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REVIEW

A scoping review of academic papers on human–lion conflict in Africa

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Abstract

Adopting a scoping review method, we examined peer-reviewed academic papers published about human–lion conflict (HLC) (including coexistence) and identified knowledge gaps. We searched papers published between January 1981 and December 2023 using academic databases, with the key terms African lion, human–lion conflict, human–lion coexistence, and human–lion interaction. This produced 485 records, reduced to 137 after using additional criteria. Ninety-eight papers were focused on lions in Kenya, Tanzania, Zimbabwe, and Botswana. Ten pan-African studies were identified in our review. Our inductive analysis identified four themes related to HLC: attitudes and perceptions toward lions, causes of HLC, consequences of HLC, and mitigating HLC. Some limitations identified in systematic reviews of human–wildlife conflict have been addressed in recent years, such as broadening the geographical scale of research. However, some knowledge gaps remain, including a lack of assessment of mitigation strategies and studies on climate changes impact on human–lion conflict. Addressing the knowledge gaps highlighted in this review will require diversifying the disciplinary composition of the research teams and increasing researcher reflexivity.

KEYWORDS

African lion, coexistence, human–lion conflict, indigenous knowledge, interdisciplinarity, knowledge gaps, scoping review

1 | INTRODUCTION

Wild African lions (*Panthera leo*) are estimated to be between 20,000 and 25,000, comprising 62 free-ranging populations across 25 countries, having been extirpated from 92% of their historic range (Nicholson et al., 2023). The International Union for Conservation of Nature (IUCN) reported a 43% decrease in numbers between 1993 and 2014 (Bauer et al., 2017), with the situation being particularly dire in West and Central Africa (Nicholson et al., 2023). These alarming statistics occur amid a growing African human population (United Nations, 2022). While numerous factors contribute to this decline, perhaps "the most important are indiscriminate killing in defence of human life and livestock, habitat loss, and prey base depletion" (Bauer et al., 2015, p. 2. see also Bauer et al., 2022). As a result, there has been a surge in academic research focused on understanding and mitigating human–lion conflict (HLC) since the turn of the 21st century.

Accelerated interest and publications about human–wildlife conflict (HWC) have led to systematic reviews of this literature. Some have identified conflict mitigation strategies that are particularly effective. Khorozyan and Waltert's (2019) review of 117 published cases across 23 countries representing North and Latin America, Europe, Africa, Australia, and Asia, mitigating human conflict with 21 predators (including lions) concluded that physical deterrents, electric fences, guarding animals, and calving control were the most effective strategies for mitigating conflict. Holland et al.'s (2018) systematic review of 186 publications (1991–2014) on human and five species of big cats (including lions) conflict reports an emphasis on assessments of the extent of conflict, the impact it has on livestock, and favored mitigation strategies (livestock management). Seoraj-Pillai and Pillay's (2016) global review found that most HWC studies are based in Africa and concern conflict between commercial farmers, lions, and leopards. Hoffmann and Montgomery's (2022) assessment of published research on human–carnivore conflict (HCC) in Sub-Saharan Africa reveals a taxonomic bias for lions. They argue that this focus on lions detracts conservation efforts from the less charismatic but more problematic spotted hyena (*Crocuta crocuta*). Reviews also report absent and underdeveloped areas research including the cultural and psychological aspects of conflict, evaluation of conflict mitigation interventions, an integrated approach incorporating all stakeholders, an eco-centric approach, and that work is often conducted at an inappropriate local scale to support the broad claims made (Bodasing, 2022; Hoffmann & Montgomery, 2022; Holland et al., 2018; Montgomery, Hoffmann, et al., 2018; Seoraj-Pillai & Pillay, 2016). Where reviews of published work specifically on HLC have been conducted, they have highlighted two main issues: a lack of interdisciplinarity among researchers (Montgomery, Elliott, et al., 2018) and the underrepresentation of Black, African, and women researchers (Bauer et al., 2019).

We recognize the valuable insights from previous reviews as they provide helpful context for the current paper. However, to understand HLC work comprehensively, we need to conduct a qualitative exploration not covered in these existing reviews. A scoping review methodology adopts an inductive approach to explore the focus of previous researchers, identify any notable gaps in current thinking and practice, and determine if the findings of previous reviews on HWC and HLC have been addressed. We aim to provide an up-to-date road map for future research and resources.

2 | METHOD

Scoping reviews effectively identify the main aspects and areas of knowledge that require further research. They allow for extracting key themes and gaps within a specific field of study (Munn et al., 2018). To conduct a scoping review, we followed the 5-stage framework for scoping reviews developed by Arksey and O'Malley (2005, p.22) while considering the revisions made by Levac et al. (2010) and Peters et al. (2020).

Stage 1: Identify the research question(s): Two key research questions informed the literature review: (i) What is known from published academic research articles about human–African lion conflict and coexistence in Africa, and (ii) What are the knowledge gaps?

Stage 2: Identify relevant studies: To capture multidisciplinary research articles, we searched the following databases: ProQuest, PsychInfo, Academic Search Complete, IngentaConnect, DOAJ, PubMed, Wiley, GFMER, OVID, PLoS, Materials Science, Nursing & Allied Health, Cambridge, and ScienceDirect. Boolean connectors (AND, OR) were used to combine search terms for ANY field: African lion AND human–lion conflict, OR African lion AND human–lion coexistence, OR African lion AND human–lion interaction. The search period was from January 1981 to December 2023, with 1981 being the earliest research publication on human–lion conflict (later excluded based on criteria in Table 1). This produced 485 records, then subjected to a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) scheme (Figure 1).

Stage 3: Study selection: We used preliminary inclusion and exclusion criteria to identify 154 relevant records. The authors then read these papers and independently scrutinized them to remove duplicates and ensure relevance to the research questions. The focus of the research article had to include African lions, resulting in 137 records for analysis.

Stage 4: Charting the data: We charted the data by reading all 137 papers and documenting the author(s), year and title of publication, keywords, study location, methodology, findings/outcomes of the study, and recommendations.

TABLE 1 Preliminary inclusion and exclusion criteria.

Included	Excluded
English publication in a peer-reviewed journal	Non-English publication
Research article	Gray literature, including newspaper and project reports
Full paper accessible	Full paper not accessible
Published between January 1981–December 2023	Books/book chapters/book reviews
	Previously published systematic reviews
	Opinion/Commentaries
	Asiatic lions

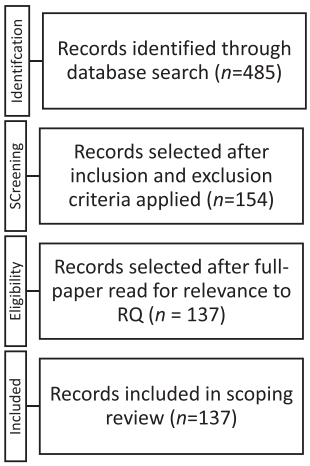

FIGURE 1 PRISMA flow diagram of selection of studies.

Stage 5: Collating, summarizing, and reporting the results: The research team discussed and agreed upon the main themes. We sorted the papers into four broad, overlapping key themes using an inductive approach. Although many papers could fit into multiple themes, we categorized them once based on their primary research question (if identified) or focus.

A complete list of papers and themes can be found in S1. The four themes were:

i. Attitudes and perceptions
ii. Causes of HLC
iii. Consequences of HLC
iv. Mitigating HLC

3 | RESULTS

3.1 | Geographic location of study and researchers

Out of the 137 papers reviewed, 98 studies focused explicitly on HWC, including HLC, in Kenya (35), Tanzania (31), Zimbabwe (17), and Botswana (15) (Table 2). Ten Pan-Africa studies are represented in this cohort from 2013 and have markedly increased since 2017.

3.2 | Attitudes and perceptions (33 papers)

Since 2007, 33 papers have been published on attitudes and perceptions toward lions. Assessing and potentially changing attitudes is key to understanding and modifying behavior.

TABLE 2 African country on which human–lion conflict papers were based and number.

Country	Number of papers
Kenya	35
Tanzania	31
Zimbabwe	17
Botswana	15
Namibia	9
Ethiopia	7
Cameroon	4
Cote d'Ivoire	2
Mozambique	2
South Africa	2
Zambia	2
Benin	1
Uganda	1

Most have centered on the negative attitudes of farmers and local communities adversely impacted by lions' presence (real or imagined). However, some research exists on the attitudes of government workers and commercial operators (Hemson et al., 2009; Van der Meer & Dullemont, 2021).

Various individual and socioeconomic factors influence attitudes toward lions: age, education, ethnicity, gender, location, size of family and farm/homestead, number of livestock owned and lost, past experiences with lions, previous attempts to mitigate HLC, and perceived/actual costs and benefits from lions (Aglissi et al., 2023; Dickman et al., 2014; Gayo et al., 2021; Gebo et al., 2022; Hazzah et al., 2009, 2013; Jacobsen et al., 2020, 2022; Romañach et al., 2007; Shibru et al., 2023). Fear, culture, politics, religion, access to Protected Areas (PAs), human resettlement and human–human conflict (HHC) (Bencin et al., 2016; Dickman et al., 2014; Gebresenbet, Baraki, et al., 2018; Hazzah et al., 2009; Hazzah et al., 2013; Hazzah et al., 2017; Hazzah & Dolrenry, 2007; Heydinger et al., 2019; Jacobsen et al., 2020; Kimaro & Hughes, 2023; Laverty et al., 2019; Western et al., 2019), aesthetic value and peer pressure (Mitchell et al., 2019), stories and gossip (Sibanda et al., 2020), the efficacy of mitigation measures such as predator-proof bomas (LeFlore et al., 2020), community bylaws (Borgerhoff Mulder et al., 2019), and community programs such as the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) (Sibanda et al., 2020) are also shown to shape attitudes to lions, positively and negatively. Additionally, Dickman et al. (2014) report "contagious

conflict," noting that perceptions and attitudes to one species influence those held by others.

Some studies observe how attitudes are influenced by the misrepresentation and dramatization of HLC by local and international media (Hahn, 2019), government (Heydinger, 2021), and culture (Fellous-Djardini et al., 2023) to serve political interests. Furthermore, Hazzah and Dolrenry (2007) acknowledge that the actions of conservationists and relief agencies can have long-term negative consequences for attitudes and behaviors around HLC. More recently, Kimaro and Hughes (2023) investigated pastoralists' attitudes toward lions, crop farmers, a conservation NGO (Ruaha Carnivore Project) and wildlife authorities, documenting how perceptions of risk, mistrust, powerlessness, and marginalization from benefit-sharing can influence these.

While studies assume that attitudes are an insight into behavior and behavior change, an experimental game study found that attitudes had little influence on hypothetical decisions made by stakeholders regarding the choice of lethal or nonlethal conflict mitigation strategy (Sargent et al., 2022).

Recommendations for improving attitudes and behavior toward lions include embedding local values in plans to coexist (Hazzah et al., 2013, 2017) and the intervention of local councils (Musiwa & Mhlanga, 2020). While conservation education was often suggested as a tool for changing attitudes and behaviors (Gebresenbet, Bauer, et al., 2018; Jacobsen et al., 2020; Lagendijk & Gusset, 2008; Lindsey et al., 2013), it was rarely designed, executed, evaluated, and published. An exception is Western et al. (2019), who assess conservation education's impact on attitudes in Kenya, Tanzania, and Zimbabwe. They found that attitudes to preserving lion populations were positively associated with personal benefits.

3.3 | Causes of human–lion conflict (34 papers)

The causes of human–lion conflict have been studied in 34 papers. Between 2001 and 2022, the attribution of cause widened considerably.

Research published between 2000 and 2005 includes attempts to identify characteristics of "problem lions" who attack humans. The "infirmity hypothesis" suggests that age, injury, or illness makes lions more likely to attack humans. Lion attacks on humans are thought to be caused by dental problems, according to studies in Kenya (Peterhans & Gnoske, 2001) and Tanzania (Baldus, 2006). However, Patterson et al. (2003) argue that this hypothesis tends to be attributed post hoc based on anecdotal evidence. Additionally, research in Kenya (Woodroffe & Frank, 2005) and Cameroon (Bauer & De Iongh, 2005) revealed that young male lions are the primary culprits in attacks on livestock.

Over time, research into the causes of HLC has evolved to explore the interplay between lions, humans, and the environment. Within this complex network of causal relationships, studies report that lions are more likely to attack livestock when livestock are away from a homestead, unattended and close to a Protected Area (Kuiper et al., 2022; Kushnir et al., 2014; Sogbohossou et al., 2011; Van Bommel et al., 2007), at night (Patterson et al., 2004), during the day (Kissui, 2008), next to a river (Abade et al., 2014), are accessible (Kuiper et al., 2022), wear bells (Loveridge et al., 2017), and unhorned (Weise et al., 2020). Other causal factors include dry (Schiess-Meier et al., 2007; Weise, Fynn, et al., 2019) or wet seasons (Kolowski & Holekamp, 2006; Kuiper et al., 2015), drought (Mukeka et al., 2020), presence of bush pigs (Packer et al., 2011), depletion of wild prey-base (Abade et al., 2020; Dunham et al., 2010; Khorozyan et al., 2015; Wood et al., 2021), low Normalized Difference Vegetation Index (NDVI) (Mpakairi et al., 2018), low elevation and tree cover (Abade et al., 2014), high vegetation productivity (Beattie et al., 2020), and forested areas (Dunnink et al., 2020). In Tanzania, lions are retaliated against because they openly defend their kills from humans (Kissui, 2008). Poor husbandry practices also contribute to conflict (Weise et al., 2020; Weise, Fynn, et al., 2019).

Some studies distinguish between lion killing that occurs as a demonstration of cultural values and practices (*Olamayio*) and that which is retaliation for lion predation of livestock (*Olkiyio*) (Hazzah et al., 2009). According to Goldman et al. (2013), the primary motivation for killing lions in Kenya is o*lamayio*, whereas in Tanzania, it is retaliation for livestock loss. However, these two explanations can be conflated, as lions killed in retaliation for livestock predation can be celebrated as o*lamayaio* (Ikanda & Packer, 2008). In Tanzania, Fitzherbert et al. (2014) explore the Sukuma's cultural practice of dancing to celebrate killing a lion in retaliation for livestock predation. In return, the dancer receives money in gratitude. This, they argue, encourages killing lions for money in the absence of a predation event. Lions can also be killed in retaliation against local authorities who are accused of marginalizing the Maasai from decision-making, negatively impacting their livelihoods (Hazzah et al., 2009). Namibia's government declaration that lions are the most problematic animals for livestock predation drives farmers to shoot them (Tavolaro et al., 2022).

Recommendations for mitigating HLC are presented in this published work. They include identifying high-

risk areas (Mpakairi et al., 2018), implementing safe practices to find lost livestock, and creating HLC incident databases (Western et al., 2021). Improving livestock husbandry (Loveridge et al., 2017; Schiess-Meier et al., 2007) and education (Sogbohossou et al., 2011) are also suggested. Restoring wild prey base populations (Khorozyan et al., 2015) and keeping lions and livestock separated by establishing alternative water and feeding stations for livestock (Beattie et al., 2020) may also be effective in limiting the likelihood of HLC.

The advancement of methodological techniques enables researchers to map and model the multiple causes of HLC, revealing complex relationships and risks. Older work has tended to focus on the causes of HLC after the event, but more recent work is beginning to predict it. For example, recent research includes climate change as a causal factor for exacerbating HLC in the future (Durant et al., 2022). Trouwborst and Blackmore's (2020) review of international wildlife law and its (in)ability to withstand climate change is a positive step toward planning for wildlife movement across borders and beyond their historic range.

3.4 | Consequences of human–lion conflict (34 papers)

Thirty-four papers examined the consequences of HLC. Most of this work focuses on the impact of HLC on lion populations and behavior, but some studies consider the consequences for people, livestock, and other species.

Some of the research explored in this review concerns physical and fatal attacks on humans (Packer et al., 2005; Yamazaki & Bwalya, 1999), including an analysis of a lion bite to reveal disease carried by wild lions (Prayson et al., 2008). One paper concerns an assessment of the impact of retaliatory lion killing on trophy hunting harvests, concluding that it is negligible (Packer et al., 2011). People also face economic hardship due to livestock predation by lions (Mhuriro-Mashapa et al., 2018; Muriuki et al., 2017). However, there are documented positive consequences of coexistence with lions. Schoe et al. (2009) observe the practice of "human kleptoparasitism" in Cameroon, where humans displace lions from wild prey kills to steal their meat. Domínguez-Rodrigo et al. (2022) cite evidence of this practice in Tanzania almost 2 million years ago. However, reports on the practice remain scant, which is unfortunate as benefiting from lions in this way could be pivotal in changing attitudes and behaviors favoring coexistence (Schoe et al., 2009).

The impact of HLC on livestock receives limited attention in the literature. Where they do exist, the focus is on livestock's stress response due to predator unawareness (Beck et al., 2020; Weise, Hauptmeier, et al., 2019). However, some positive consequences of the presence of lions have been reported. Miguel et al. (2017) found that the transmission of foot-and-mouth disease from buffalo to cattle was reduced as buffalo avoided areas where lions were present.

Numerous studies have been conducted to explore the negative impact of human–lion conflict (HLC) on wild lion populations. These studies highlight the adverse effects of anthropogenic activities such as poaching, the presence of snares, and the hunting of wild prey and lions on populations in and around PAs (Aglissi et al., 2023; Banda et al., 2023; Becker et al., 2023; Green et al., 2018; Montgomery et al., 2023; Mwampeta et al., 2021; Packer et al., 2011; Yirga et al., 2014) and across Africa (Nicholson et al., 2023). The disproportionate retaliatory killing of young males affects pride structure, dynamics, and (in)breeding (Trinkel et al., 2017) and the size and tenure of male coalitions (Felix et al., 2022). However, Western et al. (2022) found that two communal areas in Kenya had a higher density of lions than expected, indicating that effective HLC mitigation leads to coexistence, positively impacting lion populations.

The "landscape of fear" concept describes how human presence affects lion behavior and prey selection. To avoid densely populated human and livestock areas, lions engage in temporal and spatial partitioning (Burak et al., 2023; Everatt et al., 2023; Mogensen et al., 2011; Schooler et al., 2022; Schuette et al., 2013; Suraci et al., 2019; Valeix et al., 2012), causing physiological stress (Creel et al., 2013). This also leads to conflict and consequences for other species (Pozo et al., 2021; Searle et al., 2021).

Recommendations for mitigation include conservation education (Holmern et al., 2007), electric fencing (Trinkel et al., 2017), land-planning (Searle et al., 2021), border patrols (Mwampeta et al., 2021), multispecies conservation strategies (Searle et al., 2021), government economic assistance (Mhuriro-Mashapa et al., 2018), improved husbandry practices and corralling of livestock (Schuette et al., 2013; Suraci et al., 2019), and the expansion of PAs (Mkonyi et al., 2018).

3.5 | Mitigating HLC (38 papers)

Thirty-eight papers were primarily concerned with implementing and/or evaluating HLC mitigation.

Studies examined the efficacy of physical deterrents, focusing on preventing lion attacks on bomas at night. These included alert systems (Weise, Hauptmeier, et al., 2019), flashing lights (Lesilau et al., 2018), aversive

conditioning ("hazing") (Petracca et al., 2019, 2021), and predator-proof bomas or "living walls" (Kissui et al., 2019; Lichtenfeld et al., 2015; Weise et al., 2018). This work noted the need for consistent maintenance and funding to ensure effectiveness. Some papers recommend that a mitigation strategy should only be adopted under certain conditions, such as hazing young lions before livestock-raiding behaviors become entrenched (Petracca et al., 2021) or installing expensive electrified fencing only in high-risk areas (Di Minin et al., 2021). Weise, Hauptmeier, et al. (2019) note that cultural and financial barriers must be overcome for alert systems to be adopted and function effectively. Disadvantages of physical deterrents were reported, including expense, cultural resistance, human-induced risk edge effects, and a lack of long-term data to verify success.

Traditional husbandry practices can mitigate HLC. Research suggests that robust bomas and the presence of dogs and people can reduce livestock predation (Ogada et al., 2003; Woodroffe et al., 2007). However, the loss of traditional herding practices and knowledge and cultural differences in husbandry practices can be counterproductive in HLC mitigation (Jablonski et al., 2020; Tumenta et al., 2013).

Compensation schemes work on the assumption that farmers will be less likely to retaliate if the economic cost of losing livestock to lions is wholly or partially recouped. Most studies on this strategy report that they can improve attitudes toward lions and mitigate HLC when they are adequately funded and managed (Bauer et al., 2017) and accompanied by enhanced husbandry practices such as fortifying bomas and vigilant herding (Maclennan et al., 2009; Tarimo et al., 2021). However, compensation schemes can exacerbate conflict if communities feel mistreated in accessing and making a claim (Anyango-van Zwieten et al., 2015). The amount received is lower than the market value of livestock lost (LeFlore et al., 2019). Compensation schemes have also been accused of posing a "moral hazard," fostering a sense of learned helplessness, and contributing to ineffective husbandry practices (Tarimo et al., 2021). Studies have also raised concerns about the long-term economic sustainability of compensation schemes (Bauer et al., 2017) and their (in)ability to facilitate coexistence (Gusset et al., 2009).

Creating corridors and protected areas has been evaluated to reduce HLC (Kiki et al., 2021). If well-funded and well-managed, corridors can be a safe passage for lions through human-populated areas (Dolrenry et al., 2020; Lindsey et al., 2017). Fencing reserves to keep lions and humans apart is another option but requires proper management and maintenance of the fences to prevent transgressions (Kesch et al., 2015; Massey et al., 2014; Packer et al., 2013; Pekor et al., 2019). However, fencing can cause ecological disruptions, such as migration (Di Minin et al., 2021). Two studies identified suitable locations for corridors or protected areas within human–lion conflict hotspot areas (Cushman et al., 2018; Winterbach et al., 2014). However, Robson et al.'s (2021) more recent assessment of 840 protected and conservation areas in Africa found that 82% fail due to financial constraints, management structures, and threat levels.

Mixed results were found in three studies that assessed the effectiveness of lion translocation as a solution to mitigate human–lion conflict. Although Stander's (1990) study found that it could successfully reduce conflicts with farmers if the area they were moved to had sufficient wild prey, Morapedi et al. (2021) discovered that translocation was ineffective for livestock raiders in Botswana. Becker et al. (2022) reported that translocation could be counterproductive for lion conservation as it often failed to follow IUCN guidelines. Therefore, the authors suggest evaluating critical factors such as the ecological conditions of the proposed relocation site, prey availability, the origin of the lions, and community support before lion translocation takes place.

Community support is crucial for lion conservation and reducing HLC. Programs like Lion Guardians in Tanzania and Long Shields in Zimbabwe report successfully integrating cultural values and community empowerment to mitigate HLC (Dolrenry et al., 2016; Hazzah et al., 2014; Sibanda et al., 2020; Sibanda, Johnson, et al., 2021; Sibanda, Van der Meer, et al., 2021). Their approach in training community members to monitor wild lions has significantly reduced livestock loss and killings and improved community attitudes toward lions.

Community-based natural resources management (CBNRM) is a strategy that empowers local communities to manage natural environmental resources sustainably while benefiting economically (Blackburn et al., 2016). Kansky et al. (2021) highlight its positive intangible benefits, "crowding in" positive feelings toward lions. However, Matema and Andersson (2015) criticize CBNRM for failing to address cultural reasons behind lion killing, not tackling livestock predation, masking human–human conflict (HHC) over dissonant interests, and poor strategy management. Despite Namibia being the founder of CBNRM, Nattrass's (2021) cost–benefit analysis reveals a mixed picture of success across the country's existing 84 schemes. For many conservancies, the costs outweigh the revenues, necessitating additional funding to sustain CBNRM.

4 | DISCUSSION

Most HLC research, spanning from 1981 to 2023, was conducted in Kenya, Tanzania, Zimbabwe, and Botswana

despite wild lion populations in approximately 25 African countries (Nicholson et al., 2023). This indicates a need to understand HLC at a continental level.

By adopting a scoping review methodology, we have been able to delve deeper into human–lion conflict complexities than previous systematic reviews. Research has focused on factors that influence local communities' attitudes toward lions. Factors that are personal, socioeconomic, political, cultural, geographic, and the presence of NGOs/conservationists have been assessed for their role in shaping local communities' attitudes and perceptions toward lions. Surprisingly, though, in a globally digital world, the influence of social media still needs to be represented in this arena. The underlying assumption here is that attitudes predict behavior. Attitude research has been a cornerstone of social psychology since the 1920s. However, the discipline recognizes the concept is problematic as an explanatory factor for behavior due to a failure in the methodology to assess it or the failure to include a moderating variable such as intention and identity (Ajzen & Fishbein, 1977; Bravo & Farjam, 2022; Christensen et al., 2004; Wicker, 1971). This is evident in HLC work, where the relationship between attitude and behavior remains under-investigated (Browne-Nuñez & Jonker, 2008; Whitehouse-Tedd et al., 2021). Furthermore, reflexivity is needed regarding how attitudes and communities are defined by researchers, whose attitudes we are interested in, why, and the cultural appropriateness of attitude research in non-Western contexts. As Triandis (1996) points out:

> "our theories tend to emphasize the importance of attitudes, beliefs, needs, personality, and idiosyncratic values because Western culture is individualistic and Western psychology focuses on individuals and processes internal to individuals." (Triandis, 1996, p. 408).

Research on the causes of HLC has tended to be reactive, evolving from classifying problematic lions to identifying contributing features of livestock, environmental conditions, cultural practices, and human behavior. However, modern technology and modeling have broadened the scale of HLC work beyond local and national borders, becoming more proactive in predicting conflict before it occurs. Pan-African studies have risen since 2017 and include attempts to understand the ripple effects of conflict and mitigation strategies on other species. However, there is little consideration of the impact of climate change on HLC. As natural resources get depleted, people and wildlife are concentrated in smaller areas, increasing the likelihood of conflict (Abrahms, 2021). The Theory of Change framework (Durant et al., 2022) includes climate change as a factor requiring consideration to achieve human-carnivore coexistence. Research is urgently needed to model its impact on HWC/HLC across Africa and develop mitigation action plans.

HLC as a problem has been solved in various ways, from physical deterrents and translocation of lions to changes in husbandry practices, the implementation of compensation schemes, fencing, corridors, and PAs. Some critics have argued that HWC/HLC work has ignored the cultural and psychological features of conflict (Bodasing, 2022; Hoffmann & Montgomery, 2022; Holland et al., 2018; Montgomery, Elliott, et al., 2018; Montgomery, Hoffmann, et al., 2018; Seoraj-Pillai & Pillay, 2016). However, significant efforts have been made to integrate cultural norms and values in developing programs such as Lion Guardians and Long Shields. Although these are not unproblematic, they represent a step forward in engaging stakeholders and co-creating solutions for coexistence. While various conflict mitigation strategies are used, there is a need for independent evaluation of their success. Moreover, as Lucas et al. (2022) argue, clarification is needed in defining success before we can evaluate a strategy.

A lack of interdisciplinarity (Montgomery, Elliott, et al., 2018) and inclusivity (Bauer et al., 2019) in HLC work may account for some of the shortcomings and gaps in existing research. Incorporating the knowledge, theories, and methods embedded within the social, political, and human sciences and the humanities will go some way in addressing this.

DATA AVAILABILITY STATEMENT

The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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