyses that informed it were published in 2014 numerous authors have contemplated the concept of tolerance. In the remainder of the introduction, we review some of these and situate the WTM within this literature to clarify the WTM approach.

1.3. Definition of tolerance

In dictionaries, tolerance is typically defined in two ways: 1. accepting something you don't like and 2. accepting a hardship. The first emerges from concepts of prejudice, defined in the Merriam-Webster dictionary as "an irrational attitude of hostility directed against an individual, a group, a race, or their supposed characteristics". The second definition comes from the sciences where something is tested for its durability or the limits of endurance after being exposed to something, for example the temperature beyond which something will be damaged or die. In the Human Wildlife Interaction (HWI) literature both conceptions are found. Examples of the first are, "accepting wildlife and/or wildlife behaviors that one dislikes" (Brenner and Metcalf, 2020, Delie et al., 2022) or "acceptance toward feelings, habits, beliefs or behaviors differing from or conflicting with ones' own" (Frank, 2016). An example of the second conception, is "the capacity of a biological or human system to "carry the burden" of a particular wildlife population or density of animals in a specific geographic area (Carpenter et al., 2000) or "an individual's or group's acceptance of negative effects and desire for positive effects arising from interactions with wildlife populations (Lischka et al., 2019). In the WTM we define tolerance as "The ability and willingness of an individual to absorb the extra potential or actual costs of living with wildlife" since we think that anyone living in an area with wildlife must bear the risk of actual or potential costs which would not be present if there were no wildlife in the area. Thus, our definition is conceptualized as accepting a hardship or potential hardship. We don't think that whether you like a species or not is very important because one can still like an animal but want it removed when it comes into your garden or field. From the animal's perspective what people do is most important.

1.4. Operationalization of tolerance

Tolerance is typically measured in surveys (Whitehouse-Tedd et al., 2021) and measured as attitudes, beliefs, normative beliefs, or behaviors (Treves and Bruskotter, 2014, Kansky et al., 2016 Appendix A, Lischka et al., 2019, Brenner and Metcalf, 2020, Delie et al., 2022). An *attitude* is a predisposition to respond in a favorable or unfavorable manner towards an object - in other words an evaluative judgment (Fishbein and Ajzen, 2010). *Beliefs* are information held as true by a person, irrespective of whether the belief is true or not (Cambridge dictionary). In survey's respondents typically indicate positive, neutral, or negative judgments or beliefs towards a species. A statement could be "I like wolves" (attitude) or "wild dogs are dangerous (belief). *Normative beliefs* are beliefs about appropriate or acceptable behaviors in a specific situation (Zinn et al., 1998; Fishbein and Ajzen, 2010). In questionnaires it can include questions on whether a respondent thinks a policy is acceptable or not or whether the presence of a species or the size of its population is acceptable (Decker and Purdy, 1988, Bruskotter and Wilson, 2014). Normative beliefs help to define standards for management actions, identify situations about which people feel strongly, and indicate the degree of consensus among various interest groups (Zinn et al., 1998). *Behaviors* are actions that people undertake, for example voting to support a management plan or injuring or killing an animal. It is the least used measurement applied in surveys (Kansky et al., 2016 Appendix A) possibly because bias against reporting socially unacceptable or illegal behavior may be high. Intention to undertake a behavior is often used as a proxy for the actual behavior based on The Theory of Planned behavior (e.g., Marchini and Macdonald, 2012).

Brenner and Metcalf (2020) argue that tolerance should be defined and operationalized by integrating both attitudes, normative beliefs, and behavior while Bruskotter and Fulton (2012) argued that behaviors or behavioral intentions are the best indicators of tolerance since they are most likely to actually impact wildlife populations. In the WTM we operationalize tolerance using four normative belief dimensions - extent of acceptance of monetary costs, extent of acceptance of proximity to wildlife, extent of acceptance of different wildlife behaviors in different contexts before it should be killed, extent of acceptance of emotional stress from different amounts of wildlife damage and extent of acceptance for different wildlife population size (WAC, Decker and Purdy, 1988) (Kansky et al., 2016, 2021). Thus, our conception of tolerance captures the limits beyond which a person will experience hardship or risk they are not willing to endure (tangible or intangible). However, instead of only operationalizing it as a uni-dimensional measure as is often the case (e.g. Bruskotter et al., 2015; Lischka et al., 2019; Störmer et al., 2019; Teixeira et al., 2020) ours is multi-dimensional as recommended in social science research for abstract psychological concepts that are multidimensional in nature (Podsakoff et al., 2003, Babbie and Mouton, 2007) and because in a meta-analysis question type had a significant impact on tolerant attitudes (Kansky et al., 2014).

Our measure does therefore not include an attitudinal or behavioral component. We do see that including attitude would be necessary if using the first conception of tolerance because one would be measuring something in relation to your attitude about it. Like Bruskotter et al., 2015 we agree that measuring behaviors intended to negatively impact wildlife populations provides more useful information over attitudinal measures. However, since our intention was to produce a generic model to be applied cross culturally and across species, including specific behaviors would prevent creation of a standardized survey. For example, killing or trapping an animal, writing, or calling one's representative to complain about a nuisance species, or donating money to an organization would not all be relevant in each case study. Therefore, we believe operationalizing tolerance as a set of normative hypothetical limits is most appropriate for such studies. We do however see that context specific behaviors for a specific case study would be useful and therefore including them would depend on the aim of the study. Including only generalized attitudinal or belief statements about a species may not be that useful because a person may have a negative attitude but not behave negatively or have a positive attitude but behave negatively.

1.5. Antecedents to tolerance

Some authors have argued that the factors driving tolerance are not well known (Lischka et al., 2019). We disagree with this perception as the literature is abundant with surveys that have examined many predictor variables of tolerance (Kansky and Knight, 2014). Rather the problem lies in the lack of systematic syntheses of this large body of research to see if there are common factors driving tolerance across species, cultures, and contexts. Work leading up to the conception of the WTM aimed to overcome this problem by conducting a meta-analysis to synthesize this large body of work. The analysis grouped the variables into categories and sub-categories and compared the number of times each were found to be significant or not (Kansky and Knight, 2014). Based on these findings and consulting the literature beyond HWI, antecedent variables were selected for the WTM (Fig. 1, Table 1). Thus, to the best of our knowledge, the WTM remains the only model that is based on systematic synthesis of the literature. Given the exponential growth in HWI studies since the Kansky and Knight synthesis, a new synthesis is due.

One obvious variable that impacts tolerance is the species involved. For example, even when controlling for damage, people differ in their tolerance towards different species (Romañach et al., 2007; Kansky et al., 2014). Evidence of the human propensity to value animal species differently is widespread and the attributes explaining these differences are many including similarity to humans in morphology, behavior, natural history traits and phylogeny, as well as attractiveness, utility, size, rarity, danger, and cultural symbolism (see Kansky et al., 2014 Appendix A for a mini review). Therefore, in addition to contributing to understanding the drivers of tolerance in the Zambezi Region of Namibia and contrasting this case study with the Zambia and other case studies, a third aim was to compare drivers of tolerance between the five species of wildlife that commonly cause problems for people. Many similarities in drivers would allow development of common strategies to promote tolerance for all species in the landscape instead of the need for species specific plans.

2. Methods

2.1. Study area

We surveyed communities living in six communal conservancies in the Zambezi Region of Namibia living in the Kwando Wildlife Dispersal Area of KAZA (Fig. 2). The area is bordered by the Kwando, Linyanti, Chobe and Zambezi Rivers and is a region of woodlands, swamps, and flood plains. There are three national parks in the landscape, Bwabwata, Mudumu and Nkasa Lupala, as well as the Zambezi State Forest. Communal lands and 15 conservancies surround these protected areas. Conservancies are communal lands that are unfenced, multiple use areas with defined boundaries, and that serve as wildlife corridors within the regional context. Conservancy governance is guided by the Ministry of Environment Forestry and Tourism (MEFT), and conservancy policies that are implemented through elected and salaried community members who serve on Conservancy Management Committees (CMC). These committees, in turn, collect and distribute revenue generated from trophy hunting and tourist lodges (Nuulimba and Taylor, 2015; NACSO, 2022). The study area we focused on encompassed six conservancies between Nkasa Lupala and Mudumu National Parks: Bamunu, Wuparu, Balyerwa, Mashi, Mayuni and Kwandu (Fig. S1). The Zambezi region hosts a population size of 90,596, approximately 4.3 % of Namibia's total population (Namibia Census, 2011). Here, human assets are limited due to low education levels, widespread health risks and general food insecurity. Financial assets are vested in livestock ownership, crop farming, the use of natural resources that are traded in informal markets and government social grants. One of the most common threats to livelihoods are human-wildlife conflicts (Glatz-Jorde et al., 2014; Salerno et al., 2020; Stoldt et al., 2020). Additional information of the study area is in Vehrs et al., 2022.

2.2. Data collection: community surveys

Table 1 and Fig. 1 describe the variables in the WTM with the hypotheses for each variable. The survey instrument is presented in Appendix 1.

Data were collected using face-to-face questionnaires that were translated into the local siLozi language. Pilot surveys were conducted repeatedly until confidence in accuracy was achieved and the survey could be completed within an hour. Ethical requirements conformed to Research Ethics requirements of X University (project 0967). Villages were surveyed in August–September 2018, through proportionate sampling in relation to their population density such that more respondents were surveyed from larger villages. Within each conservancy we used an opportunistic street intercept-sampling frame to survey residents (Bernard, 2006). This entailed entering a village zone and approaching participants as the team encountered them in their homes, in their fields or in shared public spaces. Remote villages were sampled as well. Households were canvassed randomly between Monday and Saturday between 8 am and 6 pm. One adult (above 18 years) from each household was approached to participate in the survey. A criterion for participation was being a farmer (either crop farming or livestock or both). Few people canvassed refused to be interviewed and therefore non-response bias questions were not necessary. Face-to-face interviews were conducted in the local language by four trained, local enumerators. Data were recorded using a combination of portable devices, using the ODK collect software (getodk.org) and paper. We aimed for at least 70 surveys from each conservancy. In total we surveyed 554 farmers from six conservancies, Bamunu (69), Wuparo (77), Balyerwa (88), Mashi (80), Mayuni (73) and Kwandu (86) (Fig. 2). Most respondents were from the Mayeyi ($n = 167$), Mafwe ($n = 160$) and Mbalangwe (100) cultural groups while the remaining were from Mambukushu (75), Lozi (30), Mankuhane (16), and Matotela (3).

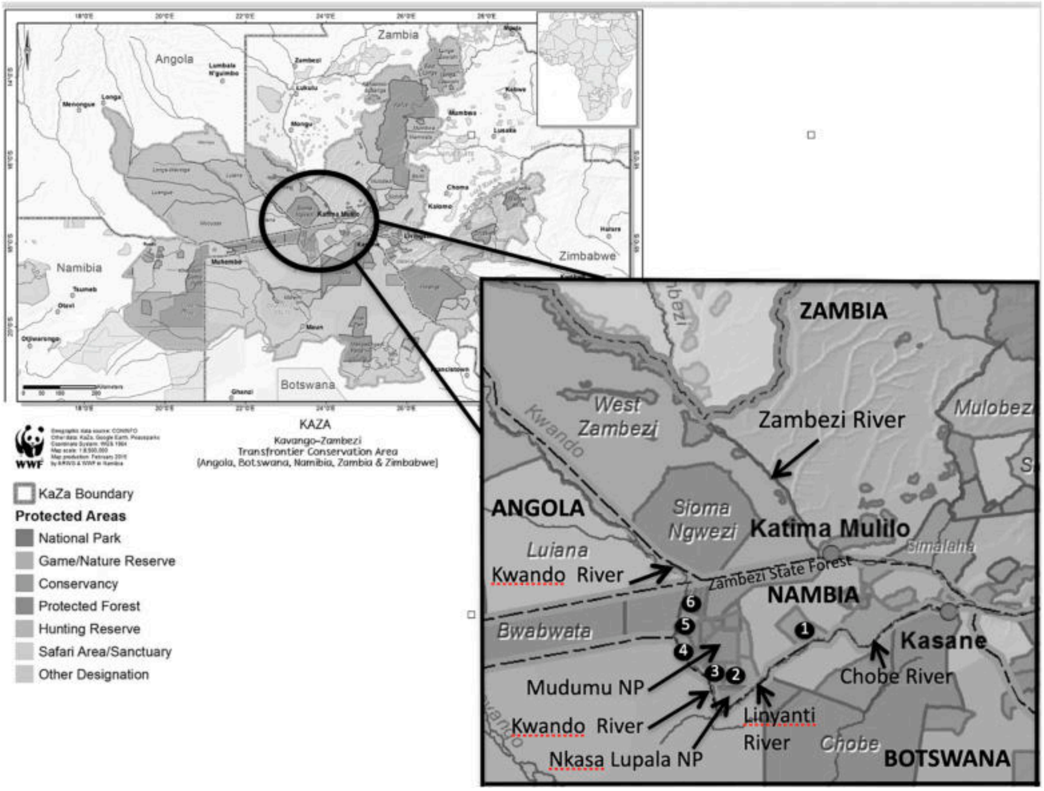


Fig. 2. Map of study site in the Kwando Wildlife Area of the Kavango-Zambezi Transfrontier Conservation Area. Conservancies where surveys were conducted are numbered as follows: 1 = Bamunu, 2 = Wuparu, 3 = Balyerwa, 4 = Mashi, 5 = Mayuni, 6 = Kwandu. Map courtesy of Namibia Association of CBNRM Support Organizations (NACSO), with modifications by author to show details of study area.

2.3. Data analysis

We used Partial Least Squares Structural Equation Models (PLS-SEM) (Lowry and Gaskin, 2014) to assess the relationships between variables in the WTM, similarly to Kansky et al., 2016, Kansky and Maassarani, 2022. We used the statistical package SmartPLS (Ringle et al., 2014). Partial Least Squares (PLS) is preferable when the research focus is to develop theories in exploratory research and for complex models that include latent (unobserved) variables (Lowry and Gaskin, 2014). In PLS-SEM, path model diagrams are used to visually display the hypotheses and latent variable relationships. Path coefficients explain how strong the effect of one variable is on another variable in the structural model and correspond to standardized betas in a regression analysis. Values of −1 indicate high negative impact while values of +1 indicate high positive impact (Wong, 2013; Hair et al., 2014). Relationships between latent variables are shown as single headed arrows and represent directional relationships. With strong theoretical support they are interpreted as causal relationships (Kansky et al., 2016; Kansky et al., 2021). The weight of different path coefficients allows their relative statistical importance to be ranked and is reported using bootstrap confidence intervals and significance of path coefficients (Wong, 2013, Hair et al., 2014). The questions used in the survey to operationalize the variables and latent variables are reported in Appendix 1.

We evaluated the Measurement Model (i.e. the relationship between a latent variable and its indicators) using four measurements: Indicator reliability (reported as outer loadings), Internal consistency (reported as composite reliability), Convergent validity (reported as average variance extracted (AVE) and Discriminant validity (Wong, 2013, Hair et al., 2014). The Structural Model was assessed using a Colinearity test (Wong, 2013, Hair et al., 2014). Additional information on these tests is in Appendix 2.

To examine the predictive power of the model, the coefficient of determination (R^2) is typically used (Wong, 2013, Hair et al., 2014) and represents the amount of explained variance of constructs in the structural model. The higher the R^2 value the better the construct is explained by the latent variables in the structural model that point at it via structural path model relationships. More information of on how to interpret the results from SmartPLS can be found at https://www.smartpls.com/documentation.

Missing values were replaced using K-Nearest Neighbours, to include as many respondents as possible. <5 % of surveys required missing value replacement and therefore there was little risk of random data generation. Respondents with over 30 % missing values were not considered for replacement and excluded. All constructs were considered reflective (Hair et al., 2014). Some latent variables from the survey questions required further computations. These are explained in Appendix 1. We standardized the Tolerance construct by computing a z-score because the scales for its items were different. The variables that included actual monetary values (Benefit Tangible and Cost Tangible) were winsorized to reduce the influence of outlier data points.

3. Results

3.1. Partial least squares structural equation models

Results and discussion for evaluation of the measurement and structural models of the PLS-SEM are presented in Appendix 2. A graphical representation of the significant and non-significant path coefficients is shown in Fig. 3 for each species. Here we report on some of the key findings of the model results, noting that due to the complexity of the model with 251 relationships (paths) between variables, it is not possible to report on all the paths. Therefore, we focus on those pathways that in our view are the most meaningful for policy in both the local and global context.

3.2. How much variation in tolerance is explained?

The model explained on average 36 % of variation in *Tolerance* for all five species (range R^2 = 0.33;0.39, Stdev = 0.02) (Fig. 3). On average, 12 % of variation in *Cost Tangible* was explained by *Exposure, Positive Meaningful Events* and *Negative Meaningful Events* (range R^2 = 0.08;0.22, Stdev = 0.07), but the most variation was explained for kudu (22 %). On average, 11 % of variation *in Benefit Intangible* was explained by *Exposure, Positive Meaningful Events*, *Negative Meaningful Events (range* R^2 = 0.04;0.22, Stdev = 0.05) (Fig. 3, Appendix 2 Table A2.1). On average, 4 % of variation *in Cost Intangible* was explained by *Exposure, Positive Meaningful Events* and *Negative Meaningful Events (range* R^2 = 0.02;0.07, Stdev = 0.02). On average, *Exposure* explained 22 % of variation in *Negative Meaningful Events (range* R^2 *= 0.12;0.29, Stdev = 0.08*) and 1 % of variation in *Positive Meaningful Events (range* R^2 = 0;0.03, Stdev = 0.01) (Fig. 3, Appendix 2 Table A2.1).

3.3. How important is exposure?

Exposure and costs and benefits - The WTM hypothesizes that higher exposure (perceived or actual) to a species increases perceptions of costs and reduces perceptions of benefits attributed to a species (monetary and non-monetary) (Table 1). We found partial support for this hypothesis; of the 24 paths from exposure to costs and benefits, eleven (46 %) of these were significant (Fig. 3). *Exposure and costs* – exposure was a significant positive driver of *Tangible Costs* for four of the five species (kudu, elephant, baboon, and hyena (β range = −0.11 to −0.3, exposure scale reversed), meaning as exposure increases *Tangible Costs* increase. However, there was generally no significant effect on *Intangible Costs*, except for kudu where the opposite effect was found – more exposure leads to less *Intangible Costs* (β = −0.17, $p < 0.01$). *Exposure and benefits* – *Exposure* was not a significant driver of *Tangible Benefits* for kudu, lion and elephant but was significant for baboon (β =0.14, $p < 0.01$ and hyena (β = 0.21, p < 0.01) meaning the more respondents are exposed to them the less perceptions of monetary benefits. *Exposure* was not a significant driver of *Intangible benefits* (mankind and nature) for kudu, but it was significant for baboon, elephant, hyena and lion (β range 0.11–0.17), meaning the more respondents are exposed to them the less they perceive non-monetary benefits (Fig. 3, Appendix 3).

Exposure and experiences – The WTM hypothesizes that higher exposure leads to more negative experiences and less positive experiences. Seven of the 10 (70 %) pathways from exposure to experiences were significant thus mostly supporting the hypothesis. Exposure to *Negative Meaningful Experiences* had a significant effect for all five species (β range 0.34–0.55), meaning that more exposure leads to more negative experiences. *Exposure* to *Positive Meaningful Experiences* were significant only for baboon (β = −0.17, $p < 0.01$) and kudu (β = −0.16, p < 0.01) but in opposite direction to our prediction - more exposure leads to more positive events (Fig. 3, Appendix 3).

3.4. How important are experiences?

The WTM hypothesizes that meaningful experiences drive perceptions of costs and benefits – positive experiences enhance perceptions of benefits and reduce perceptions of costs while negative experiences reduce perceptions of benefits and increase perceptions of costs. In general, we found partial support for these hypotheses – out of the 48 paths, 23 were significant (48 %) (Fig. 3, Appendix 3).

3.4.1. Negative meaningful experiences (NME) effect on costs

There was a significant positive effect of *NME* on *Tangible Costs* for four species (kudu, baboon, hyena, lion) (β range 0.13–0.36), and a significant positive effect from *NME* to *Intangible Costs* for three of the species (elephant, hyena, baboon) (β range 0.12–0.15), meaning higher *NME* drive perceptions of higher monetary and non-monetary costs (Fig. 3, Appendix 3). *Negative Meaningful Experiences (NME) effect on benefits* – There was only a significant effect on *Tangible Benefits* for baboon and elephant with a negative effect for baboon (β = −0.11, p < 0.01) (more negative experiences less benefits) but a positive effect for elephant (β = 0.12, $p = 0.02$) (more negative experiences more benefits) (Fig. 3, Appendix 3). *NME* on *Intangible Benefits* was significant for two species but the two separate dimensions were only consistently significant for elephant. *NME* to *Intangible Benefit* (mankind and nature) was significant for kudu (β = 0.15, p < 0.01) and elephant (β = 0.13, p < 0.01) while *NME* to *Intangible Benefit* (you and community) was significant for elephant (β = 0.12, $p < 0.01$) and lion (β = −0.09, $p = 0.04$). However the direction of the effect was contrary to our hypothesis for elephant and kudu– the more negative experience the higher the perception of *Intangible Benefits*, but for lion it was in the expected direction – more *NME* less benefits (Fig. 3, Appendix 3).

3.4.2. Positive meaningful experiences (PME) effects on costs

There were no significant effects of *PME* on *Tangible Costs* for all species but there was a significant negative effect of *PME* on *Intangible Costs* for baboon (β = −0.11, p = 0.02) and kudu (β = −0.15, $p < 0.01$) only, meaning more positive experiences lead to less perceptions of *Intangible Costs*. *Positive Meaningful Experiences (PME) effects on benefits* –*PME* had a significantly moderate positive effect on *Tangible Benefits* for elephant (β = 0.27, p < 0.01) and kudu (β = 0.24, p < 0.01), a weak positive effect on *Intangible Benefit* (mankind and nature) for elephant (β = 0.13, p < 0.01), and hyena (β = 0.09, $p = 0.01$) and a significant positive effect with *Intangible Benefit* (you and community) for elephant (β = 0.08, p = 0.02), hyena (β = 0.1, p = 0.04), and kudu (β = 0.2, p < 0.01).

3.5. How important are costs as drivers of tolerance?

Tangible Costs incurred by the single target species were not significant drivers of *Tolerance* for all five species (Fig. 3, Appendix 3). Int*angible Costs* were also mostly not significant except for kudu where there was a significant but small negative effect (β = −0.09, $p = 0.04$). Kudu was also the only species where *Tangible Costs* had a significant positive effect on Int*angible Costs ((*β = −0.14, p < 0.01) meaning that the more monetary damage farmers experience from kudu the more they perceive psychological hardship which ultimately drives intolerance for kudu.

Intangible Costs from all wildlife species (CI*_ALL)* were also not significant drivers of tolerance for each of the five focal species meaning that tolerance to kudu, hyena, elephant, lion and baboon was not driven by perceptions of intangible costs of living with all wildlife species in the landscape (Fig. 3, Appendix 3).

Tangible Costs for all wildlife species (CT_ALL), including both our five target species as well as all other damage causing wildlife species, were not significant drivers of *Tolerance* for three of the five species examined but it did have a small negative effect for both kudu (β = −0.08, p = 0.04) and baboon (β = −0.01, p = 0.01) meaning that the more damage from all wildlife species in the landscape (in addition to the five focal species, for e.g. hippo, leopard, crocodile, bushpig, monkeys, duiker and porcupine) the less tolerance people have for kudu and baboon. But damage from all these species has no effect on tolerance for elephant, lion and hyena. (Fig. 3, Appendix 3).

3.6. How important are benefits as drivers of tolerance?

T*angible Benefits* were not significant drivers of tolerance for four of the species but there was a small significant effect for kudu in the opposite direction than expected - the more monetary benefits perceived the less tolerance for kudu (β = −0.09, $p = 0.03$) (Fig. 3, Appendix 3). *Intangible Benefits* were significant drivers of *Tolerance* for all species. However, the two separate dimensions of the construct showed different results for different species. *Benefit Intangible* for mankind and nature (BI-man_nat) were significant for three species - hyena (β = 0.15, *p* <

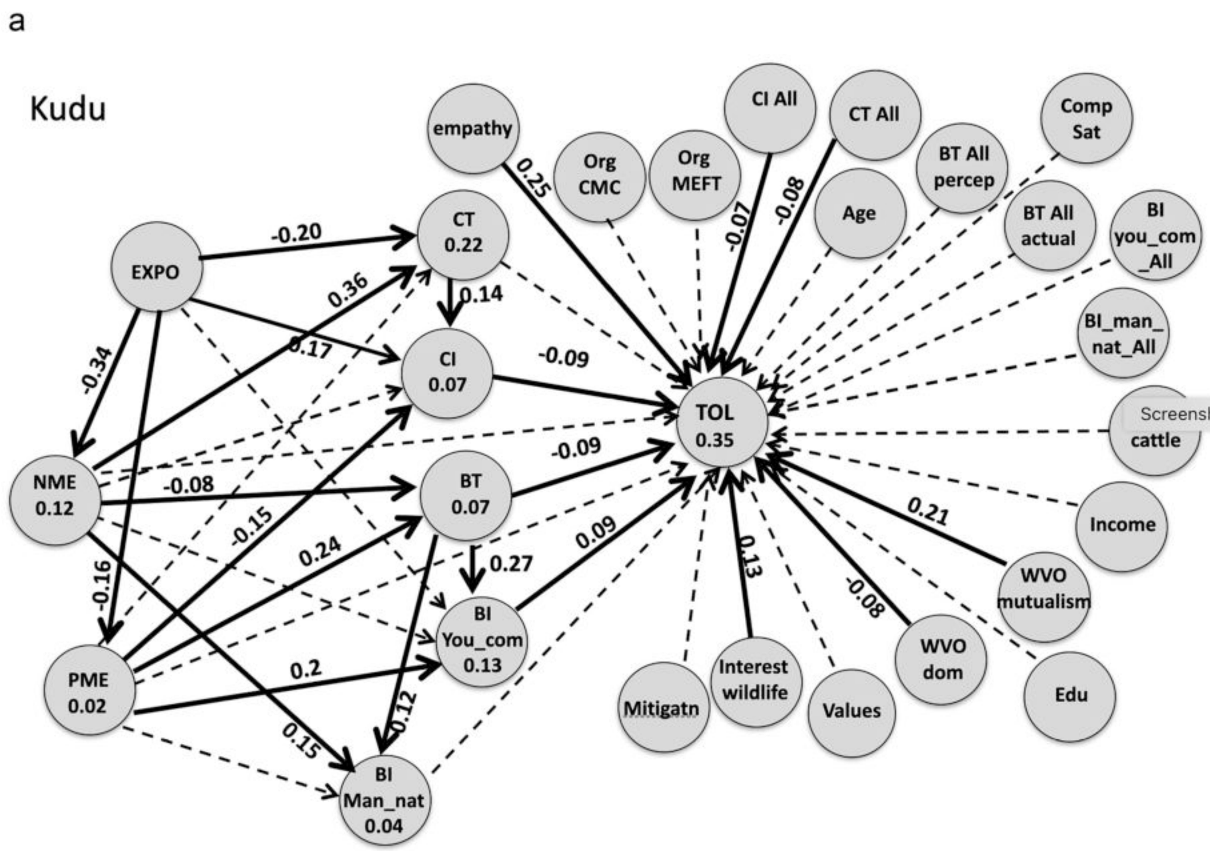


Fig. 3. Path model diagrams showing causal relationships between variables for a) kudu, b) baboon c) elephant, d) lion, and e) hyena. Path models are read from left to right, with the variables on the left (independent variables) predicting the outcome variable on the right. Path coefficients explain the strength of the effect of one variable on another and correspond to standardized betas in a regression analysis. Values of −1 indicate high negative effect, +1 indicate high positive effect. Solid lines indicate significant paths while broken lines indicate non-significant paths. Values in circles indicate R^2 values and values on lines indicate significant path coefficients. More information of on how to interpret the results from SmartPLS can be found at https://www.smartpls.com/documentation.
Expo = exposure, PME = positive meaningful events, NME = negative meaningful event, CT = cost tangible, CI = cost intangible, BT = benefit tangible, BI you_com = intangible benefit for you and your community, BI man_nat = intangible benefit for mankind and nature, WVO = wildlife value orientation, dom = domination, Org = organization, CMC = conservancy committee, MEFT = Ministry of forestry and environment, Comp sat = satisfaction with compensation scheme,

0.01), baboon (β = 0.14, p < 0.01) and lion (β = 0.19, p < 0.01) while *Benefit Intangible* for the respondent and their community (BI_you_com) were significant for two species baboon (β = 0.08, *p* = 0.05) and elephant (β = 0.16, p < 0.01) (Fig. 3, Appendix 3).

T*angible Benefits* were however significant drivers of *Intangible Benefits* for all five species. This was the case for both dimensions of the construct, although the paths were stronger for the *Intangible Benefits* for the respondent and their community (BI_you_com) (avg β = −0.19) than for *Intangible Benefits* for mankind and nature (BI-man_nat) (avg β = −0.30) (Fig. 3, Appendix 3). This means that monetary benefits are indirect drivers of *Tolerance* through their effect on *Intangible Benefits.*

We found *Intangible Benefits* for all species (BI_ALL) were generally not significant drivers of *Tolerance*. However, there was a small significant effect for elephant for the *Intangible Benefits* for the respondent and their community (BI_you_com_ALL) dimension and baboon for the *Intangible Benefits* for mankind and nature (BI-man_nat_ALL) but in the opposite direction than expected - the more monetary benefits perceived from all wildlife species the less tolerance there was for elephant (β = −0.12, p = 0.04) and baboon (β = −0.11, *p* = 0.02)(Fig. 3, Appendix 3).

3.7. How important are sociodemographic variables?

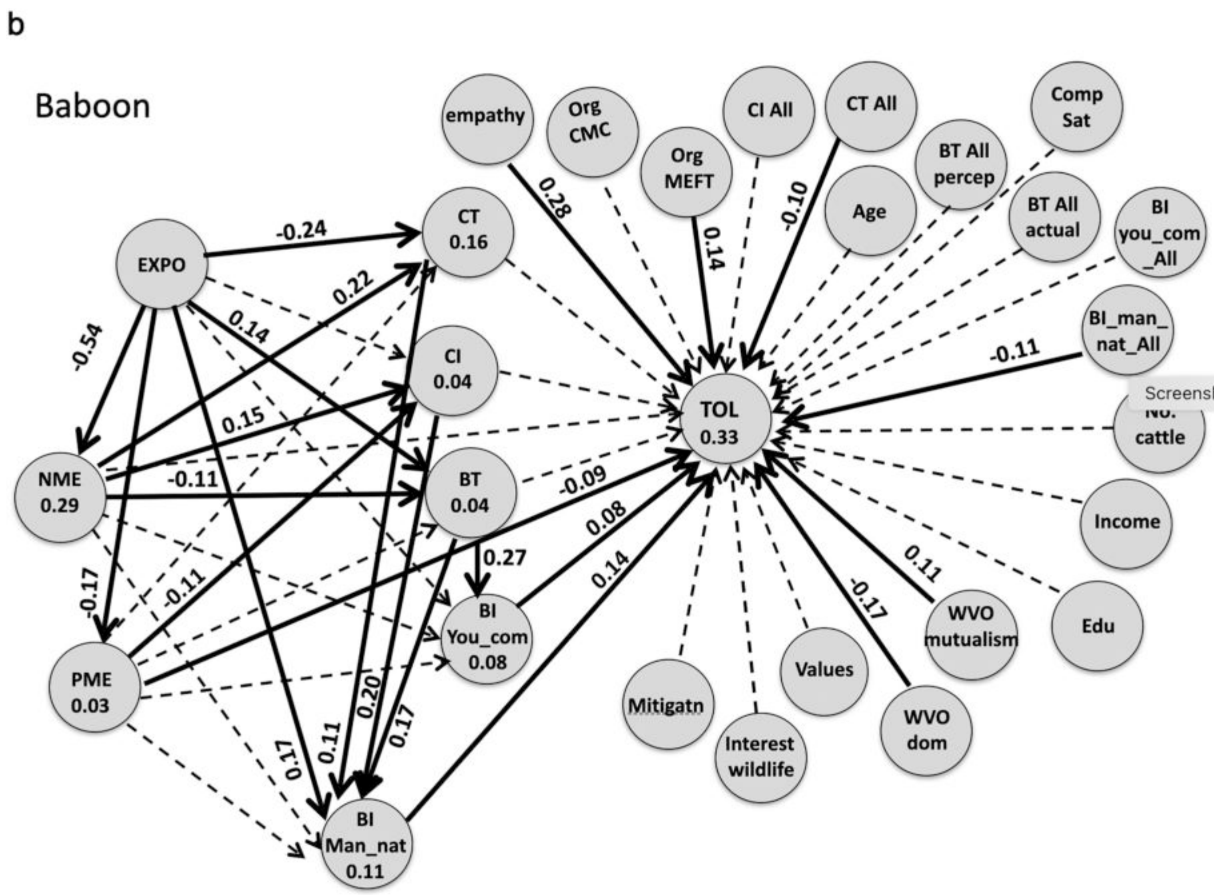
We investigated the effect of age, education level, income from farm activities, income from non-farm activities and number of cattle on tolerance and generally found no significant effect on tolerance for all species. One exception was a for lion where there was a weak negative effect on tolerance meaning the more cattle a respondent had the less tolerant they were of lion (β = −0.11, p = 0.02) (Fig. 3, Appendix 3).

3.8. How important is empathy?

Empathy had a strong positive effect on *Tolerance* for all five species. Kudu had the least effect (β: 0.25) while baboon, elephant, lion and hyena all had path coefficients above 0.35 (Fig. 3, Appendix 3). This confirmed the WTM hypothesis that higher empathy towards a species drives tolerance (Fig. 3, Appendix 3).

3.9. How important are relationships with organizations involved in wildlife management?

In the study area two main organizations are involved with wildlife management- Ministry of Environment, Forestry and Tourism (MEFT) and the Conservancy Management Committee (CMC). The WTM hypothesizes that positive perceptions of organizations involved in managing a species will increase tolerance to a species. We found that at least one of these organizations had a significant effect on tolerance for four of the species but for kudu there was no effect. *MEFT* had a significant weak positive effect on tolerance for baboon (β = −0.14) and lion (β = 0.11) while *CMC* had a significant positive effect for elephant (β = −0.15) and hyena only (β = 0.13) (Fig. 3, Appendix 3).



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3.10. How important are values?

In the WTM we measure values using two different dimensions; 1. Schwartz values (Schwartz, 2012), where we only use the three general environment values, and 2. Wildlife Value Orientations (WVO) (Fulton et al., 1996) which focuses on values towards wildlife and for which there are two main dimensions Mutualism and Domination (see Appendix 1 and discussion for more detail on these). *Mutualism* wildlife values were significant positive drivers of *Tolerance* for baboon ($\beta = 0.11$, $p = 0.03$) and kudu ($\beta = 0.21$, $p < 0.01$) only while *Domination* wildlife values had a medium negative effect on *Tolerance* for all five species (range β: 0.08–0.19) (Fig. 3, Appendix 3).

3.11. Similarities and differences between species

Seventy-nine pathways (32 %) showed similar results for all five species out of the 251 possible relationships between variables in the SEM model. Of these, 25 (32 %) were significant paths and 54 (68 %) were not significant. Of the remaining 172 relationships that did not show similar results for all five species, some showed similar results for four, three or two species and some were unique to a single species (Appendix 3). Overall, there were 100 paths (40 %) across all species that were significant out of all 251 possible relationships.

The pathways that were significant for all five species were: Benefit Tangible to Benefit Intangible man_nature (range $\beta = 0.11$, $p = 0.02$), Benefit Tangible to Benefit Intangible you_community(range $\beta = 0.11$, $p = 0.02$), Exposure to Experience Negative(range $\beta = 0.11$, $p = 0.02$), Empathy to Tolerance (range $\beta = -0.11$, $p = 0.02$) and Wildlife Value Orientation_utilitarian to Tolerance (range $\beta = 0.11$, $p = 0.02$) (Fig. 3, Appendix 3).

The non-significant relationships for all five species were: Cost Tangible to Tolerance, Exposure to Benefit Intangible you_com, Positive Meaningful Event to Cost Tangible, Age to Tolerance, Benefit Tangible_ALL to Tolerance, Cost Tangible to Tolerance, Education level to Tolerance, Income from farm to Tolerance, Income Total to Tolerance Values to Tolerance and Cost Intangible to Benefit Intangible you_com (Fig. 3, Appendix 3).

4. Discussion

The aim of the WTM is to identify a suit of variables that can be applied consistently across case studies to compare tolerance and its drivers (Kansky et al., 2016). Applying the same model in different contexts helps to fill the gap in this field as many studies do not use similar variables or operationalize them consistently thus making a synthesis of tolerance drivers difficult (Kansky and Knight, 2014). Namibia is the ninth case study to apply the WTM. Here 36 % of variation in tolerance was explained by the model. The amount of variation explained in other WTM case studies averaged 50 % (range 30–60 %) (Kansky forthcoming), which is considered good in social science research where human behavior is inherently difficult to explain. Compared to the Zambia case study ($R^2 = 50$ %) the WTM in Namibia had slightly less explanatory power, perhaps because Namibia's CBNRM environment is more complex with more nuanced variables that were not captured within the WTM.

Applying the same model consistently across case studies to compare tolerance and its drivers also enables strategies and policies that target many species rather than species specific management plans to be implemented if similarities exist across these different contexts. This is especially useful in areas of high biodiversity, typically occurring in

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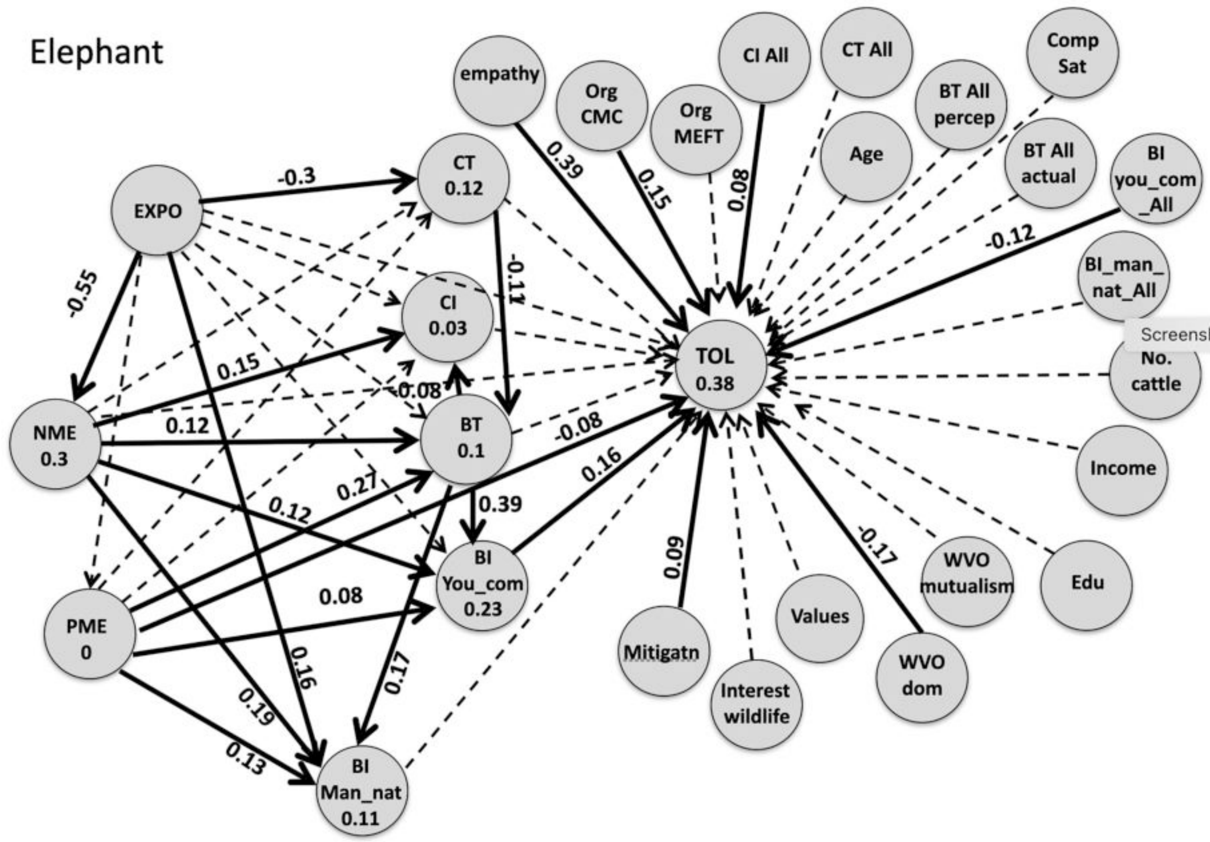

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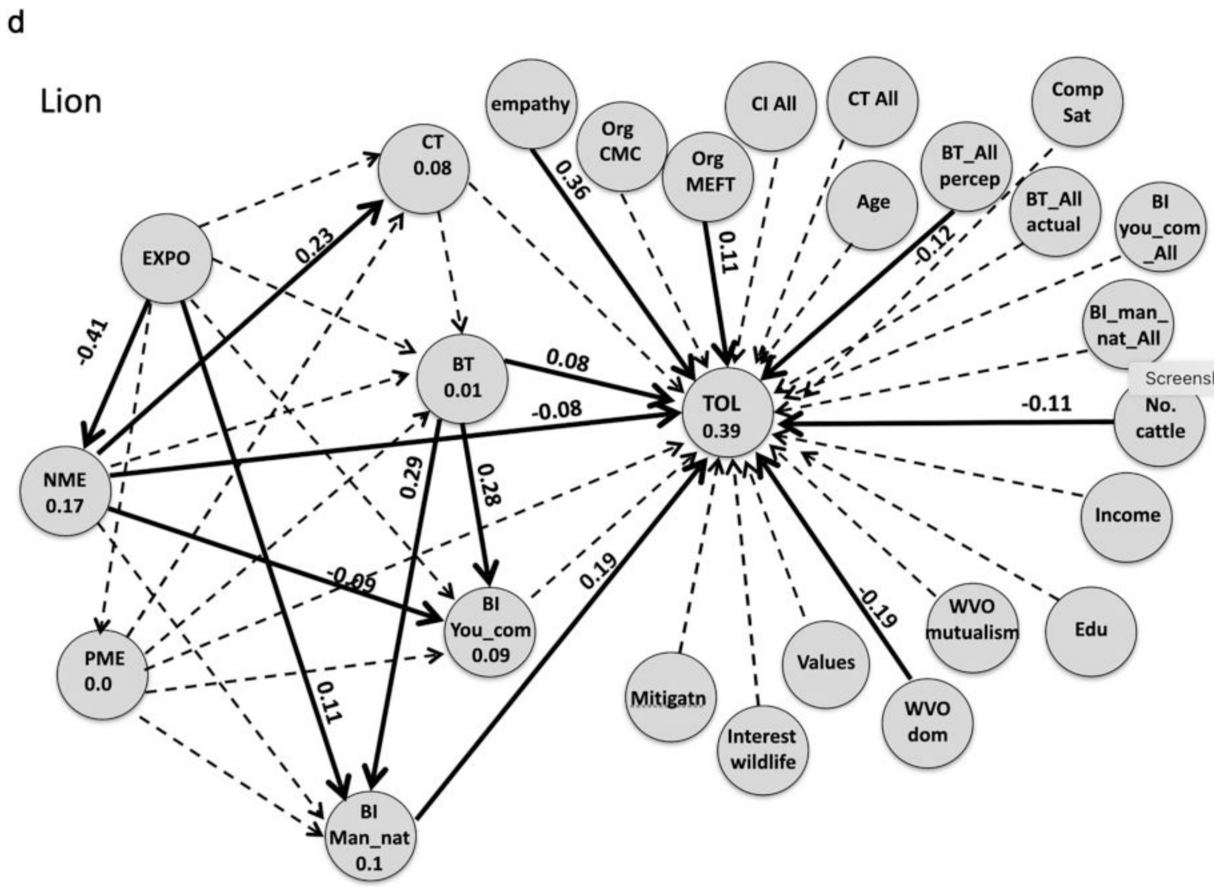
developing countries with few resources to manage wildlife. Although we found that only a small proportion of relationships (32 %) were significant across all five species there were common management recommendations that could be applied across all species, such as increasing empathy and non-monetary benefits and improving relationships with organizations. These results are similar to the other WTM case studies where *Empathy* towards wildlife (four countries for 10 different species) and *Intangible Benefits* were examined (seven countries for 11 species). Both were significant for 90 % of species (Kansky forthcoming, Kansky et al., 2016, Wiseman-Jones, 2018, Van Gelder, 2019, Saif et al., 2020, Marino et al., 2020, Kansky et al., 2021). Thus, in Namibia, Zambia and elsewhere interventions to promote these two variables have the potential to increase tolerance towards many species, even without the existence of monetary benefits. These findings are encouraging considering the decline in the global appetite for utilitarian and consumptive use of wildlife such as trophy hunting.

4.1. Empathy

In our study, similarly to the other WTM studies, empathy had the strongest effect on tolerance compared to other variables. Namibia however presented some of the highest path coefficient values (elephant (0.39), lion (0.36) and hyena (0.35) compared to other case studies (average $\beta = 0.25$, $n = 14$) and were also stronger compared to Zambia for elephant (0.18), lion (0.25) and hyena (0.14), although they were similar for kudu (0.25) and baboon (Zambia: 0.29, Namibia 0.28). Empathy has never been included in tolerance and attitude surveys (Kansky and Knight, 2014) but was included in the WTM because empathy predicts pro-social behavior towards humans (Konrath et al., 2011) and animals (Ruckert, 2016) and increases compassion for animals after being exposed to humane education programs (e.g., www.hecoalition.org) (Aguirre and Orihuela, 2014). Based on the support of empathy as a predictor of tolerance in this and the other WTM studies, two programs were implemented in four conservancies in our study area that aimed to improve HWI and management and included training in Nonviolent Communication (Rosenberg, 2005; Williams et al., 2021). Results showed encouraging improvements in attitudinal and behavioral change in empathy towards wildlife and people (Kansky and Maassarani, 2022; Kansky forthcoming). For example, a female participant reported the following: *"I didn't value animals before the workshop, but I learnt about their needs and now I love watching them and appreciate them. Even when the elephants come and people chase them I say no I want to watch them. For example, this year the elephants came past our village and people wanted to chase them. So I advised them to just leave them and then they just listened to me and watched the elephants go by and enjoyed them."* And a male participant reported: *"Last year in November we found baboons stuck with no water at the riverside while I was camping with the game guards doing their patrols. We were camping and the river was dry so we put water in a small container and gave it to them. They were so weak so we gave them every day, three of them and one young one. The young one we kept at the camp and fed it and when it was strong we released it. R: What would you have done in the past? B: in the past we wouldn't have done that as we know it destroys our crops. But now we know baboons also help us for example by eating scorpions. R: Now when they raid crops what do you do? B: Now we chase them and guard our field. Before we would put chili in maize cobs and when they got chili in the eyes we would hammer them, beat them and kill them. We didn't eat the baboons. But now I can't do that, now it's very difficult for me to kill anything. After the training I realised we are killing innocent beings, that they are just looking to meet their needs. It is us as humans who can use different ways to meet our needs but the animals are just trying to live*



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their life". Such programs therefore offer great potential to be applied more widely (Kansky forthcoming) to increase tolerance, especially in cases where no monetary benefits are available such as in Zambia.

4.2. Benefits

The WTM distinguishes between *Tangible* and *Intangible Benefits* from wildlife. Tangible refers to benefits that have a monetary value such as salaries, bursaries, or cash whereas *Intangible Benefits* are the non-monetary benefits people perceive from wildlife such as the positive emotions from living with wildlife, cultural value, meaning, learning or spiritual value. This distinction was made based on differences in their importance as drivers of tolerance in a meta-analysis where intangible benefits were more significant than tangible benefits (Kansky and Knight, 2014). Benefits are measured in few studies (Kansky and Knight, 2014 (16 %), Lozano et al., 2019) and distinctions between monetary and non-monetary benefits are not usually made (Kansky and Knight, 2014). The Namibian case study, similarly to three other WTM case studies where monetary benefits were available (Italy, Uganda and India) found no significant effect of *Tangible Benefits* on *Tolerance* in 75 % of cases, in contrast to *Intangible Benefits* where it was significant in 90 % of cases with path coefficients ranging from 0.16 to 0.69 (baboons: South Africa, Zambia, Uganda; chimpanzees: Uganda; langurs: India; elephants: Bangladesh, Zambia, Uganda; lion: Zambia; leopard: India; hyena: Zambia; wolves and bears: Italy; kudu: Zambia; cobra: India (Kansky forthcoming, Kansky et al., 2016, Wiseman-Jones, 2018, Van Gelder, 2019, Saif et al., 2020, Marino et al., 2020, Kansky et al., 2021). These findings confirm the importance of distinguishing between these two dimensions of benefits and have potentially important management implications - significant monetary benefits require a focus on commercialization of a species while non-monetary benefits require focus on educational or positive experiential experiences.

However, based on our findings of the significant relationship between *Tangible* and *Intangible Benefits* in Namibia, which were not examined in the other WTM studies, we caution against these implications. In contrast to Störmer et al., 2019, who found both tangible and intangible benefits from wildlife in Namibia to promote positive attitudes towards wildlife, in our study *Tangible Benefits* was not a significant driver of *Tolerance* for all five species. However, there was a significant path from *Tangible Benefits* to *Intangible Benefits* for both intangible benefit dimensions (Fig. 3). This suggests that monetary benefits can increase tolerance indirectly through "crowding in" *Intangible Benefits.* Motivation Crowding Theory (Frey and Jegen, 2001), where monetary incentives "crowd in" or reinforce the intrinsic valuation of these species also explained higher tolerance of Namibians compared to Zambians for some species (Kansky et al., 2020). This suggests that the current focus of Namibian CBNRM wildlife policy on procuring monetary benefits from wildlife is likely to have a positive effect on tolerance into the future, if most members perceive these benefits. This is not however always the case. Firstly, because there is variation in the ability of conservancies to generate income (Humavindu and Stage, 2015, Nattrass, 2020, Stoldt et al., 2020). Secondly, the number of recipients is too large for the amount of income generated resulting in little and unequal impact at the household level (Scanlon and Kull, 2009, Snyman, 2014, Salerno et al., 2020, Stoldt et al., 2020, Thomsen et al., 2022) and this skew is likely to increase with population growth and climate change (Jirren et al., 2021; Salerno et al., 2021). Thirdly, the off-take rate of wildlife is presumably at its maximum leaving little scope to increase revenue through increasing trophy quotas - the main source of income for many Namibian conservancies (Naidoo et al., 2016a, 2016b, 2016c). Fourth, due to challenges in governance accountability, benefits do not reach everyone (Schnegg and Kiaka,

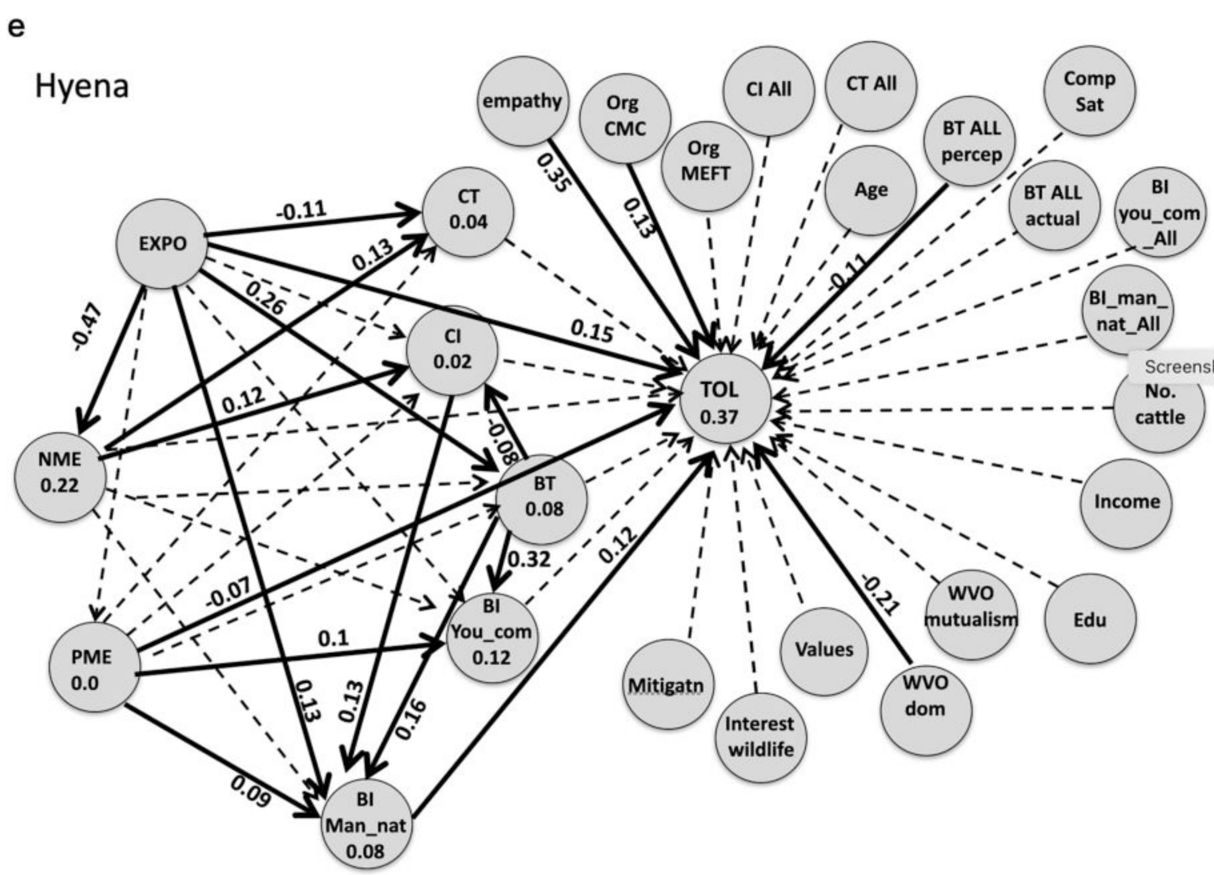

Fig. 3. (*continued*).

2018; Kansky, 2022). Given these challenges, perhaps the best approach would to focus on increasing *Tangible Benefits* through reducing governance challenges to ensure more equitable benefit distribution (Kansky, 2022), reducing poaching to allow an increase in hunting quotas (Naidoo et al., 2016a, 2016b, 2016c; Thomsen et al., 2022), increasing monetary income through non consumptive projects such as tourism, and at the same time implementing programs to increase perceptions of I*ntangible Benefits* and *Empathy*, for example such as the one described in Kansky and Maassarani (2022). In this program training in Nonviolent Communication combined with discussions about the non-monetary values of wildlife promoted attitude and behavior change towards wildlife. New ideas for increasing non consumptive monetary income for communities are also emerging such Payment for Ecosystem Services schemes (Dickman et al., 2011; Gross et al., 2021; Rakotonarivo et al., 2021), and a basic income to pay communities as custodians of wildlife and share the burden of conservation (Buscher and Fletcher, 2019; Ron, 2022).

Comparing path coefficients between Zambia, Namibia and the other WTM case studies, the path coefficients of Intangible benefit to Tolerance were weaker in both Zambia and Namibia (average $\beta = 0.18 \pm 0.08$) compared to the other case studies (Avg $\beta == 0.44 \pm 0.13$). One possible reason for this is the utilization focus of wildlife CBNRM in southern Africa (Child, 2019). Path coefficients for Zambia (range $\beta =$ 0.16–0.27) were however higher than those in Namibia (range $\beta =$ 0.08–0.19). In Namibia we also found that the construct had low reliability and needed to be split into two sub dimensions: i) benefits for you and your community and ii) benefits for mankind and nature. In addition, these two dimensions were not always significant for all species (Fig. 3). This suggests that this concept is more nuanced and needs to be further unpacked in the Namibia context.

4.3. *Wildlife value orientations*

Wildlife Value Orientations (WVO) (Fulton et al., 1996) are general patterns of basic beliefs that give direction and meaning to fundamental values in the context of wildlife. Two dimensions are measured - Mutualistic and Domination. Domination values see wildlife as primarily for human use and benefit while Mutualism values reflect an egalitarian ideology of social inclusion and equality that extends to animals. They view wildlife as part of an extended family deserving of rights and care (Jacobs et al., 2014). WVO predict many positions towards wildlife, for example domination values predict support for lethal wildlife management while mutualistic values predict support for welfare-enhancing behaviors for individual wildlife (Jacobs et al., 2014).

In other WTM studies measuring WVO half of studies found significant effects of WVO on tolerance (Kansky forthcoming), but no significant paths were found in the Zambia case study. Therefore, Namibia was unusual in that domination values were significant for all five species. Given Namibia's CBNRM program is designed for utilization of wildlife for human benefits, perhaps these results are not surprising. While CBNRM in Zambia is also designed for wildlife utilization, the fact that Zambians didn't get any tangible benefits from wildlife at the time of our study (Kansky et al., 2020) may explain the lack of an effect of these utilitarian values. While it is generally accepted that personal values are slow to change, if at all, (Manfredo et al., 2017; Horcea-Milcu et al., 2019), the social learning programs we have implemented in Namibia suggest that it may be possible to reduce the strength of domination values and this shift can persist after at least one year (Kansky forthcoming).

4.4. *Reducing exposure*

The WTM hypothesizes that exposure to problematic wildlife species generally has a negative effect on tolerance, with costs and benefits having a mediating effect. In general, WTM case studies have shown exposure to be significant in only 50 % of cases with a general negative effect meaning that where it is significant, more exposure leads to more costs and less benefits (Kansky forthcoming). The Namibia and Zambia case studies followed a similar trend suggesting that reducing the frequency of seeing a species in the fields or in a village can lead to increased tolerance indirectly, through reducing negative experiences and costs and increasing benefits (Fig. 3). However, achieving this would not be easy in the context of the Zambezi Region (Namibia and Zambia) due to the nature of the mixed-use landscape and the need for wildlife corridors and access to rivers for both people and wildlife as part of KAZA goals. Long-term spatial planning (Songhurst et al., 2016) together with assistance with mitigation measures (Gross et al., 2021; Kansky, 2022) may therefore be the only viable long-term strategy. Our research in the region has reported that while in general policies promote spatial planning and applying mitigation measures, in practice there is much room for improvement (Kansky, 2022; Kansky forthcoming).

4.5. *Reducing negative experiences and increasing positive experiences*

The WTM hypothesizes that positive or negative meaningful experiences could drive tolerance through the mediating effects of costs and benefits (Fig. 1). Meaningful experiences are defined as emotionally charged experiences (positive or negative), which may have occurred at any time during an individual's lifetime. In other WTM case studies, like Namibia, experiences are significant in around 50 % of cases. Despite this partial effect, in Namibia reducing the number of negative meaningful experiences (NME) could indirectly increase tolerance to kudu, lion, baboon, and elephant while increasing the number of positive meaningful experiences (PME) could increase tolerance towards kudu, baboon, elephant and hyena through various significant paths (Fig. 3). Similar results were reported for the Zambia case study (Kansky et al., 2020). We did not ask what these experiences were during the surveys, but we did learn about these during a follow up Social Learning program in Namibia (Kansky, 2022; Kansky and Maassarani, 2022). We learned that community members have very little knowledge and have received no training on how to behave when encountering wildlife as they go about their daily activities. They also receive little support in implementing mitigation measures to prevent wildlife impacts and negative incidences while protecting their fields (Kansky, 2022). Therefore, interventions to provide training and support to reduce negative encounters are urgently required. After implementing a Social Learning program in the area to improve human-wildlife coexistence in 2019 participants reported feeling safer and more competent in dealing with wildlife. One year after the program these effects had persisted and in one conservancy implementing mitigation measures reduced damage claims by 30 % (R.K unpublished data). Programs to increase knowledge and reduce risk perceptions have also been shown to be effective for coyotes (Sponarski et al., 2016).

4.6. *Promoting trust and communication with external organizations*

The WTM examines five relational aspects of perceptions of organizations - trust, skills and knowledge, general performance and communication with community. While most other WTM studies have included this construct in surveys, sample sizes are often insufficient to include it in path models because not all organizations are equally known by respondents. However, in both the Zambia and Namibia studies where it was possible to examine this effect, there were mostly significant positive effects highlighting the importance of this variable. In Namibia, where two organizations were sufficiently widely known to have a sufficient sample size to examine this effect, we found that although perceptions of different organizations were important for four species (baboon, elephant, lion, hyena) different organizations were important for different species. Higher performance perceptions of MEFT resulted in higher tolerance for baboon and lion while higher evaluation of the CMC resulted in higher tolerance for elephant and hyena. It is not immediately clear the reasons for these differences other than highlighting the finding that relationships with organizations do matter and therefore should be nurtured as reported in other studies as well (Rakotonarivo et al., 2021; Slagle et al., 2022). In a follow up Social Learning program in Namibia (Kansky, 2022) many of these governance challenges with the CMC and MEFT emerged and can help inform where improvement in needed. Namibian path coefficients were slightly weaker (range $\beta = 0.11–0.15$) compared to those from Zambia (range $\beta = 0.22–0.26$), We noticed that in Zambia relationships with the Zambian Wildlife Authorities was particularly negative compared to Namibia and this may explain the stronger effect.

5. Conclusions

Understanding the factors that enable or hinder human tolerance is critical in the face of the many challenges that communities face in sharing landscapes with wildlife, especially in mixed-use areas where both people and wildlife struggle to survive and thrive. While many studies have examined numerous variables as potential drivers of tolerance, progress is hindered by a lack of systematic syntheses of these studies. The Wildlife Tolerance Model is one attempt to provide a framework based on a systematic synthesis of this large body of work with nine case studies and 12 wildlife species studied to date, including this study in Namibia. Similarly, to findings from other case studies, *Empathy,* and perceptions of *Intangible Benefits* from a species emerged as consistent drivers of tolerance for a variety of species. In CBNRM programs monetary benefits are presumed to promote tolerance for wildlife however we found no direct influence of monetary benefits in driving tolerance. Rather, we found an indirect effect where monetary benefits “crowd in” non-monetary perceptions of wildlife, meaning that tolerance could be increased indirectly through monetary benefits. At the same time and contrary to most other WTM studies we found that domination wildlife value orientations had a negative effect on tolerance meaning that people who see wildlife mostly as serving the needs of people have a lower threshold for accepting potential wildlife costs. Because increasing monetary benefits for wildlife is challenging in Namibia and due to the negative effect of domination values on tolerance, perhaps the best avenue for increasing tolerance is therefore to focus on increasing empathy and non-monetary benefits of wildlife. In the case of Zambia and other areas where the potential for raising revenue from wildlife is low, these findings are encouraging as it suggests that tolerance could potentially be promoted without the need for monetary benefits. Social Learning programs such as those we have applied in Namibia involving Nonviolent communication (Kansky and Maassarani, 2022; Kansky forthcoming) as well as specific communication programs (Slagle et al., 2013) show promising results for increase empathy and the intrinsic value of wildlife and nature. At the same time perceptions of trust, competence and communication of organizations working with conservancies were also predictors of tolerance for all five species in both Namibia and Zambia. Training in Nonviolent communication also shows promise for achieving this and therefore could pay a double dividend. These results as well as those from other WTM studies suggest that despite few common drivers of tolerance between species and contexts, as well as the lack of monetary benefits in many cases, there are management options that can be applied across these different case studies, meaning that species specific policies and plans are not always necessary. Lastly, this and other WTM studies highlight the importance of separating the two dimensions of benefits- monetary and non-monetary. Finally, managing HWC and coexistence is complex with many factors and approaches emerging to tackle the problem (Marchini et al., 2019; IUCN, 2020; König et al., 2020; Pooley et al., 2020). We see understanding tolerance and its' drivers as one component of this complexity. The WTM is one more tool in our toolbox that can be applied to unpack this complexity in a systematic way to see what factors are consistent across a range of species and contexts.

CRediT authorship contribution statement

Ruth Kansky: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Writing – original draft. **Martin Kidd:** Formal analysis.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Ruth Kansky reports financial support was provided by Volkswagen Foundation.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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