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Human-Giraffe Interactions: Characterizing Poaching and Use of Parts as a Threat to Giraffe in Northern Kenya

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HUMAN-GIRAFFE INTERACTIONS: CHARACTERIZING POACHING AND USE OF PARTS AS A THREAT TO GIRAFFE IN NORTHERN KENYA

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An Abstract of the Dissertation Presented
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Giraffe (*Giraffe* spp.) are iconic wildlife species to Africa, yet relatively little conservation funding and research have been directed at protection of giraffe in the wild. A growing number of national governments and conservation organizations are implementing management strategies to address the threats that giraffe face. To inform these plans, there is a need for social science that examines the human pressures associated with decline of giraffe populations, including poaching and the use of giraffe parts. As the large majority of reticulated giraffe (*Giraffa reticulata*) range occurs outside formally protected areas, conservation plans must be made with pastoralist communities and other actors in northern Kenya where the land is shared between people, their livestock, and wildlife. The research presented in this dissertation was conducted as part of a community-based program focused on reticulated giraffe, called the Twiga Walinzi Initiative ("Giraffe Guards" in Swahili), and represents the first quantitative study on the human dimensions of giraffe conservation.

Goals of the research project were to examine key cognitions to human-giraffe interactions (i.e. attitudes, beliefs, perceptions), assess relationships between certain cognitions within areas that adopt a community-based conservation approach, and understand the extent and drivers of giraffe meat and part usage. Face-to-face interviews were conducted at two study sites over survey periods in 2016/17 (n=579) and 2019 (n=680).

Results from these studies provide insights to how pastoralist communities view and act toward local giraffe. Factors that significantly influenced support for giraffe conservation differed between study sites, suggesting that local context is important to shaping human-giraffe interactions (Chapter 2). For instance, perceived benefits had stronger influence on normative belief in communities more recently connected with wildlife-based tourism. The linkages between perceived benefits, attitudes, and behaviors were further explored by assessing the relationships between these concepts within a community-based conservation setting (Chapter 3). Findings suggest a positive association between perceived benefits and attitudes toward giraffe, but there was less evidence that perceptions of wildlife-related benefits influenced use of giraffe meat/parts. As human behavior is of central interest to conservation, we also assessed levels of giraffe meat consumption (Chapter 4) and determinants of intention to consume giraffe meat (Chapter 5). Specialized questioning techniques were utilized to estimate prevalence of giraffe meat consumption preceding the two surveys. Estimated prevalence of giraffe meat consumption declined after establishment of the Twiga Walinzi. Perceived behavioral control had stronger relative influence than attitudes and subjective norms on future intention to consume giraffe meat. Collectively, these research findings are relevant for applied giraffe conservation efforts and provide a framework for understanding human-giraffe interactions and associated threats in diverse global settings.

DEDICATION

To my grandmother, Joyce Ruppert, for taking me to the library

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ACRONYMS

ANOVA	Analysis of variance
CBC	Community-based conservation
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CITES	Convention on International Trade in Endangered Species
DQ	Direct questioning
GCF	Giraffe Conservation Foundation
GEM	General Elimination Methodology
GFI	Goodness-of-Fit Index
GPS	Global Positioning System
HDW	Human dimensions of wildlife
IUCN	International Union for Conservation of Nature
KWS	Kenya Wildlife Service
NFI	Normed Fit Index
NRT	Northern Rangelands Trust
NT	Nominative technique
NWCT	Namunyak Wildlife Conservation Trust
PBC	Perceived behavioral control
RMR	Root Square Mean Residual
RRT	Randomized response technique
SDZG	San Diego Zoo Global
SPSS	Statistical package for the social sciences
SQT	Specialized questioning technique
TNC	The Nature Conservancy
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UCT	Unmatched count technique
WTM	Wildlife Tolerance Model

CO-AUTHORSHIP STATEMENT

Kirstie Ruppert has been the primary researcher for studies included in this dissertation. This work involved obtainment of appropriate permissions for community-based research, literature review, research design, training on methods and protocols with the interview team, data management, data analysis, and manuscript preparation. Co-authors on the manuscripts within this dissertation contributed in different ways, including program administration and funding acquisition, questionnaire refinement, data collection, data visualization, and manuscript review and editing. Drs. Carly Sponarski and Jenny Glikman were co-advisors over the research process for this dissertation and substantially contributed by providing critical feedback during the development of each manuscript.

For each of the following manuscripts, the author of this dissertation is the primary and corresponding author. The four manuscripts are listed below, along with the journals for which the articles have been prepared and the included co-authors.

Chapter 2 ("Perceptions, Attitudes, and Beliefs Toward Giraffe in Northern Kenya") is under review at *Human Dimensions of Wildlife*. Co-authors include Dr. Carly Sponarski (University of Maine), Symon Masiaine (Loisaba Conservancy), Lexson Larpei (Loisaba Conservancy), Johnson Lekushan (Namunyak Wildlife Conservation Trust), Daniel Lenaipa (Namunyak Wildlife Conservation Trust), Jonathan Lenyakipiro (Namunyak Wildlife Conservation Trust), Sebastian Lerapayo (Namunyak Wildlife Conservation Trust), Jenna Stacy-Dawes (San Diego Zoo Institute for Conservation Research), David O'Connor (San Diego Zoo Institute for Conservation Research), and Dr. Jenny Glikman (San Diego Zoo Institute for Conservation Research).

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Chapter 5 ("Determinants of Intention to Consume Giraffe Meat") will be submitted to *Human Dimensions of Wildlife*. Co-authors include Dr. Carly Sponarski, Dr. Elizabeth Davis, Jesus Lekalgitele, Ruth Lekupanai, Joseph Lemirgishan, Jonathan Lenyakipiro, Sebastian Lerapayo, Jenna Stacy-Dawes, and Dr. Jenny Glikman.

CHAPTER 1: INTRODUCTION

1.1 Human Dimensions of Wildlife Conservation in Global Contexts

Wildlife management and conservation science have historically been rooted in the biological sciences, until the emergence of human dimensions of wildlife (HDW) as a field for conservation research and practice in the 1970's. HDW research involves understanding and using insights about how humans affect, and are affected by, wildlife and decisions about how to manage wildlife (Decker, Riley, & Siemer, 2012). Though the field of HDW originated in North America, psychological concepts utilized in HDW research are universal in nature, including values, attitudes, motivations, emotions, and decision-making processes.

The state of global biodiversity is in crisis (Butchart et al., 2010), so the integration of HDW is needed in international contexts to understand complex conservation issues and address associated threats. The ways that people interact and come into contact with wildlife are changing; instances of conflict about wildlife are increasing, partly due to expanding human settlements and habitat loss and fragmentation (Manfredo, 2008). HDW approaches have supported conservation managers and other actors when conflicts arise due to negative human-wildlife interactions or social conflict around conservation (Madden, 2004). There is also a need to expand HDW work beyond instances in which conflicts about wildlife are thought to be explicit, as can be the case with damage-causing species (Kansky et al., 2014; Pooley et al., 2017). HDW can support conservation efforts to address the human activities that put negative pressure on wildlife populations, as well as engage with communities to understand the challenges faced when living with wildlife. There is opportunity for such work in diverse global

contexts; the field of HDW is rapidly expanding from its roots in North America to help shape conservation policies and practices globally.

Research and practice in HDW are guided by a diversity of classic and applied social science disciplines (Bennett et al., 2017). Conservation research can be framed from perspectives rooted in psychology, sociology, geography, anthropology, and economics, among other social sciences. Social psychology is the "scientific study of the way in which people's thoughts, feelings, and behaviors are influenced by their environment" (Vaske & Manfredo, 2012, p. 43). Many HDW studies are concerned with individuals' cognitions, or mental processes, used in thinking and understanding relationships with wildlife. The cognitive hierarchy places cognitions in relation to each other, organized in order of increasing number and specificity. The cognitive hierarchy framework will be described in detail in Chapter 2. Values, value orientations, attitudes, and norms can mediate individuals' behavior. This is of high interest to conservationists, as conservation success very often relies on some change in human behavior. In this dissertation, components of the cognitive hierarchy are used to describe the relationships between key cognitions relevant to giraffe conservation.

This research, described in this dissertation, explores aspects of the human dimensions of giraffe conservation. At the individual level, I explore the relationships between key cognitions (i.e. perceptions, attitudes, beliefs) formed by interactions with giraffe in northern Kenya (Chapter 2). Then, I question how individuals' cognitions are influenced within particular social contexts by examining perceptions, attitudes, and behaviors toward giraffe within two conservancy areas that adopt a community-based conservation approach in their program (Chapter 3). The second half of this dissertation shifts to understanding human behavior by measuring levels of past giraffe consumption (Chapter 4) and influences on intention to consume

giraffe in the future (Chapter 5). I end with a discussion of how these research findings can inform applied giraffe conservation and the relevance to the HDW field.

This dissertation is structured to build on each topic by presenting the applications for giraffe conservation efforts. The connections between some HDW concepts (perceptions, attitudes, beliefs, behaviors) are examined in relation to each other, and then within the context of community-based conservation in Kenya. The first chapters of the dissertation provide understanding about human-giraffe interactions, which build toward research in the latter half of the dissertation that is focused on behaviors (giraffe meat and part consumption) relevant to giraffe conservation. These three research areas: giraffe conservation, conservation with communities, and human behavior are explored in the four research manuscripts.

1.1.1 Giraffe Conservation

Giraffe (*Giraffa* spp.) are icons of Africa, but given their high profile, knowledge about giraffe is surprisingly limited. Population estimates across the continent suggest that giraffe numbers have fallen by about 40% in the last few decades, prompting reassessments in 2016 and 2018 by the International Union for Conservation of Nature (IUCN) that moved their status from "Least Concern" to "Endangered" (Muller et al., 2018).

This rapid decline is mainly thought to be due to habitat loss and fragmentation, land degradation, and poaching. National wildlife agencies and conservation organizations have been coordinating efforts to address these threats and protect wild populations, which are increasingly guided by national giraffe management strategies (Giraffe Conservation Foundation, 2019). Conservation translocations have been undertaken in recent years when critically needed to reinforce or diversify fragmented populations (e.g. Brown et al., 2019). These projects provide

strong examples of collaborative conservation efforts but can require significant resources for planning and implementation (Fennessy et al., 2019). A sustainable future for giraffe, in part, rests on changes within communities toward collective action to reduce threats like poaching. There is opportunity and need to understand how to best engage with communities using bottom-up approaches to giraffe conservation. In such instances of bottom-up conservation, community-level action and planning are tied to positive social and ecological outcomes, as opposed to policies enacted by state and international actors (Abrams et al., 2009).

There is yet to be any published literature on the social aspects of giraffe conservation and associated threats, which points to the urgent need for social science to inform the many growing conservation efforts. This research proposes the first HDW study specific to giraffe conservation. In this dissertation, the relationships between key cognitions (how individuals think about giraffe) that influence support for giraffe conservation are explored in Chapter 2.

1.1.2 Conservation with Communities

As the practice of biodiversity conservation has evolved, bottom-up approaches have highlighted the roles of communities. A shift from "fortress conservation," or preservation of natural systems as separate from humans, has given way to more people-oriented approaches (Adams & Hutton, 2007). This change was due in part to the recognition that exclusionary conservation overlooked the social and economic factors that are inextricable from natural systems, as well as the social injustices of conservation management that further marginalized disadvantaged human communities (Ghimire & Pimbert, 1997). More inclusive conservation practice is underpinned by participatory processes, guiding decision-making that includes deliberation by those involved with, and impacted by, conservation practices.

Community-based conservation (CBC) approaches emphasize community engagement and participation in conservation planning (Nilsson et al., 2016). Although binding CBC with a strict definition is discouraged by Western & Wright (1994), it can be loosely conceptualized as "natural resource management or biodiversity protection done by, for, and with the local community" (p. 7). At its core, CBC is driven by devolution of control towards local authority over natural resources.

Some CBC initiatives work in direct concert with nature-based tourism operations, so that generated revenue and other related benefits can be governed by local leadership. The social and economic incentives tied to such CBC programs and partnerships can be key to meeting conservation goals (Brooks et al., 2012), and are likely to affect how people relate to local wildlife in these places. Thus, it is important to assess HDW in the contexts that utilize CBC approaches. In this dissertation, the potential influence of the benefits tied with wildlife and CBC programs are examined in relation to attitudes toward giraffe and past behavior of giraffe meat consumption (Chapter 3). Applied research in CBC settings can help illuminate the conditions in which conservation efforts are successful (Berkes, 2004; Jenks et al., 2010), so components of the Twiga Walinzi program (described in section 1.2) are assessed to gain understanding of critical factors for success.

1.1.3 Conservation and Human Behavior

Major drivers of biodiversity declines stem from human behaviors – including choices and actions by individuals and groups at varied scales (Selinske et al., 2018). The complexities inherent in human behavior can make it challenging for conservation to effectively guide behavior changes required for conservation outcomes. Reddy et al. (2017) proposed a set of guidelines for understanding behavior for conservation interventions, which start with the need

to identify the behavior of interest, who and which groups are engaging with that behavior, and at what levels the behavior is occurring. Improved understanding of these aspects can lead to the effective design and evaluation of behavior change interventions.

This dissertation addresses the first set of questions needed to plan for behavior change: does giraffe meat consumption occur, by whom, and at what prevalence? There is limited data on the extent of giraffe part usage, but based on precautionary measures, all giraffe species were listed on Appendix II by the Convention on International Trade in Endangered Species (CITES) in 2019. This change in regulation, along with the total hunting ban of all wildlife in Kenya, mean that measuring compliant behavior is of relevance to giraffe conservation. Preliminary research by Dunn et al. (*in prep*) suggests that meat is the main giraffe product used domestically in Kenya, so Chapters 4 and 5 focus on giraffe meat consumption as the behavior of interest. A key consideration for this research is the illegality of giraffe poaching and part usage in the context where this research was conducted. Illegal behavior is a source of uncertainty for policy and evaluation of conservation initiatives, potentially guiding management planning with misinformation (Cross et al., 2013). Thus, specialized methods are needed for researching sensitive behaviors like illegal activity. Chapter 4 applies specialized questioning techniques to estimate prevalence of giraffe meat consumption and presents evidence for reduced levels of giraffe meat consumption following the introduction and expansion of a community-based program for giraffe conservation. Chapter 5 then builds toward the next relevant question for the behavior change process—what motivates individuals to act a certain way—by examining determinants of behavioral intention to consume giraffe meat.

1.2 Research Context

This research was conducted in northern Kenya as part of the Twiga Walinzi Initiative—a collaborative conservation and research effort underpinned by partnerships between San Diego Zoo Global (SDZG), Giraffe Conservation Foundation (GCF), Northern Rangelands Trust (NRT), Loisaba Conservancy, Namunyak Wildlife Conservation Trust (NWCT), Sarara Camp, Kenya Wildlife Service (KWS), Lewa Wildlife Conservancy, The Nature Conservancy – Africa (TNC), and others.

The Twiga Walinzi (roughly translated to "Giraffe Guards" in Swahili) program was established in 2016 as the first community-based program to focus on reticulated giraffe conservation in Kenya. There was a conservation need to focus on reticulated giraffe, estimated to have declined close to 50% over the last three decades (Muneza et al., 2018). Any killing of reticulated giraffe is illegal in Kenya, and the Kenya Wildlife Service works with national law enforcement to apprehend and prosecute citizens involved with giraffe poaching. The majority (~95%) of reticulated giraffe range occurs outside government-managed protected areas (O'Connor et al., 2019). Thus, conservation of giraffe is predominantly situated on community and privately-owned land in northern Kenya. The Twiga Walinzi team is comprised of 14 members that are local to the communities where the program is based. The research team conducts socio-ecological assessments of local giraffe populations and relevant threats to giraffe and implements conservation education and outreach. Social and ecological research consists of human dimensions interviews and giraffe population assessments through photo monitoring, distance sampling, and camera trap surveys.

The human dimensions interviews generated the data presented within this dissertation and were all conducted by the Twiga Walinzi. Before two survey periods in 2016/17 and 2019,

the entire team participated in a capacity building workshop for conservation social science (led by Kirstie Ruppert in October 2016 and co-led by Kirstie Ruppert and Dr. Jenny Glikman in June 2019). During these training sessions, recommendations were given to reduce biases from interviewer effects (Kreuter, 2008), and each interviewer practiced the survey and data collection protocols. Based on discussions with local leadership and conservation organizations in the area, it was determined that the Twiga Walinzi were the best candidates to conduct the interviewers, as they were more likely to garner trust and elicit participation in their communities than enumerators from other places. As the Twiga Walinzi were conducting interviews within their communities, there was the possibility for social desirability biases. Potential for interviewer effects were addressed during the training sessions by standardizing the scripts used to describe the research, request participation, and present each item. Also based on guidance from local organizations, compensation to individual participants was not given for completion of interviews because of precedent in the areas and challenges with distribution of cash associated with research. Instead, the Twiga Walinzi program (which includes the human dimensions surveys) made annual contributions to community-level funding that were directed at prioritized needs (e.g. student scholarships, school infrastructure improvement). Access to census information is limited in the study areas, and local families can move often for livestock grazing. As such, randomized sampling was not possible. Quota sampling (Battaglia, 2008) was selected as the best choice for nonprobability sampling. Using quota sampling, the Twiga Walinzi acquired target numbers of interviews in manyatta (village) areas proportional to total size of the village and for even gender ratios within the two samples. More detailed description of the methods and associated limitations are presented within each chapter.

For their ecological work, the Twiga Walinzi team tracks movements of livestock—goats, cattle, and camels—to determine how livestock grazing patterns relate to giraffe observations. The Twiga Walinzi team also supports additional giraffe monitoring efforts that include rapid population assessments through mark-recapture surveys, aerial counts, and an Africa-wide satellite tracking program called Twiga Tracker. Research findings inform Twiga Walinzi community engagement strategies and are regularly shared with local leadership and broader community members. The overall community engagement approach is comprised of key activities that include monthly outreach to local manyattas (villages), community-wide festivals, annual celebrations for World Giraffe Day, and giraffe-focused conservation education with school-based Wildlife Clubs. The Twiga Walinzi team also contributes undesignated community funds annually that are directed based on prioritized needs. Past designations include school-based infrastructure projects and materials for local classrooms like desks and books, and secondary school bursary scholarships.

The foundation of the Twiga Walinzi Initiative is built on the relationships with the local pastoralist communities where the program is based. One conservancy that hosts Twiga Walinzi is Namunyak Wildlife Conservation Trust, one of the first community conservancies to be established in affiliation with the Northern Rangelands Trust in 1995. NWCT is community-owned by the local Samburu community and collectively manages the land through local governance structures. Twiga Walinzi are also based at Loisaba Conservancy, a wildlife conservancy owned by the Loisaba Community Trust and managed for wildlife habitat and as a working ranch. Loisaba is bordered to the north and east by the NRT-affiliated conservancies called Kirimon, Ol Dnyiro, and Naibunga. Three additional group ranches, Sagumai, KMC, and P&D, are adjacent to Loisaba and engage with the Twiga Walinzi.

Where the Twiga Walinzi program is situated in northern Kenya, the Northern Rangelands Trust is supporting the development and governance of community conservancies. These community conservancies hold legal ownership over their land and are key to preserving and managing connectivity across the northern rangelands landscape. The conservancy system is critical for protecting Kenya's biodiversity, as the majority of wildlife lives outside government protected areas.

In these communities, the predominant livelihood is pastoralism. Pastoralism is characterized by ownership of livestock and varying levels of nomadic movements for access to grassland resources. The movement of livestock over the same habitat as wildlife species supports the ecosystem functioning that has facilitated evolution of East African megafauna (Reid, 2012). The significance of pastoralism in northern Kenya means that conservation planning must account for the needs of wildlife, people, and their livestock. This is true for the spaces that giraffe and people share—the Twiga Walinzi Initiative aims to inform conservation planning with research conducted at the interfaces between giraffe, people, and livestock.

1.3 Research Objectives

To support giraffe conservation efforts, the research objectives for this dissertation are to:

a. establish baseline measurements of community knowledge, perceptions, attitudes, and beliefs around human-giraffe interactions,
b. examine how human-giraffe interactions and related cognitions can be influenced in contexts that are guided by community-based conservation,
c. quantify local levels and identify areas of giraffe part and product usage in and around two conservancies,
d. assess key drivers and contributing factors of giraffe meat consumption.

Chapters 2 through 5 are presented as individual manuscripts to address each of these objectives with pertinent research questions.

1.4 Organization of Dissertation

This dissertation is organized into six sections: an introductory chapter, four manuscripts, and a conclusion chapter. Abstracts for each of the manuscripts are as follows:

Chapter 2 assesses the relationships among key human dimensions cognitions (normative beliefs, attitudes, existence value, and perceptions), specific to reticulated giraffe in northern Kenya. Data from in-person structured interviews indicated that the strength of associations differed by study area, but overall, respondents felt positively toward giraffe, valued giraffe as very important, and believed that giraffe populations should increase. Data were analyzed separately for each study conservancy, and path analyses to test relationships between cognitions were conducted using linear and logistic regressions. Our results support that conservation messaging should be tailored to localized context and such messaging can target psychological cognitions to increase support for giraffe conservation. There was little variation in key cognitions among the sample, suggesting that audience segmentation is not as necessary for giraffe conservation interventions as with other conservation contexts, and messaging can be framed for broader community levels. This chapter presents theoretical and applied implications for integrating human dimensions information into giraffe conservation efforts.

Chapter 3 investigates whether perceived benefits influence attitudes and behaviors toward wildlife by using the case of reticulated giraffe conservation in northern Kenya. Some community conservation models are situated near or in direct collaboration with nature-based tourism, so that wildlife-related business increases revenue for the benefit of local communities. Studies that assess these relationships to support or critique this presumption, however, have not

been well documented. In-person interviews were used to collect data on perceptions of benefits associated with giraffe, attitudes toward giraffe, as well as giraffe meat consumption behavior in the two study conservancies. Analyses included one-way analyses of variance (ANOVA), multiple dummy variable regression, and chi-square tests to explore the influences of tangible and intangible benefits onto attitude, and whether past consumption of giraffe meat differed between groups with varying levels of perceived benefits. At both study sites, attitudes toward giraffe differed between groups that perceived various conservation benefits associated with giraffe. There was less evidence, however, to support a connection between perceived benefits and behavior. Shifting attitudes toward wildlife and conservation can be an intended outcome for conservation activities, so emphasizing specific benefits (tangible and intangible) could be an effective avenue for influencing attitudes. More often, however, there is need to change human behaviors that are placing negative pressures on wildlife populations. In our case, community members that associated tangible benefits from conservation with giraffe were just as likely to have consumed giraffe meat, which points to the need for additional work to understand different motivations for use of giraffe parts and products.

In **Chapter 4**, specialized questioning techniques (SQT) were utilized to estimate prevalence of giraffe meat consumption. Biodiversity conservation is fundamentally about human behavior, but when certain behaviors are illegal or otherwise sensitive, actors can be hesitant to admit engagement with illicit behaviors. Monitoring compliance with conservation rules can be difficult given the likelihood of biases from social desirability or non-response during data collection. I compared behavioral prevalence of giraffe meat consumption between direct questioning and two SQTs, randomized response technique (RRT) and unmatched count technique (UCT), from 2017 to 2019. The SQTs produced higher estimates (RRT=36.5%

prevalence; UCT=27.7% prevalence) than direct questioning (22.3) in the 2017 survey. There was an observed decline is estimated prevalence across all three methods in the 2019 survey (RRT=7.8%, UCT=1.2%, and Direct=3.2%). Comparisons between the two samples yielded significant differences across all three methods, with confidence intervals distinctly divergent between years. The significant disparity between the two samples for all three methods suggests that there was a true reduction in giraffe meat usage from 2017 to 2019. The key change in the study area between the two time periods was the introduction of Twiga Walinzi, a community-based program for giraffe conservation. Primary program activities, including ecological monitoring, community outreach and education, and collaboration with wildlife security teams, align with other conservation programs that have demonstrated reduced poaching pressures. The Twiga Walinzi's local presence likely deterred giraffe poaching, and the meat consumption to follow, potentially by changing would-be poachers' perceived risk of detection and the community norms about acceptability to poach and consume giraffe.

Chapter 5 examines the social-psychological and background factors that influence behavioral intention to consume giraffe meat. This study builds on Chapter 4 by progressing from estimation of levels of giraffe meat usage to prediction of the variables most likely to influence behavioral decision making around consumption. I applied the Theory of Planned Behavior (TPB) to test relative strength of attitudes, subjective norms, and perceived behavioral control on future intention to consume giraffe meat. A second multiple regression model utilized the TPB with additional background factors to explain additional variance in behavioral intention. Confirmatory Factor Analysis (CFA) was used to verify that individual scale-based items clustered as discrete variables. The CFA model fit was acceptable, and mean variables were calculated for (a) attitudes toward giraffe meat (three items; Cronbach's alpha=.72), (b)

subjective norms about community acceptability of giraffe meat (four items; Cronbach's alpha=.86), (c) perceived behavioral control (three items; Cronbach's alpha=.67), and (d) intention to consume giraffe meat in the future (three items; Cronbach's alpha=.82). Components of the traditional TPB model each had significant predictive relationships with behavioral intention (R^2=.27). Additional background factors improved predictability of the model, explaining 44.3% variance. The strongest determinant of behavioral intention was perceived behavioral control, highlighting how opportunity comprises an important component of intention. These findings suggest that interventions to increase local protection of giraffe and community-level support for enforcement is likely to influence giraffe usage.

Chapter 6 concludes this dissertation with a discussion of how research findings contribute to the field of human dimensions of wildlife conservation, implications of research outcomes for applied giraffe conservation, and recommendations for future work.

CHAPTER 2: PERCEPTIONS, ATTITUDES, AND BELIEFS TOWARD GIRAFFE IN NORTHERN KENYA

2.1 Introduction

Despite biases of conservation efforts toward mammals and charismatic species, many are in continued decline (Bennett, 2011; Schipper et al., 2008). Included in this trend are giraffe (*Giraffa* spp.), listed as Vulnerable by IUCN and declining up to 40% in the last three decades (Muller et al., 2018). Giraffe exhibit many of the qualities that draw attention to particular species, including aesthetic appeal and high recognizability (Clucas et al., 2008; Smith et al., 2012). Giraffe, however, are anomalous from the bias toward charismatic mammals (Albert et al., 2018), as they have received relatively little conservation funding and attention (Giraffe Conservation Foundation, 2013; O'Connor et al., 2019). Potential reasons for this oversight are perceptions of commonality from the frequent inclusion of giraffe in captive institutions (Muneza et al., 2017) or the distance between giraffe and other species involved in more proximate human-wildlife interactions (Douglas & Verissimo, 2013; Redpath et al., 2013). Giraffe have recently garnered more international attention after scientists proposed an updated classification from nine subspecies to four distinct giraffe species (Fennessy et al., 2016; Winter, Fennessy, & Janke, 2018), but there is yet to be any published peer-reviewed literature on the social dimensions of giraffe conservation. This study targeted that gap by examining human cognitions in relation to interactions with giraffe in northern Kenya.

2.1.1 Threats to Giraffe

The four giraffe species have adapted to multiple different habitat types across the 21 range states (Fennessy et al., 2016; Winter, Fennessy, & Janke, 2018). Across these range states, the management and protection of giraffe have been prioritized to varying degrees. Southern giraffe

populations are stable or increasing (Deacon & Tutchings, 2019), whereas northern giraffe, Masai giraffe, and reticulated giraffe are listed by IUCN as Critically Endangered, Endangered, and Endangered, respectively (O'Connor et al., 2019). These declines are important for both ecological and societal reasons. Giraffe play a role in ecosystem functioning, notably through their foraging behaviors, seed dispersal mechanisms, stimulation of new plant growth, and pollination (Muller et al., 2018). Giraffe are considered culturally relevant and valuable in some range countries, with special recognition as national symbols of pride in Tanzania, Botswana, Niger, and Namibia (Kümpel et al., 2015). Many range countries rely on wildlife-based tourism as a top industry, so giraffe prevalence in areas with active tourism-based operations has economic value (Bercovitch & Deacon, 2015; Fennessy, 2004; Okello, Manka, & D'Amour, 2008). From an intrinsic perspective, giraffe can also be a source of aesthetic appreciation for communities that live nearby giraffe (de Pinho et al., 2014).

To protect giraffe across their range, conservation policy and strategies require an understanding of the drivers of declines. Similar to giraffe ecology, there are few published studies and limited knowledge on the threats that giraffe face. The main drivers of declines are thought to include habitat loss and land use change, human encroachment associated with population growth, and poaching (Giraffe Conservation Foundation, 2013), all of which have significantly altered and reduced the geographic distribution of giraffe across Africa (Muller et al., 2018). Much of the historic ranges for giraffe are outside government and privately protected areas, and in overlap with land use for agriculture and livestock herding (Ogutu et al., 2016). As land use intensifies with global population growth and climate disruption, giraffe habitat is likely to be further impacted and reduced by human activities into the future (Shorrocks, 2016; Muller et al., 2018).

It is well-documented that human expansion and associated consumption have negative impacts on global biodiversity (van Vuuren & Bouwman, 2005), and lifting such pressures will require influencing human behavior, along with large scale policy and action by governments and other organizations (St. John et al., 2011). Solutions aimed at conservation challenges can and should reflect the needs of both people and nature on shared landscapes (DeFries & Nagendra, 2017; Ellis, 2019). Reducing the threats that giraffe face will require shift in human behaviors, which necessitates a better understanding of the factors that influence and predict behavioral decisions. Behavior is not the focus of this article, but this study explores the relationships between variables that are posited as influences on behavioral decision making.

2.1.2 Theoretical Background

Human dimensions of conservation involves understanding and using insights about how humans affect, and are affected, by wildlife and decisions about how to manage wildlife (Decker, Riley, & Siemer, 2012). Research in the human dimensions of wildlife conservation (HDW) includes the study of individual level attributes, like attitudes, values, beliefs, perceptions, and behaviors, in regards to relationships with wildlife (Decker et al., 2012; Manfredo, 2008). The cognitive hierarchy (Figure 2.1) places such cognitions, the mental processes used in thinking and understanding, in relation to each other and in order of increasing number and specificity (Fulton et al., 1996; Vaske & Donnelly, 1999). Values serve as the foundation for other cognitions, and are the most central to an individual's belief system (Vaske & Donnelly, 1999). Certain cognitions are posited to influence others in ascending levels of the hierarchy. At the top of the hierarchy, behaviors and behavioral intentions are theorized to be the most elastic, and more likely to change based on situational factors.

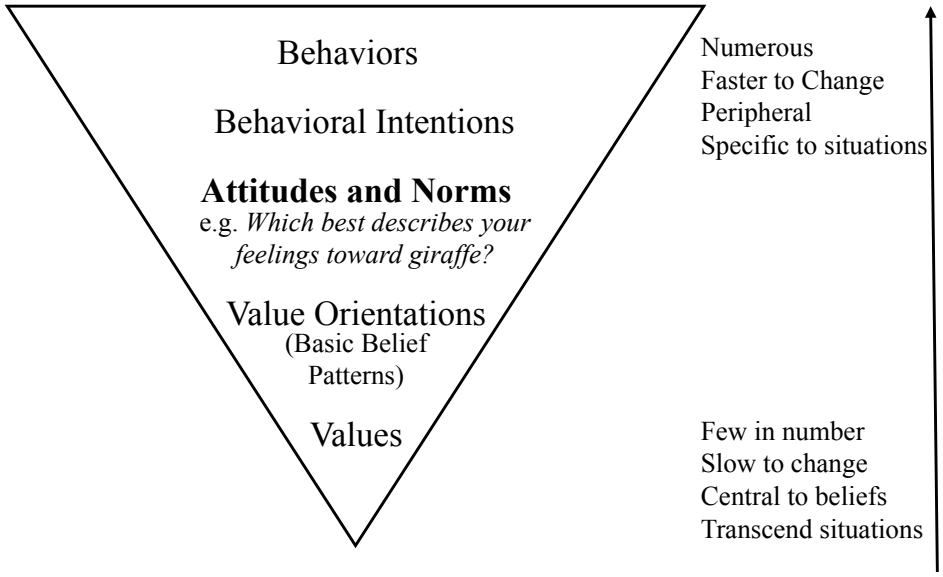

Figure 2.1. Cognitive Hierarchy. Level of attitudes and norms, in relation to other components of the cognitive hierarchy (adapted from Vaske & Donnelly, 1999).

This study investigates the relationships among cognitions within the attitudes and norms category of the cognitive hierarchy (i.e. general attitude, existence value, and normative belief) in the context of human-giraffe relationships.

Social norms are shared beliefs about a situation (Zinn et al., 1998), such as levels of wildlife populations or the conditions around wildlife management. Normative beliefs (e.g. supportive of giraffe conservation efforts) are personal judgements and are most appropriate in a given context (Vaske & Whittaker, 2004). Normative beliefs have been studied to assess the acceptability of wolf and bear management (Glikman, Vaske, Bath, Ciucci, & Boitani, 2012), elk management on private lands (Metcalf et al., 2017), and management of free-roaming cats in Malaysia (Davey et al., 2019). In this study, normative beliefs are conceptualized as a key component of support for giraffe conservation through the judgement that local giraffe populations should increase. Variables hypothesized to influence normative beliefs about giraffe

conservation are attitudes, existence value, perceived benefits, and perceptions of giraffe population trend.

Attitudes are positive or negative evaluations of an object (e.g. giraffe), and are comprised of cognitive and affective components (Eagly & Chaiken, 1993). The cognitive component is comprised of beliefs and thoughts about the attitude object, whereas the affective component is driven by feelings and emotions related to the attitude object (Glikman et al., 2012). For this study, we are testing the affective attitude toward giraffe as related to the cognitive measures that comprise existence value and normative beliefs. Attitude studies are widely used in human dimensions research (Manfredo, Teel, & Bright, 2004), and situated within the cognitive hierarchy as a mediating variable between values/value orientations and behavior. Attitudes can be formulated about a wide range of attitude objects that are relevant to wildlife conservation, including species (Glikman et al., 2019), management options (Sponarski et al., 2015), conservation policies (Shelley et al., 2011), and spatial planning (Granados & Weladji, 2012). When looking at correspondence between variables, it is important to consider the specificity principle (Fishbein & Ajzen, 1975): general attitudes (i.e. feeling toward giraffe) should be strongly related to general normative beliefs (i.e. acceptability of giraffe increase).

Existence value can be assessed in economic terms, and measured by individuals' willingness to pay for biodiversity (Kontogianni et al., 2012). Existence value can also be conceptualized as belief in a species' intrinsic right to exist (Park & Allaby, 2013), which has been used in studies about wildlife species without market prices for consumptive use (Engel et al., 2016). Economic and intrinsic valuation are not necessarily mutually exclusive; an individual may interpret existence value using both understandings. We conceptualize existence value as a belief about the importance of having giraffe, which could incorporate either or both economic

and intrinsic valuation by community members in this study. As giraffe are recognized national symbols of pride and part of tourism-based operation, we propose existence value to be a predictor of normative beliefs about giraffe.

Although less theorized and thoroughly studied as other human dimensions concepts of the cognitive hierarchy, perceptions can influence support for conservation. Perceptions can be conceptualized as "the way an individual observes, understands, interprets, and evaluates a referent object, action, experience, individual, policy, or outcome" (Bennett, 2016, p. 565). Perceptions are formed through both conscious and unconscious processing, guiding the subjective development of how people both experience and interpret someone or something (Beyerl et al., 2016). Consideration of perceptions as individuals' reality, based on how each individual experiences and interprets, suggests that they can be a useful tool for conservation strategies and management. Perceptions can be categorized into different areas of insights for wildlife conservation planning, including social impacts of conservation, ecological outcomes of conservation, legitimacy of conservation governance, and acceptability of conservation management (Bennett, 2016). Perceptions regarding views of social impacts and whether such impacts are considered equitable is one category particularly relevant to human dimensions research and planning. In this context, perceptions of benefits and costs of living with wildlife can be useful. In African conservation contexts, studies have linked the importance of connecting community benefits to wildlife conservation (Bruyere et al., 2008). Examples of studies that explore perceived benefits and community support for wildlife conservation include those for Grevy's zebra (Sundaresan et al., 2012), African elephants (Gadd, 2005), and lions (Mkonyi et al., 2017). Perceptions of both tangible and intangible benefits can be classified and studied (Kansky et al., 2016). Another category of perceptions relates to people's views on ecological

processes and trends. Exposure to and experiences with wildlife can predict attitudes toward a species (Kansky & Knight, 2014), so perceptions of giraffe population trends may influence other cognitions.

2.1.3 Aim and Hypotheses of the Study

The purpose of this study is to understand the relations among key human dimensions cognitions (Figure 2.2), specific to reticulated giraffe in northern Kenya.

H_{1ab}: Attitudes and beliefs toward giraffe will differ based on demographic traits.

H_2: Exposure to giraffe (frequency of giraffe sightings) will be positively related to perceived population trend.

H_{3ab}: Perceived benefits of living with giraffe will be positively related to attitudes towards and existence value of giraffe.

H_{4abc}: Attitudes toward giraffe, existence value of giraffe, and perceived benefits of living with giraffe will be positively related to normative beliefs toward giraffe.

H_5: Perceived decline in giraffe population trend will be negatively related to positive normative beliefs toward giraffe.

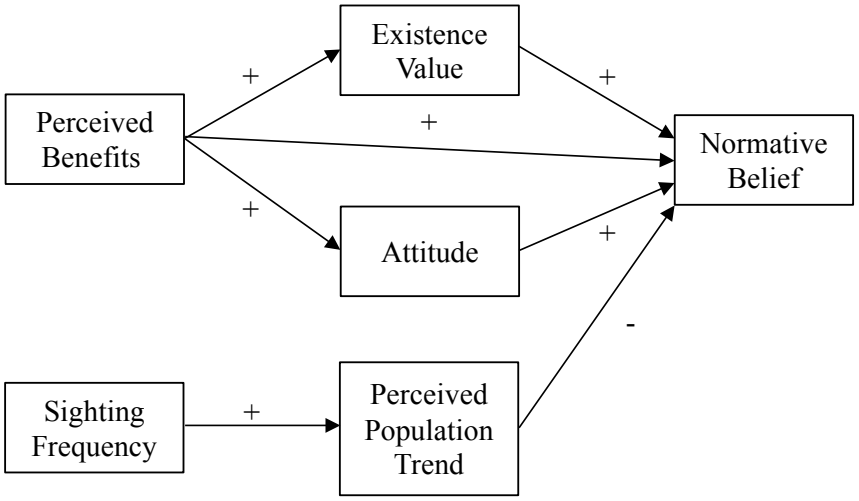

Figure 2.2. Hypothesized Relationships Among Concepts.

2.2 Methods

2.2.1 Study Area

This study was conducted within two areas in northern Kenya: the southeastern unit of Namunyak Wildlife Conservation Trust (Namunyak Conservancy), a community conservancy in Samburu County, and six group ranches/community settlements (Il Motiok, Koija, Ol Dnyiro, Kirimon, Sagumai, and P&D) along the northern and eastern borders of Loisaba Conservancy in Laikipia County (Figure 2.3). The landscape in both areas is characterized by semi-arid savannah Acacia woodland and grassland, and land use is dominated by subsistence pastoralism and in Laikipia, commercial ranching, as well as management for wildlife conservation and tourism operations.

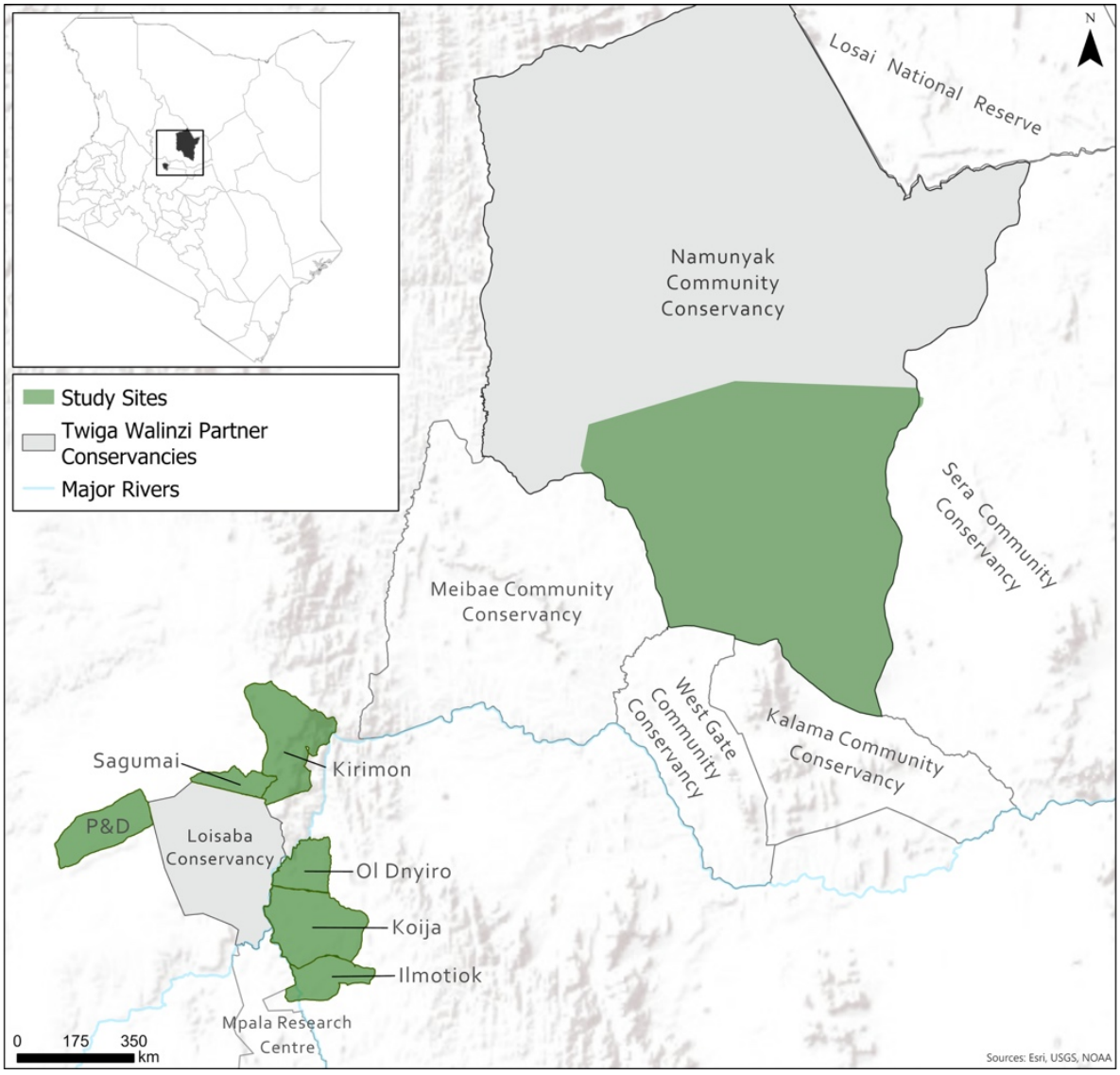

Figure 2.3. Study Sites in Northern Kenya.

Namunyak Conservancy is comprised of 383,800 ha and a population of 17,000, including an estimated 1,500 adults living in the manyattas (pastoral villages) within the study area. The land is communally owned under Kenya's Community Land Act (No. 27 of 2016), and governed by an elected local board. Namunyak Conservancy registered with the Northern Rangelands Trust in 1995. The wildlife on these lands is under the jurisdiction of Kenya Wildlife Service, and conservancy members are held to national policies that forbid killing of any

wildlife. The people in Namunyak share a Samburu ethnicity and culture. Income is generated through subsistence pastoralism, livestock sales, conservation and wildlife-based tourism, and small businesses (e.g. grocery, hospitality, carpentry).

Loisaba Conservancy is a 23,000 ha private wildlife reserve and working ranch, in the northeastern corner of Laikipia County. In 2014, The Nature Conservancy facilitated ownership transfer of the property to the Loisaba Community Trust. The estimated adult population was 1,400 within the study area of six group ranches around Loisaba. The pastoralists in these areas are Maasai and Samburu, sharing a similar culture.

2.2.2 Data Collection

Respondents were selected using quota sampling of manyatta areas (pastoral villages) within the study areas. Updated census data were limited in both sites, so community elders generated a sampling plan from population estimates. Manyatta quotas were generated by population totals and a target sample of 300 respondents at each site.

Six research assistants conducted face-to-face interviews with a structured questionnaire. The questionnaire was developed in English, translated to the local Maa language, and back-translated to English to ensure reliability of item wording. Research assistants were from the local communities, conducted in pairs using the Maa language. Data were entered using QuickTap software (version 9.3) on iPad tablets.

Interviews in Namunyak were conducted from October 2016 to January 2017. Interviews in the group ranches around Loisaba were conducted from November 2016 to December 2016 and from July 2017 to August 2017. The questionnaire consisted of 68 items about giraffe, other wildlife, and demographics (Appendix A) and took an average of 40 minutes to complete. The

study, including the verbal consent process and script, was reviewed and approved by the Institutional Review Board (IRB# 02156e) of Miami University, Ohio.

2.2.3 Analysis Variables

The questionnaire assessed six variables (Table 2.1 for exact wording): (a) attitudes towards giraffe, (b) normative belief about giraffe, (c) perceived population trend, (d) existence value of giraffe, (e) exposure to giraffe, and (f) perceived benefits from giraffe. Four additional demographic variables were measured: gender, age, occupation, and education level. Respondents' ages were recorded as continuous and then recoded into four discrete categories, based on age sets in Samburu and Maasai culture (18-25, 26-35, 36-50, 51+). Respondents' occupation (pastoralist, crop farmer, tourism worker, business, student, ranger, teacher, wildlife, casual laborer) and highest education level completed (none, primary, secondary, university) were also coded into discrete categories.

General attitude toward giraffe was measured on a 5-point scale from *strongly dislike* (1) to *strongly like* (5). Normative belief was measured by asking respondents what they think should happen to the local giraffe population in their area in the next three years, measured on a 3-point scale (*be reduced, stay the same, increase*). Two additional response categories (*should not be here, do not know*) were presented for the normative belief item. Normative belief was recoded into whether respondents felt that the local giraffe population should increase (1) or not (0). Perceived population trend was measured on the same 3-point scale (decreased, stayed the same, increased), with an option for *do not know*, when asked what had happened to the local giraffe population in the previous three years. Existence value was measured by evaluations of the importance of having giraffe in the local area. Responses were coded on a 3-point scale (not important, a little important, very important), with an option for *do not know*. Exposure to giraffe

was measured by perceived frequency of sightings, measured by four categories (*never, few times per year, few times per month, few times per week*), and options for *I do not know that animal* and *I do not know how often*. Respondents indicated whether they felt the following benefits from living with giraffe: revenue from tourists, jobs in conservation/wildlife tourism, aesthetic enjoyment, meat or other giraffe parts, role in ecosystem functioning with crops, livestock, and/or savannas, or other benefits (recorded as an open-ended response and recoded as a dichotomous variable). Perceived benefit categories were coded as dichotomous variables for no (0) and yes (1), and a summative index (0-7) was computed. The list of potential benefits from living with giraffe was generated through research planning meetings with conservancy leadership and the research team of local enumerators. Though the list was meant to be exhaustive, the open-ended prompt for "other" benefits provided space for respondents to list additional benefits.

2.2.4 Data Analysis

For all analyses, responses from Loisaba and Namunyak were filtered to run tests at each site separately. We used an alpha level of $p < .05$ for all analyses. H_1 was tested with chi-square, independent sample *t*-tests, and one-way Analysis of Variances (ANOVA) to compare groups. Path analyses were conducted with linear regression to examine H_2 and H_3, and logistic regression for H_4 and H_5. The following effect size indices were used: Cohen's *d* for independent samples t-test, eta (η) for ANOVA, ϕ for chi square, correlation coefficient (*r*) for regressions, and Nagelkerke R^2 for logistic regression. Levels of effect sizes were interpreted using recommendations from Vaske (2008): minimal relationship for correlation coefficients of 0.1, typical relationship for coefficients of 0.3, and substantial relationships for coefficients for

coefficients of 0.5. We used SPSS version 25.0 (Statistical Package for the Social Sciences) for all analyses.

2.3 Results

2.3.1 Sample Characteristics

The questionnaire was completed with 579 individuals; 50.9% were male and 49.1% were female. The respondents fell into the following age categories: 19.2% were between 18 to 25 years, 33.3% were between 26 to 35 years, 31.4% were between 36 to 50 years, and 16.1% were 51+ years old. The following levels of education were completed by respondents: none (65.1%), primary (23.8%), secondary (6.9%), post-secondary (4.1%). The sample included the following occupations: livestock herder/pastoralist (85.3%), crop farmer (1.6%), tourism worker (2.8%), business (5.9%), student (2.1%), ranger (0.5%), teacher (0.7%), wildlife-related job (0.2%), and casual laborer (1.0%).

There were few significant differences between demographic groups (H_1). At Namunyak, attitude towards giraffe differed between respondents with varying education levels. Those with secondary education had more positive attitudes than those without any completed education (F=3.58, p=0.01, η=0.19). At Namunyak, levels of perceived benefits differed between respondents with varying education levels (F=3.82, p=0.01, η=0.20) and occupations (F=5.87, p<0.001, η=0.36). Respondents that completed post-secondary education perceived higher levels of benefits from giraffe than those without completed education (p=.02). Tourism workers had higher levels of perceived benefits than pastoralists (p<.001), crop farmers (p<.01), and business owners (p<.01). At Loisaba, the only significant difference was between those with no completed education and post-secondary education regarding their levels of perceived benefits (F=4.92, p<0.01, η=0.22).

Table 2.1. Descriptive Statistics. Sample size, mean, and standard deviation for attitudes, beliefs, and normative beliefs toward giraffe for the two study areas.

		n	Mean	Standard Deviation
Attitude[a]	Namunyak	286	4.55	.71
Which best describes your feelings toward giraffe that live in this area?	Loisaba	295	4.27	.79
Existence Value[b]	Namunyak	284	2.88	.35
How important is it for giraffe to live in this area?	Loisaba	258	2.56	.62
Normative Belief[c]	Namunyak	276	.94	.24
In 5 years, do you think the number of giraffe in this area should increase?	Loisaba	180	.71	.46
Perceived Benefits[d]	Namunyak	286	3.70	1.39
Do you receive this benefit from having giraffe in this area?	Loisaba	295	2.36	1.53
Perceived Population Trend[b]	Namunyak	265	2.78	.62
In the last 5 years, what has happened to the giraffe population in this area?	Loisaba	247	2.40	.86
Sighting Frequency[e]	Namunyak	285	3.43	.76
How often do you see giraffe in this area?	Loisaba	199	3.24	.63

[a]Measured on 5-point scale, 1=Strongly dislike to 5=Strongly like
[b]Measured on 3-point scale, 1=Not important to 3=Very important
[c]Dichotomous variable, 0=No, 1=Yes
[d]Index (0-7), Summative index for types of benefits associated with local giraffe
[e]Measured on 4-point scale, 1=Never, 2=Few times/year, 3=Few times/month, 4=Few times/year

The majority of respondents felt positively towards giraffe (92.4%), valued giraffe as very important (76.4%), and believed giraffe populations should increase (84.6%). A majority of the sample, 68.1%, perceived the population trend of giraffe in Kenya to be increasing, and 48.3% reported to see giraffe a few times per week or more (Table 2.1). The benefits most included in index scores were aesthetic appreciation (90.0%), jobs in tourism/conservation (60.1%), and financial benefits from tourism (50.3%), and the mean index score for benefits was 3 (index 0-7).

2.3.2 Path Analyses

The path analysis was conducted separately with data filtered by field site. Path relationships from Namunyak are shown in Figure 2.4a. There was a positive association between perceived benefits and existence value ($R^2 = .12$, $\beta = .34$, $p < 0.001$, n=284; H_{3b}) and attitude ($R^2 = .02$, $\beta = .14$, $p = 0.02$, n=286; H_{3a}). There was a positive relationship between frequency of giraffe sightings and perceived population trend ($R^2 = .11$, $\beta = .33$, $p < 0.001$, n=263; H_2). The model explained 12.1% variance in normative beliefs (Nagelkerke $R^2 = .12$). There were significant positive associations between normative beliefs and existence value (Wald $\chi^2 = 4.24$, $p = .04$; H_{4b}) and with attitude (Wald $\chi^2 = 5.44$, $p = .02$; H_{4a}). Perceptions of benefits and giraffe population trend were not significantly related to normative belief (H_{4c}, H_5).

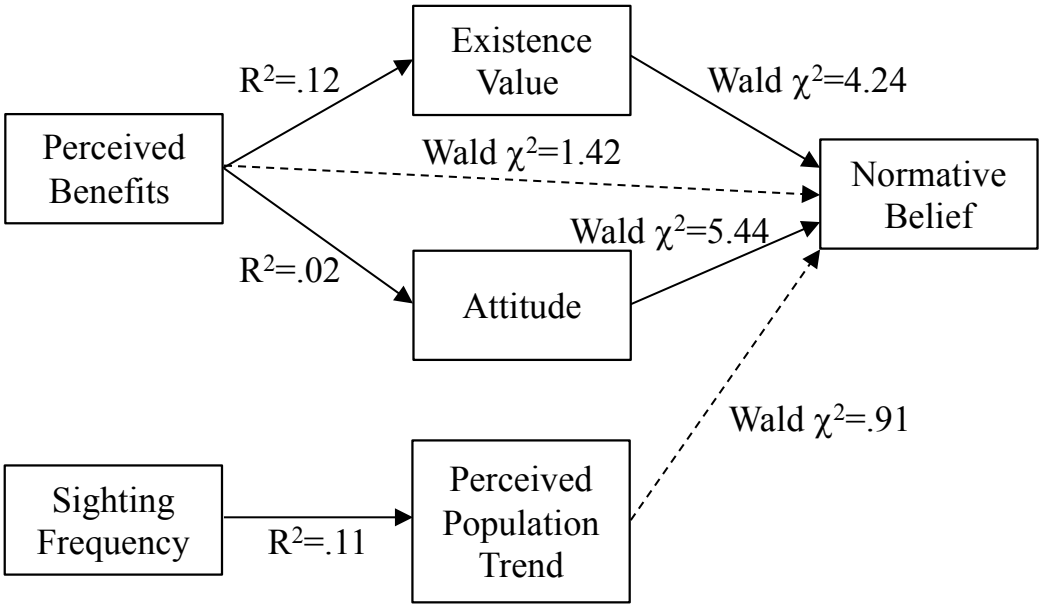

Figure 2.4a. Path Analysis Model for Namunyak (n=261 for logistic regression onto normative belief).

Path analysis for Loisaba is shown in Figure 2.4b. There was a positive association between perceived benefits and existence value (R^2 = .16, β = .398, p <0.001, n=258; H_{3b}) and attitude (R^2 = .11, β = .337, p <0.001, n=295; H_{3a}). There was a positive relationship between frequency of giraffe sightings and perceived population trend (R^2 = .05, β = .219, p < 0.01, n=182; H_2). The model explained 33.9% variance in normative beliefs (Nagelkerke R^2 = .34). Attitude toward giraffe and existence value did not have significant relationships with normative belief (H_{4ab}). There was a significant positive association between perceived benefits and normative belief (Wald χ^2 = 4.00, p = .04; H_{4c}). Perceived population trend was positively related to normative belief (Wald χ^2 = 25.98, p < 0.001; H_5).

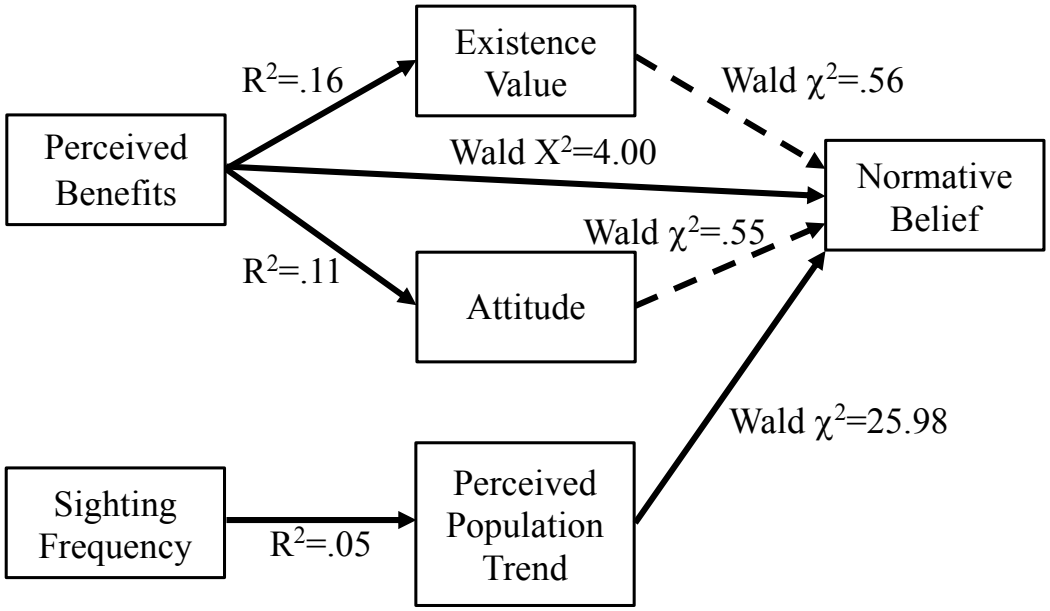

Figure 2.4b. Path Analysis Model for Loisaba (*n*=164 for logistic regression onto normative belief).

The results support the following hypotheses: (a) frequency of giraffe sightings were positively related to perceived population trend (H_2), (b) perceived benefits were positively related to attitudes towards and existence value of giraffe (H_{3a}; H_{3b}), (c) existence value was positively related to normative belief (Namunyak) (H_{4b}), and (d) perceived benefits were associated with normative belief (Loisaba) (H_{4c}). Hypothesis one was partially supported; respondents differed in attitudes and levels of perceived benefits based on level of education and occupation. The following relationships were not significant: attitudes and perceived benefits as predictors of normative belief at Namunyak (H_{4a}; H_{4c}), and attitudes and existence value did not relate to normative belief at Loisaba (H_{4a}; H_{4b}). Perceived population trend was not negatively associated with normative belief at either site, contrary to the predicted relationship in H_5.

2.4 Discussion

This study explored the relationships among key human dimensions cognitions about reticulated giraffe in northern Kenya. Results suggest particular cognitions have stronger influence on normative beliefs about giraffe population recovery, advancing theoretical understanding and applications for giraffe conservation.

2.4.1 Theoretical Implications

Development of theory requires testing of proposed relationships within diverse contexts to see how relationships hold up or change. Many international HDW studies are descriptive in nature, needed by conservation managers to develop strategies and interventions tailored to socio-economic and ecological contexts. However, designing studies with theoretical framing advances the field toward increased understanding of the mutual influences of human-wildlife interactions (Decker et al., 2012).

Increased understanding of the relationships among human cognitions and perceptions can aide in conservation management and planning. These results show how pastoralists feel toward and think about local giraffe populations, and support how cognitions have different levels of influence depending on the context. Results reveal partial support for conceptual framing that structures the cognitive hierarchy, in which general concepts influence context-specific and situational concepts. For example, at Namunyak, existence value had the strongest predictive relationship of normative beliefs about whether giraffe populations should increase. This suggests that processing of human-giraffe relations and interactions does not influence cognitions exclusive of each other. Instead, a shift in one type of cognition can serve as a path of influence for a change in another type.

The specificity principle proposes that the validity of cognitive measurements and predictive value of correlations between cognitions will increase with specificity (Heberlein, 2012). Many previous studies based in African contexts utilized wildlife as a general attitude object (Browne-Nuñez & Jonker, 2008). Beliefs about wildlife species are influenced by situational determinants (Zinn et al., 2000). There is great need to further test specific cognitions with theoretical framing that has increased specificity for improved data validity. To best inform conservation management for specific species, human dimensions studies are needed in particulars contexts, like this examination of human dimensions cognitions related to giraffe conservation.

Quantitative social science often requires formulation of constructs measured on a point scale and treated as a continuous variable (Vaske, 2008). The global biodiversity crisis necessitates research done cross-culturally, but there are challenges involved with adapting theories and methods that were developed in the Western world for use in diverse settings (Browne-Nuñez & Jonker, 2008). Limitations with measurement in social science studies are in need of consideration in areas with low literacy, when instrument content may shift due to translations to different languages, or based on other cultural factors (Gore & Kahler, 2015). Prior to this study, Likert-type scale-based questionnaires had not been utilized in many places within the study areas. Based on uncertainty around the applicability of 5-point scales during face-to-face interviews, some variables (e.g. existence value, normative belief) were measured using scales with fewer items and descriptive scale labels (e.g. decrease, stay the same, increase). Quantitative research in cross-cultural settings and areas with varying levels of literacy requires in depth training of enumerators and pilot testing, so that both item wording and response types can be adapted for appropriate use.

2.4.2 Applied Implications

The large majority of respondents at both sites held extremely positive attitudes towards giraffe. Attitudes can be an important component of communities' understanding and acceptance of wildlife, and previous studies in African contexts found positive attitudes among certain subgroups toward wildlife, certain species, or conservation (Hariohay et al., 2018; Tessema et al., 2010). When views toward wildlife are positive, communities are more receptive to living with wildlife. In some cases, negative attitudes and views are correlated with high-conflict species like predators (Mitchell et al., 2019; Mkonyi et al., 2017). Positive attitudes can be utilized to strengthen receptivity and support for conservation through framing of coexistence (Frank et al., 2019). There is potential to link positive attitudes with normative messaging to build support for conservation efforts or interventions. Injunctive norms are perceptions of what is typically approved or disapproved (Cialdini, 2003), so emphasizing the descriptive norm from the large majority of positive attitudes about giraffe can serve to reinforce norms and potentially shift those within a community with a more negative attitude. Leveraging normative messaging with widely held positive attitudes can build receptivity for conservation efforts, including targeted reduction in undesirable behaviors like poaching and giraffe meat consumption.

Though some variables in the proposed model demonstrated a significant influence on normative belief, the routes of influence and strength of relationships differed by site. These results support the notion that human-wildlife interactions and relationships with wildlife are context-specific. One study in Samburu, Kenya (Mitchell et al., 2019) found that residents of a community conservancy held positive attitudes towards lions and leopards and expressed negative attitudes towards hyenas and wild dogs, disproportionate to rates in which those carnivores are involved in depredation events. Other studies in northern Kenya have reported that

local pastoralist communities hold majority negative views toward carnivores (Romañach et al., 2007, 2011). Cognitions have also been shown to differ among adjacent communities, such as perceived benefits of Grevy's zebra between ranches with and without tourism enterprises in Laikipia County (Sundaresan et al., 2012). These examples measure cognitions related to focal species, but contextual differences can also apply to other cognitive objects, like conservation management interventions. Two neighboring communities differed significantly in perceptions of a fence to reduce crop raiding by elephants (Van Eden et al., 2016). Conservation efforts should be tailored to a context based on the many social and cultural factors that influence attitudes and perceptions toward wildlife (Dickman, 2010). Our results suggest differences between the two study sites that can be integrated into conservation messaging and interventions so that diversity is reflected.

Though the cultural and ecological contexts are similar between the two study sites, the models for land use and ownership differ. Interactions with land and ownership models influence the ways in which people view the wildlife that lives there. In community conservancies (e.g. Namunyak), the stream of benefits is more direct, as locally elected leadership governs the operational budget from local tourism operations and entrepreneurship. Many tourism lodges and outfitters are privately owned, but direct revenue to projects in neighboring communities. Thus, community development from tourism is a key incentive for coexisting with wildlife and habitat protection. Our results suggest that perceptions of benefits are more strongly linked with attitudes and beliefs about giraffe in communities adjacent to a privately-owned conservancy (e.g. Loisaba).

The relationship between perceived benefits and normative belief was not significant within the community-owned conservancy. Instead, existence value mediated the relationship

between perceived benefits and normative belief. Receptivity for conservation could be built by strengthening the relationships between increased community benefits and community participation in species conservation, particularly in areas where there are mixed land use models. The links between benefits from conservation with peoples' attitudes and behaviors are complex (Scanlon & Kull, 2009), but here we focused on perceived benefits, determined by individuals' interpretation of personal benefits from conservation. However, outside the scope of this study, there is a need for additional work to explore both perceived and realized benefits connected to conservation, and the relationship among benefits from wildlife protection and human dimensions cognitions.

There was little variation in cognitions among the respondents based on demographic differences. There is often heterogeneity within a social group, even those viewed as cohesive (e.g. Sponarski, Semeniuk, Glikman, Bath, & Musiani, 2013). Closer agreement of certain values and beliefs, however, can foster agreement on receptivity for conservation interventions that align with such views. Our results suggest that the demographic groups more likely to hold positive attitudes, values, and beliefs about giraffe are those with higher levels of education and occupations related to wildlife conservation. Evidence of influence from demographic variables on cognitions related to giraffe conservation is limited. Such little variation among the population at study sites suggests that conservation messaging would be more uniformly received by members of the general population. Audience segmentation is useful for tailoring conservation messaging for particular subgroups (Kidd et al., 2019). Since human dimensions cognitions are more consistently held across these pastoralist communities, however, conservation messaging can be framed for broader delivery at community-level events.

The hypothesis that perceived population trend would be negatively correlated with normative belief about future giraffe population trend was not supported. Although reticulated giraffe populations have declined across their range, it is possible that local giraffe populations at the study sites have increased. Though in overall decline, wildlife populations have become denser in space managed for conservation, either through government protected areas or community or privately-owned conservancies (Ogutu et al., 2017). For many pastoralist communities, their knowledge of the land is very deep, but at a local scale. Thus, when overall declines of a species across its range are not proportional to local population sizes, using conservation status as a communication tool may not align with the lived experiences of communities in the same range. Within the context of these study sites, perceived population trend does not negatively correlate with normative belief about future trends in local giraffe populations, and thus should not be emphasized by messaging within this context.

2.4.3 Limitations of the Study

This study provides initial insights into the human dimensions of giraffe conservation, but there are several limitations to note. This study was conducted in areas with low literacy, and thus, face-to-face interviews with closed ended items were utilized. The applicability of scale-based items within this cultural context was uncertain, so single-item measures were used for multiple variables. Hypothesis testing would be improved with a repeat study that constructs variables with multiple items tested for internal reliability and computes mean variable scores.

The amount of variance explained by the hypothesized model suggests that other variables are involved in determining normative beliefs about giraffe. The significant relationships suggested by these data may increase in explanatory power with the use of multiple item measures and mean variables for hypothesis testing. This use would necessitate reporting of

effect sizes to interpret the meaning of significant paths in the proposed model. Other possible explanatory variables that were not tested could be the cognitive component of attitudes, meaningful experiences with giraffe, separated tangible and intangible benefits from giraffe, or basic belief patterns.

2.4.4 Recommendations for Future Research

Findings from this study are contextual for pastoralist communities in northern Kenya. Giraffe range expands across 21 African countries with varying socioeconomic and political climates, as well as ecological diversity. There is high need for human dimensions research to aide giraffe conservation policy and planning in diverse contexts, particularly around questions linked to threats that giraffe face including community receptivity for giraffe translocations, protected area relations, giraffe part use and trade, and giraffe conservation in relation to sustainable use and livelihoods.

As most theories used in HDW research were developed in North American contexts, additional testing is needed to assess their utility in diverse cultures and locations. To advance theoretical understanding of human-giraffe relationships, future research should test alignment with the cognitive hierarchy and test variables with greater specificity. Such research can connect values, beliefs, attitudes, and norms with behavioral intention for actions related to giraffe conservation. This study verified the use of quantitative scales in pastoralist communities, and now more refined measurement techniques need to be utilized in similar contexts for further research on applicability of the cognitive hierarchy to giraffe conservation.

There is also need for future research on human dimensions information related to species involved in low levels of conflict with communities. There is more opportunity to shift communities' perceptions, attitudes, and beliefs when negative views are held, such is the case

with some species involved in conflicts about wildlife management. However, other species, like herbivorous mammals, are in continued decline and in need of targeted conservation action. An area of future research should focus on how to build receptivity for conservation when positive attitudes and beliefs about a species are embedded within a community, but threats are still present.

2.5 Conclusions

Applied research on specific species can progress understanding of human-wildlife interactions and inform conservation management. This study explored relationships among key cognitions that form pastoralists' understanding of local reticulated giraffe populations. Attitudes toward giraffe were very positive and belief in the importance of local giraffe populations was strong across the study population. Additional work is needed on how to leverage positive perceptions, attitudes, and beliefs about a low conflict species into receptivity and community support for conservation actions that reduce threats to wildlife. It is important to consider cultural and social contextual factors that influence human-wildlife interactions and how human dimensions information can be integrated into management options.

CHAPTER 3: LINKING WILDLIFE BENEFITS WITH ATTITUDES AND BEHAVIOR: EVIDENCE FROM GIRAFFE CONSERVATION IN KENYA

3.1 Introduction

Current approaches to conservation practices reside on a spectrum, with varying involvement of people in management and planning (Gavin et al., 2015). This diversity is in part due to the call for transition from protectionism and 'fortress conservation' to more inclusive and people-centric models for conservation (Berkes, 2004). There are critiques against integrated conservation and development, arguing that integrated goals can dilute the outcomes for targets (Salafsky, 2011), yet there is evidence to suggest that community-based approaches to conservation can result in favorable social and ecological outcomes (Brooks et al., 2013.

Conservation challenges are embedded in complex systems, and thus the actions to address such issues are needed at multiple scales (Berkes, 2007). At local levels, community-based conservation (CBC) aims to devolve control of natural resource management, directing the process and purpose of conservation to be by, for, and with local communities (Western & Wright, 1994). Among other principles (e.g. decentralized governance, participation, adaptation), a key focus of CBC is shifting the imbalance of bearing costs and accessing benefits from living with wildlife (Meguro & Inoue, 2011). A main assumption made by those that promote and implement CBC is that linking benefits with conservation will result in the protection of wildlife and natural resources. This study aimed to test this theory, exploring whether perceived benefits influence attitudes and behaviors toward wildlife by using the case of reticulated giraffe (*Giraffa reticulata*) conservation in northern Kenya.

3.1.1 Benefits from Conservation

There are a number of benefits and costs, tangible and intangible, that can be derived from wildlife conservation (Kansky et al., 2016). Intangible benefits from wildlife can include intrinsic or aesthetic appreciation (de Pinho et al., 2014), ecosystem services provided by resilient and biodiverse ecosystems (Silvestri et al., 2013), and social capital and learning from participation in governance (Brooks et al., 2012). Tangible benefits take form in financial benefits from conservation operations, including direct employment, school bursaries or other learning programs (Kieti et al., 2013), and revenue generated by consumptive (e.g. permitted hunting) and non-consumptive (e.g. photo-based tourism) models for wildlife industry (Naidoo et al., 2016). Both economic and non-economic incentives and strategies can support behavior change aligned with conservation efforts, depending on conditions (Nilsson et al., 2016).

Benefits derived from conservation activities are not likely to be distributed or realized equally across a community. Though communities are often thought of as bounded by a similarity, whether it be geographic location, traditions, livelihood practices, or other unifying connection, the concept of a community is more accurately understood as a dynamic, multidimensional, and changing network (Berkes, 2004; Carlsson, 2000). Even traditional communities have differences embedded across divergent interests or other social lines (Western & Wright, 1994). Within any CBC institution, there will be a diversity of abilities, access, or motivations to participate in conservation strategies, attitudes toward wildlife management, and beliefs in how conservation should be planned and executed, among other factors. As with any social system, there are also power dynamics that shape how and in what roles local actors can be involved in conservation planning. The distribution of benefits derived from conservation and wildlife management can be assessed by different disciplinary approaches, including

perspectives from economics (Shwiff et al., 2013), anthropology (Noe & Kangalawe, 2015), and political ecology (Greiner, 2012).

Another approach that reflects the applied field of human dimensions of conservation can examine the link between benefits and conservation through individuals' perceptions of such proposed benefits. Past studies have explored the links between conservation benefits and perceptions of protected areas (Bruyere et al., 2008), ecosystem services (Hartter et al., 2014; Sommerville et al., 2010), and species (Hazzah et al., 2014; Sundaresan et al., 2012). There are few, however, studies across Africa that assess the relationships between perceived benefits, attitudes, and behaviors. The most direct example in the literature is Scanlon and Kull (2009), which presents a case study from Torra Conservancy in Namibia and how/if benefits influence attitudes and behaviors. In their proposed model, attitudes and behaviors have dual influence on the other. Findings supported that benefits were positively associated with attitudes and pro-conservation behaviors. Key variables to these relationships, however, include the types of benefits and equitability of distribution, realized autonomy over related process, and community characteristics like norms, identity, and aspirations tied to conservation activities.

Their proposed framework is in contrast to other theoretical frameworks like the cognitive hierarchy model, which situates attitudes as influence on behavioral intentions and behaviors (Fulton et al., 1996). The cognitive hierarchy model was developed and has been predominantly used for research on human dimensions of wildlife in North American contexts, so there are additional factors that may influence individuals' cognitions, or mental processes used in thinking and understanding, in regards to relationships with wildlife in global and diverse contexts. Perceptions—the ways an individual understands and interprets their reality—are not identified in the cognitive hierarchy, but can be linked to many concepts and contextual factors,

including those included in the cognitive hierarchy model (Bennett, 2016). Perceptions toward many concepts, including costs, benefits, species, institutions, and personal experiences, are integrated into Kansky et al.'s (2016) Wildlife Tolerance Model (WTM) to explain drivers of tolerance in living with wildlife. An intended use of the WTM is to inform management interventions related to damage-causing wildlife. Rather than exploring interactions embedded in situations of human-wildlife conflict, like the WTM, the aim of this study is to explore the assumption that benefits related to conservation have an impact on how people view and act toward wildlife. We assess the relationships between perceptions of benefits associated with giraffe, attitudes toward giraffe, and giraffe part usage behavior within the contexts of community-based approaches to conservation.

3.1.2 Background

Kenya is rich in biological and cultural heritage, shaped through millennia of human-environment interactions. Nature-based tourism comprises the country's third largest source of foreign income, enabling over 1.5 million jobs (Sanghi et al., 2017). Early conservation models reflected traditional parks systems. In the 1970s, Kenya Wildlife Service introduced grazing fees to communities adjacent to Amboseli National Park as the initial form of payment for ecosystem services (Western et al., 2015), and a ban was placed on all consumptive uses of wildlife. In 1991, Kenya Wildlife Service began promoting CBC as an additional conservation model to protected areas. This evolution included the establishment of the Northern Rangelands Trust (NRT), a non-profit NGO that aims to support community conservancies that self-organize for governance and communal land ownership titles under the Community Land Act (Pellis et al., 2015). NRT currently consists of 39 community conservancies that span 42,000 km^2 and includes a population of over 320,000 (Northern Rangelands Trust, 2018). In this study, we focus

on the relationships between perceived benefits, attitudes, and behaviors among the communities that own NRT-affiliated Namunyak, Kirimon, Ol Dnyiro, and Naibunga Conservancies. In Samburu and Laikipia counties, these community conservancies are adjacent to government-protected national parks and reserves, as well as privately-owned properties, some of which are managed for wildlife habitat and livestock rearing. Loisaba Conservancy, another study site, is one of these private properties managed for wildlife conservation, and implements social programs within the neighboring communities, more closely reflecting a protected area system.

Assessments of the social and ecological outcomes associated with community conservation models are mixed. Wildlife populations have declined across protected and non-protected areas in Kenya (Ogutu et al., 2016), but there is also evidence for conservation outcomes, such as wildlife densities and reduced poaching, on community-owned lands managed for wildlife conservation (Ihwagi et al., 2015; Kiffner et al., 2020). Results that demonstrate the importance of community models for conservation serve to contest narratives of land degradation driven by pastoralist overgrazing. Instead, pastoralism can be compatible with wildlife management, with rangelands governed as common property systems, co-managed at local levels, and in accordance with state-level policies (Mwangi & Ostrom, 2009).

Revenue-generating programs are an important element for resiliency within the socio-ecological system of community conservancies. Wildlife-based tourism accounts for both direct employment and the conservancy fees derived from tourism (Cheung, 2012), which are directed into conservancy operations and community beneficiaries like education bursaries, health programs, infrastructure improvements, and other conservancy needs. A presumption with this model is that tourists will be attracted to visit by experiences that include viewing opportunities of local wildlife species. Though there is likely diversity of preferences and interests among

clientele, Kenya's charismatic wildlife are often marketed as such experiences for visitors (Skibins et al., 2013).

In this study, reticulated giraffe are used as a focal species to assess the connections between perceived benefits, attitudes, and behaviors related to conservation. Three giraffe species (Northern, Masai, and Reticulated) occur in Kenya and account for approximately 30% of Africa's giraffe populations (Giraffe Conservation Foundation, 2019). All giraffe species in Kenya show declining population trends, threatened by habitat loss and degradation driven by climate change and landscape development, disease, poaching, and illegal trade of meat or other parts. Illegal hunting and trade of giraffe meat and parts are recognized as key drivers of giraffe population declines, but the dynamics and extent of giraffe part usage are not well understood. In Kenya, all killing and use of giraffe parts are illegal. Preliminary research (Dunn et al., *in prep*) listed meat as the primary giraffe product used in Kenya. Giraffe part usage is further explored in Chapters 4 and 5.

Reticulated giraffe provide an important case for review of conservation benefits due to their role in wildlife-based tourism (Okello et al., 2008), continued population declines, and the majority of positive community support for local giraffe populations among pastoralist communities (Chapter 2). The consumption of giraffe parts are pressuring some giraffe populations in East Africa, so a better understanding of influences on, and descriptors of, those that use giraffe parts is particularly relevant for giraffe conservation planning. This study assesses the links between perceived benefits derived from local giraffe populations and the associated attitudes toward giraffe and consumptive behaviors.

3.1.3 Hypotheses

We explore the following hypotheses:

H_1: Attitudes toward giraffe will differ between respondents with varying perceived conservation benefits.

H_2: Attitudes toward giraffe will differ between respondents that perceive a consumptive benefit from giraffe.

H_3: Non-consumptive and consumptive benefit types will be positively associated with attitudes toward giraffe.

H_4: Respondents that perceive conservation benefits will be less likely to have consumed giraffe parts.

H_5: Respondents that perceive non-consumptive benefits from giraffe are less likely to have consumed giraffe parts.

H_6: Respondents that perceive a consumptive benefit from giraffe are more likely to have consumed giraffe parts.

3.2 Methods

3.2.1 Study Sites

Study areas spanned (a) sixteen villages within Naibunga, Oldnyiro, and Kirimon Community Conservancies and three group ranches adjacent to Loisaba Conservancy in Laikipia County and (b) fifteen villages within Namunyak Community Conservancy in Samburu County (Figure 3.1). These lands are home to pastoralist communities, with the local population predominantly comprised of Maasai and Samburu tribes. Land use in these areas is dominated by pastoralism, in which livestock are reared for subsistence and livestock sale. Other properties in the regions are owned as government-protected reserves or private lands that are managed for

wildlife habitat and/or commercial ranching. Additional industries in the area are centered around wildlife tourism and independent businesses for goods and services.

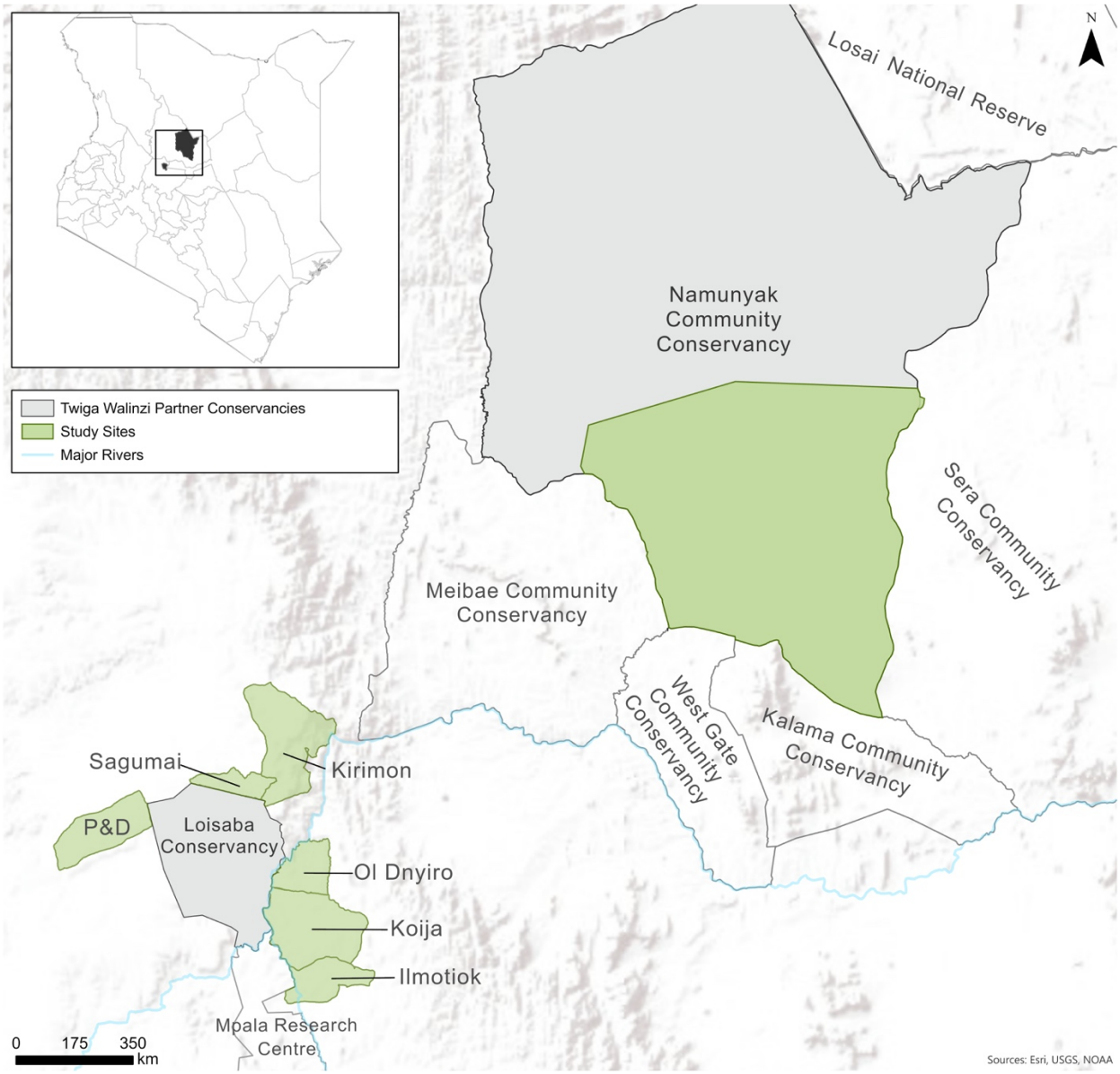

Figure 3.1. Map Depicting Study Sites. The areas in green include the sampled villages within Namunyak (n=284) and with the communities that surround Loisaba (n=295).

3.2.2 Data Collection

Data were collected from October 2016 to September 2017 with a close-ended instrument and face-to-face interviews. We used quota sampling so that the total sample reflected proportions of each village population. Each village had a target quota, and interviewers alternated between approaching men and women for participation. The interviews included open-ended items and close-ended items and lasted approximately 40 minutes.

Research protocols, instrument, and consent process was reviewed and approved for ethical consideration by Miami University, Ohio—IRB Protocol #02156e. The questionnaire was written in English, translated into the local Maa language, and back-translated to ensure reliability of item wording. The questionnaire included questions regarding exposure to various wildlife species, perceived threats, perceived benefits, attitudes, beliefs, and past behavior (Appendix A). Items on the questionnaire, including types of potential benefits associated with giraffe, were developed with a team of local enumerators, in consultation with community leadership, and from pre-testing with local community members. For this study, some of these variables were used for analyses. Perceived benefits, attitudes toward giraffe, past giraffe meat consumption behavior, and demographic variables were measured.

3.2.3 Perceived Benefits

We assessed perceived benefits by prompting with the question: “For each of the following, please tell me whether or not you received that benefit from having giraffe in this community.” Potential benefits listed were: (a) money from tourists coming to see them, (b) job in conservation/tourism, (c) I enjoy seeing them, (d) meat or other parts of the giraffe, (e) helps with crops, (f) helps with livestock, (g) helps with the working of the savanna. Respondents were also asked if there are any other benefits from giraffe that were not previously listed. Responses

were coded as dichotomous variables, (0) for *No* and (1) for *Yes*. An additional response item was given for *I don't know*. Two items – money from tourists coming to see giraffe and job in conservation/tourism – were coded as conservation benefits. A categorical variable was computed for each respondent: no conservation benefit, money from tourism, job in conservation, both conservation benefits. An additional variable was recoded for consumptive versus non-consumptive perceived benefits, based on whether a participant responded *yes* to receiving benefits from the prompt about meat or other parts of the giraffe.

3.2.4 Attitude

We measured the affective component of attitude toward giraffe by asking, "Which best describes your feelings toward giraffe that live in this area?" Responses were measured on a five-point Likert-type scale, from *strongly dislike* (1) to *strongly like* (5).

3.2.5 Behavior

For this study, behavior was defined by whether or not a respondent stated that they had consumed giraffe meat or parts. Interviewers utilized a direct question, "When was the most recent time you used giraffe meat or other parts of giraffe?" Categorical response options were: *never, within the last 12 months, between 1-5 years ago, between 6-10 years ago, more than 10 years ago,* or *I don't know*. A categorical variable was recoded for recent behavior, for which respondents were grouped into (0) Never have consumed giraffe meat, (1) More than one year for most recent consumption, or (2) Consumed giraffe within the last 12 months.

3.2.6 Demographic Traits

Demographic variables were recorded in each interview, including gender of respondent, main occupation (*livestock herder or pastoralist, crop famer, tourism worker, business owner,*

other), age (recorded as continuous and recoded into meaningful age categories for Maasai and Samburu societies), and highest completed level of education (*none, primary, secondary, university*).

3.2.7 Data Analysis

The relationship between varying levels of perceived benefits from conservation (money from tourists coming to see giraffe and/or a job in conservation/tourism) and attitude toward giraffe were compared using one-way analyses of variance (ANOVA) and Bonferroni (equal variances assumed) or Tamhane's T2 (equal variances not assumed). Eta (η) were used to evaluate the strength of significant relationships. An independent t-test was used to assess differences between those that do and do not perceive consumptive benefits of giraffe, in regards to attitudes toward giraffe, using Cohen's d to estimate effect sizes. Predictive relationships of each perceived benefit on attitude toward giraffe were tested using multiple dummy variable regression, with independent variables (each perceived benefit type) entered stepwise. Chi-square tests were used to evaluate differences between groups of conservation benefits on past consumption of giraffe meat or parts. Cramer's V was used to determine strength of those relationships. Chi-square tests and Cramer's V were also used to test differences between groups for each type of perceived benefit and reported consumption behavior. Interpretation of effect sizes from Cohen's d, Eta, and Cramer's V were based on recommendations from Vaske (2008).

3.3 Results

The questionnaire was completed by 284 respondents at Namunyak and 295 respondents at Loisaba. The sample was close to evenly split by gender at both sites (Namunyak, 52.8% male and 47.2% female; Loisaba, 49.2% male and 50.8% female). Overall, the respondents fell into

the following age categories: 19.2% were between 18 to 25 years, 33.3% were between 26 to 35 years, 31.4% were between 36 to 50 years, and 16.1% were 51+ years old. In the total sample at both sites, attitudes toward giraffe were positive (M=4.40; SD=.76), with 40.2% responding with *like* and 51.7% responding that they *strongly like* giraffe. The total sample was split between those that perceive meat/parts as a benefit from giraffe (50.9%; n=297) and those that do not (48.6%; n=284). The participants were split into different categories for perceived conservation benefits: 35.3% (n=206) reported that they receive no benefits from tourism or jobs in conservation, 4.5% (n=26) reported benefits from tourism revenue, 14.2% (n=83) reported benefits from employment in conservation/tourism, and 45.5% (n=266) of the sample reported benefits from both tourism revenue and conservation employment. For the direct question about consumption of giraffe meat or parts, 21.5% (n=124) responded that the most recent time they used meat/parts was within the last year. Approximately half (45.7%; n=267) of the respondents had never used giraffe meat or parts. Distribution of each type of perceived benefit varied from helping with crops (5.8%; n=34) to aesthetic enjoyment (89.4%; n=522). The frequency of perceived benefits at each site is depicted in Figure 3.2.

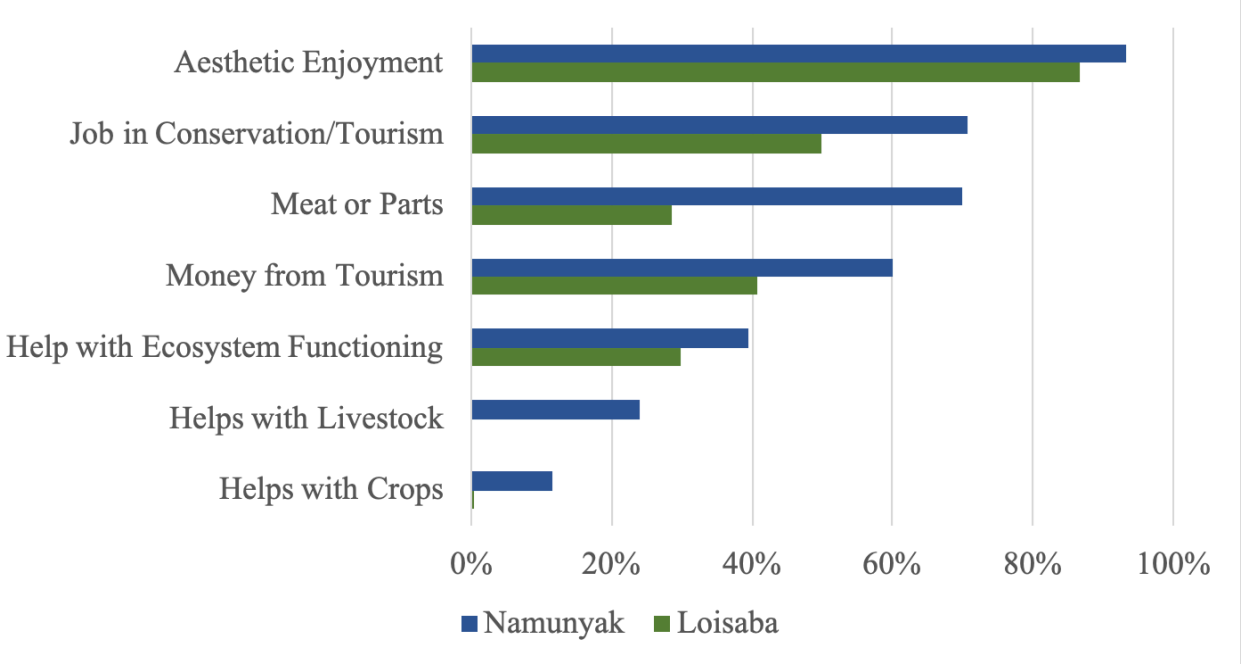

Figure 3.2. Frequencies of Perceived Benefits. Relative frequency of each type of perceived benefit associated with giraffe within the sampled areas in Namunyak (n=284) and around Loisaba (n=295) conservancies.

3.3.1 Perceived Benefits and Attitudes

For the Namunyak sample, an ANOVA was used to test for differences in attitudes between groups with varied perceptions of conservation benefits. The Levene statistic for all benefit group types was significant, so homogeneity of variances could not be assumed, and Tamhane Post Hoc test was utilized. There were significant differences in attitudes between comparisons of the following group types (η=.269): no conservation benefits and money from tourism (p<.01), money from tourism and job in conservation/tourism (p<.001), job in conservation/tourism and both conservation job and money from tourism (p=.001) (Table 3.1).

Table 3.1. Namunyak ANOVA. The results of the one-way ANOVA between the dependent variable affective component of attitude (i.e. feeling) toward giraffe and the independent variable, type of perceived conservation benefits.

	None (*M*) (*n*=65)	Money (*M*) (*n*=19)	Job (*M*) (*n*=49)	Both Money & Job (*M*) (*n*=153)	*F*	*p*	η
Attitude	4.42[a]	4.89[ab]	4.22[bc]	4.55[c]	7.326	<.001	.269

[a,b,c] The letter superscripts denote significant differences between means based on the Tamhane post hoc test

In Namunyak, an independent sample t-test was used to test differences in attitudes between those that perceive consumptive benefits (giraffe meat/parts) (*M*=4.51, *n*=200) and those that do not (*M*=4.63, *n*=86), and there was no significant difference (*p*=.20, Cohen's *d*=.182).

A multiple dummy variable linear regression was run to explore the strength of the relationship between each type of perceived benefit and attitudes toward giraffe (Figure 3.3a). There were significant positive associations between attitudes toward giraffe and the following: money from tourism (β=.225, *p*=.001), crop function (β=.176, *p*=.002), and ecosystem functioning (β=.157, *p*=.008). There was a negative association between livestock functioning (β= -.152, *p*=.008). Together, the types of perceived benefits explained moderate amounts of variance in attitudes toward giraffe (R=.375, R^2= .141).

The same series of tests were run, filtered for data within the Loisaba sample. An ANOVA was run to test for differences in attitudes toward giraffe between groups with different types of perceived conservation benefits. The test for equal variance was not significant, and

Bonferroni was used for post hoc testing. There was a significant difference between those that do not perceive conservation benefits and those that perceive benefits from both money and jobs (p<.001;η=.404) (Table 3.2).

Table 3.2. Loisaba ANOVA. The results of the one-way ANOVA between the dependent variable affective component of attitude (i.e. feeling) toward giraffe and the independent variable, type of perceived conservation benefits.

	None (M) (n=141)	Money (M) (n=7)	Job (M) (n=34)	Both Money & Job (M) (n=34)	F	p	η
Attitude	3.96[a]	4.00	4.32	4.65[a]	18.965	<.001	.404

[a] Denotes significant differences between means based on the Bonferroni post hoc test

An independent sample t-test compared attitudes toward giraffe between those that do (M=4.24, n=84) and do not (M=4.28, n=211) perceive consumptive benefits from giraffe, and there was no significant difference (p=.683, Cohen's d=.052).

At Loisaba, multiple dummy variable linear regression for influence of perceived benefit types on attitudes toward giraffe resulted in model that explained 23.0% (R=.479, R^2=.230) (Figure 3.3b). There was a significant association with jobs in tourism/conservation (β=.249, p=.002). There were negative associations between consumptive use (meat/parts of giraffe) (β=-.126, p=.025) and crop functioning (β=-.226, p<.001).

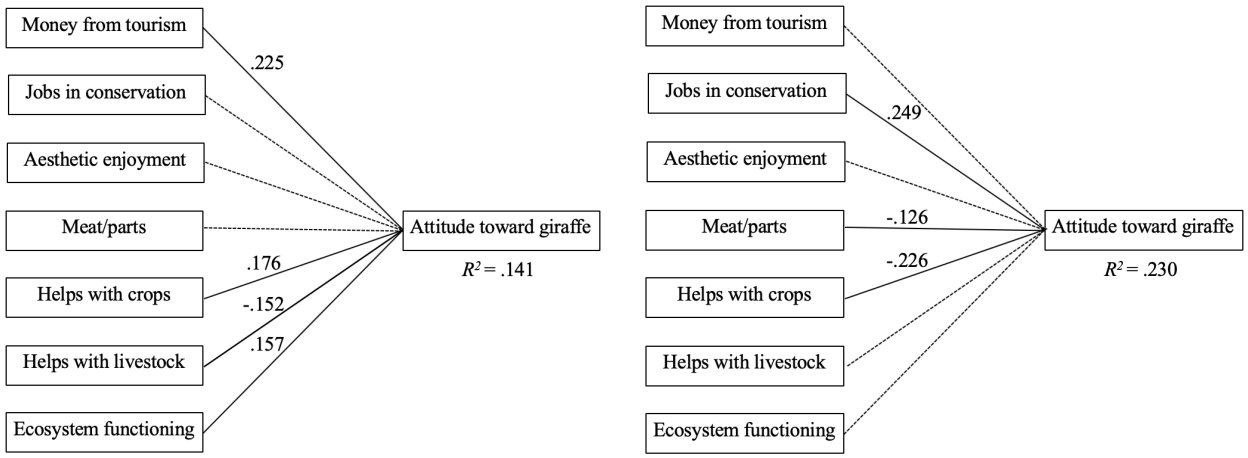

Figure 3.3. Types of Perceived Benefits. Multiple dummy variable regression from Namunyak (left) and Loisaba (right) to test strength of directional influence of each type of perceived benefit associated with giraffe onto attitude toward giraffe as the dependent variable. Solid lines denote significance at the p<.05 level, and dotted lines represent variables without significant association.

3.3.2 Perceived Benefits and Recent Behavior

Respondents were grouped into three categories for time period of most recent giraffe meat/part consumption: Never, More than one year ago, and Within the last year. Chi square analyses did not show any significant difference based on categories of conservation benefit types at either Namunyak or Loisaba (Table 3.3).

Table 3.3. Conservation Benefits x Giraffe Consumption. Chi square analyses to compare differences in giraffe consumption based on types of perceived benefits from conservation.

	Conservation Benefits	Never consumed meat/parts	Meat/parts consumed – More than one year ago	Meat/parts consumed within last year	χ^2	*p*	Cramer's V
Namunyak	None	10.2%	7.0%	5.3%	8.24	.22	.221
	Tourism Money	1.8%	2.5%	2.5%			
	Job in Conservation/ Tourism	9.9%	2.8%	4.6%			
	Both Tourism & Job	22.2%	14.4%	16.9%			
Loisaba	None	25.0%	16.1%	6.5%	4.29	.64	.086
	Tourism Money	1.4%	1.0%	0.0%			
	Job in Conservation/ Tourism	5.8%	3.8%	2.1%			
	Both Tourism & Job	16.4%	16.4%	5.5%			

Individual chi square tests were run to look at differences in recent consumption behavior categories based on each perceived benefit type (Tables 3.4 and 3.5). At Namunyak, groups that perceived the following types of benefits differed significantly by consumption behavior: aesthetic enjoyment (χ^2=7.51, p=.02), meat or parts (χ^2=29.41, p<.001), and ecosystem functioning (χ^2=10.03, p<.01). At Loisaba, respondents with the following types of perceived benefits differed significantly on categories of meat consumption time periods: Meats or parts (χ^2=90.392, p<.001) and ecosystem functioning (χ^2=12.915, p<.01).

Table 3.4. Perceived Benefits x Giraffe Consumption at Namunyak. Chi square analyses to compare differences in giraffe consumption behavior by perception of different types of benefits from giraffe.

Type of Benefit		Never consumed meat/parts	Meat/parts consumed – More than one year ago	Meat/parts consumed within last year	χ^2	*p*	Cramer's V
Aesthetic Enjoyment	Yes	42.4%	23.3%	27.6%	7.51	.02	.16
	No	1.4%	3.5%	1.8%			
Job in Cons/ Tourism	Yes	32.0%	17.3%	21.5%	2.00	.37	.08
	No	12.0%	9.5%	7.7%			
Tourism Revenue	Yes	23.9%	16.9%	19.4%	3.31	.19	.11
	No	20.1%	9.9%	9.9%			
Meat or Parts	Yes	23.6%	21.5%	25.0%	29.41	<.001	.32
	No	20.4%	5.3%	4.2%			
Ecosystem Functioning	Yes	13.4%	14.1%	12.3%	10.03	<.01	.188
	No	30.6%	12.7%	16.9%			
Helps with Livestock	Yes	8.8%	7.7%	7.7%	2.37	.31	.09
	No	35.2%	19.0%	21.5%			
Helps with Crops	Yes	5.3%	1.4%	4.6%	4.42	.11	.13
	No	38.5%	25.4%	24.7%			

Table 3.5. Perceived Benefits x Giraffe Consumption at Loisaba. Chi square analyses to compare differences in giraffe consumption behavior by perception of different types of benefits from giraffe.

Type of Benefit		Never consumed meat/parts	Meat/parts consumed – More than one year ago	Meat/parts consumed within last year	χ^2	*p*	Cramer's V
Aesthetic Enjoyment	Yes	40.8%	33.6%	13.0%	3.31	.19	.11
	No	7.9%	3.8%	1.0%			
Job in Cons/ Tourism	Yes	22.3%	20.2%	7.5%	1.98	.37	.08
	No	26.4%	17.1%	6.5%			
Tourism Revenue	Yes	17.8%	17.5%	5.5%	2.70	.26	.10
	No	30.8%	19.9%	8.6%			
Meat or Parts	Yes	3.4%	14.0%	11.3%	90.392	<.001	.56
	No	45.2%	23.3%	2.7%			
Ecosystem Functioning	Yes	10.0%	15.1%	5.2%	12.915	<.01	.211
	No	38.8%	22.0%	8.9%			
Helps with Livestock	Yes	0%	0%	0%	-	-	-
	No	48.6%	37.3%	14.0%			
Helps with Crops	Yes	0.3%	0%	0%	1.07	.59	.06
	No	48.1%	37.7%	13.8%			

3.4 Discussion

Community conservation programs aim to integrate human needs and participation into conservation planning, often working under the assumption that an increase in benefits associated with conservation will foster more support for wildlife. Here, we report findings about the linkages between perceived benefits, attitudes, and behaviors by analyzing these relationships through the lens of giraffe conservation in northern Kenya.

3.4.1 Conservation Benefits and Attitudes

Research on attitudes toward wildlife and conservation has been increasingly utilized for conservation programs in different contexts across Africa, as attitudes are often used as an important metric of support for conservation planning and to measure changes within and between communities and regions over time (Browne-Nuñez & Jonker, 2008). An aim of this study was to test the connection between perceived benefits and the attitudes held toward giraffe. Results suggest that attitudes differed based on individual perceptions that giraffe are linked with employment in conservation or tourism, as well as activities driven by money derived from wildlife-based tourism. Both types of benefits are tangible and tied with monetary incentives from local reticulated giraffe populations. However, there are potentially additional benefits that can be associated with conservation and tourism beyond direct employment or revenue streams.

There were significant differences between the types of conservation benefits at the two study sites, which can be discussed in relation to how the land ownership and use models vary at these places. Loisaba is a privately-owned conservancy, managed for wildlife habitat and situated within a wildlife migratory corridor. The pastoralist communities that live adjacent to Loisaba utilize a community governance model for grazing and land use, and a few have recently established community conservancies affiliated with NRT. This mix of land ownership types is more reflective of traditional protected area systems, with agreements and restrictions around grazing access and a gradient of wildlife densities from the private conservancy to community-owned land. Reports of the social and ecological outcomes of protected areas are mixed, but a global assessment found that positive socioecological and conservation outcomes are more likely when protected areas maintain livelihood benefits, among other social factors (Oldekop et al., 2016). The significant difference between those that perceived both employment and tourism

revenue from giraffe and those that perceived neither benefit demonstrates that stronger integration of wildlife industry and community benefits can influence attitudes toward a species like giraffe.

Within some CBC institutions, conservation and livelihood goals are connected to increased economic value and opportunity from wildlife conservation (Nilsson et al., 2016). Of the NRT Conservancies, Namunyak consistently has the highest level of tourism income (Northern Rangelands Trust, 2018). At Namunyak, a higher percentage of the sample perceived a connection between local giraffe and tangible conservation-related benefits (77.3%, compared to 52.2% at Loisaba; Tables 3.1 and 3.2). However, the mean attitude score for those at Namunyak that reported benefits from giraffe in the form of jobs in conservation/tourism was lower than those that do not perceive tangible benefits. A potential reason for this disparity is that those that are without perceived tangible benefits hold positive attitudes toward giraffe for intangible reasons, and those that are employed in conservation are attributing their tangible benefits with high profile wildlife species, such as the "Big Five." The "Big Five" includes lion, leopard, elephant, rhino, and African buffalo, which were originally grouped based on difficulty to hunt by Western safari hunters. After all hunting was banned in Kenya, the distinction has since evolved to refer to large mammal species desirable to see on tourism safaris. In this study, the effect sizes suggest a typical and substantial relationship at Namunyak and Loisaba, respectively, between tangible conservation/tourism benefits and attitudes toward giraffe, meaning the strengths of these relationships are medium to high.

These results also suggest that types of benefits can influence attitudes toward giraffe at varying levels of strength and by direction. At Namunyak, those that reported benefits from money related to tourism and perceived giraffe to play a role in crop health or ecosystem

functioning held more positive attitudes toward giraffe. At Loisaba, positive attitudes were more likely held by those that perceived benefits from employment in conservation/tourism. Negative associations were present between attitudes toward giraffe and following perceived benefit types: role in helping livestock (Namunyak), giraffe meat/parts (Loisaba), and crop health (Loisaba). The multiple linear regression models for each site show that types of benefits have varying influences on attitudes toward giraffe, and therefore, should be considered as unique entities when considering how benefits are associated with conservation planning. In this case, more specific types of benefits, rather than "benefits" as a generalized category, influenced attitudes toward giraffe, which has implications for both research and applications for conservation. With research on the human dimensions of wildlife, specificity of a variable or construct matters when designing measurement, and cognitions with similar levels of specificity are more likely to have stronger associations (Whittaker et al., 2006). If fostering more positive attitudes toward giraffe is an intended outcome of conservation efforts, tailoring the embedded activities and messaging to highlight certain types of benefits as connected to local giraffe could be a more effective avenue to influence attitudes than general messaging.

Attitudes toward giraffe did not differ between those that did and did not perceive meat or other parts as a benefit from giraffe. Attitudes are formed as evaluative judgments and can be informed by a wide breadth of human-wildlife interactions. Some of these interactions may be integrated into positive attitudes, but not aligned with goals for conservation outcomes. Resource users can identify provision of products like meat or other parts as a related benefit from a local wildlife population. Positive attitudes toward wildlife that are driven by availability of wildlife as a resource can occur in regions with plans for sustainable use (Störmer et al., 2019), but also in places where illegal hunting occurs, driven by complex social, economic, and political factors

(Waylen et al., 2009). Though it is important to recognize that not all benefits from wildlife may be in alignment with intended conservation outcomes, perceptions of consumptive and non-consumptive benefits are not necessarily mutually exclusive. Perceptions in both categories can be held simultaneously, pointing to the need for more nuanced discussion, explanation, and understanding of the role of benefits from wildlife in developing support for conservation.

3.4.2 Conservation Benefits and Behavior

There were limited results that suggest a connection between perceived benefits associated with giraffe and consumption of meat or other parts. At both sites, there were no differences in perceptions of tangible conservation benefits among those who had previously consumed giraffe and respondents that had not. In addition, respondents employed in conservation or involved in activities funded by conservation/tourism were just as likely to have consumed giraffe products as others. The time periods of most recent consumption did vary based on perceptions of giraffe playing a role in ecosystem functioning, as well as aesthetic appreciation at Namunyak. At both sites, there was a strong association between the perception of meat/parts as a benefit from giraffe and prevalence of consumptive behavior.

These findings do not suggest that an increase in benefits related to conservation will impact behaviors tied with threats that wildlife face. In this case, consumption of giraffe meat and parts is one driver of reticulated giraffe population decline. In Kenya, all hunting and consumption of wildlife is restricted, and thus, the context differs from areas and countries with sustainable use models and yields for wildlife meat. Our results suggest that people who associated benefits from conservation with giraffe were just as likely to have engaged in this behavior.

There are local and non-local forces that drive conservation outcomes, and understanding human behavior is necessary for improved conservation. A confluence of factors drives behavioral decision making, yet economic approaches and education strategies are most frequently applied to conservation challenges. There is mounting support for diverse disciplinary approaches to understanding human behavior, demonstrating how social factors, like norms, trust, and emotions, can influence behavior toward wildlife. Humans do not weigh costs and benefits on strictly rational evaluations (St. John et al., 2011), so acceptance of wildlife cannot solely be based in financial incentives, as demonstrated by the challenges tied with compensation programming (Dickman, 2010). The lack of strong evidence to link conservation benefits with giraffe means that for conservation efforts to address illegal hunting and consumption as threats, additional factors that determine these behaviors will need to be considered. This distinction highlights the need for more nuanced understanding when considering how tangible benefits are employed to garner support for wildlife conservation.

3.4.3 Limitations of the Study

Though this study provides insights for the community conservation literature, it is important to note several limitations. First, the data were specific to human-giraffe relationships and the mean for our measurement of attitudes skewed very positively. There is potential that for a species more commonly involved in negative or higher attention interactions with people, like different predators, elephants, or primates, a wider distribution of data across a sample would result, and perceived benefits could have a stronger association with attitudes and behaviors related to other species. Again, as this study focused on communities' perceptions of giraffe and benefits linked with conservation, it is possible that other species are more readily identified and highly perceived to be connected with conservation programs and tourism operations.

Second, local context shaped what was possible for measurement. There has been limited quantitative research on the human dimensions of wildlife in this region. Populations in the study areas have varying levels of literacy, so this initial work was designed with close-ended items and few response categories. This resulted in use of dichotomous variables for perceived benefits, a single item measure for attitude, and categorical response options for behavior.

Third, there was a mismatch of scale in terms of timeline for measurement. Attitudes and perceived benefits were measured based on those cognitions at the time of the interview and based on respondents' current position. The measure for behavior was based on the previous year as a time period. Over that time period, it is possible that respondents' perceptions and attitudes shifted. For this study, the analyses included the assumption that the same or similar attitudes and perceptions were held for the year preceding the time of interview, so that perceived benefits, attitudes, and behavior could be assessed as variables in this study.

3.4.4 Recommendations for Future Research

While some key relationships between conservation benefits and attitudes emerged through this work, there is additional research needed to further understand how these constructs are shaped. Work is needed to explore the process of developing and implementing programs that tie tangible and intangible benefits with conservation and natural resource management, which was beyond the scope of this study but critical to recognize. Scanlon & Kull (2009) refer to the complex use of benefits in conservation as a 'black box', in which the variability in types of benefits, process and equity of distribution, and socio-ecological contexts mutually interact and determine how people receive, access, and are changed (for better or worse) by conservation benefits.

3.5 Conclusions

Approaches to CBC often include livelihood opportunities that align with goals aimed at improved living conditions for local communities and favorable outcomes for wildlife populations. This has largely been in response to a dominant narrative that people have historically been excluded from conservation, and those that live with wildlife should benefit from such co-occurrence. The inherent assumption is that benefits derived from conservation activities are positive influences on attitudes and behavior toward wildlife, and yet there is limited study that explicitly tests these relationships. Based on our findings, there is evidence that perceptions of different types of tangible and intangible benefits can influence attitudes toward giraffe; there is a less tenable relationship between perceived benefits and, in the case for giraffe conservation, behaviors that impact giraffe populations. Results from this study suggest that different types of benefits, both tangible and intangible and those tied to conservation operations, have varying influence on attitudes and behaviors. As such, we recommend a more complex conceptualization of conservation benefits when utilized for conservation programming.

CHAPTER 4: CONSERVATION ACTION LEADING TO DECLINE IN GIRAFFE MEAT CONSUMPTION

4.1 Introduction

Overexploitation of wildlife from unsustainable hunting poses a dire threat to global biodiversity (Hoffmann et al., 2011; Schipper et al., 2008). Unsustainable illegal hunting has caused declines in a range of species, documented at the species level (Rogan et al., 2017) and through assessment of entire taxa, like birds (Szabo et al., 2012) and mammals (Ripple et al., 2016). Wild meat (i.e. bushmeat) hunting is one form of direct exploitation (Milner-Gulland & Bennett, 2003), and can be defined as non-domestic terrestrial animals that are harvested for food (Nasi et al., 2008). Along with negative pressures on biodiversity, wild meat practices are tied to a range of social impacts (Cooney et al., 2015). As many people in rural areas rely on wild meat for protein or income, wildlife population declines are also cause for human development concern (Fa et al., 2003, 2015).

Many African countries have responded to biodiversity declines that are tied to wild meat and corresponding social impacts by establishing and enforcing regulations that ban or permit hunting (Lindsey et al., 2013b). Impacts from illegal and unsustainable wild meat hunting are differentiated from policies on legal harvest of "game meat" produced and managed on ranches and communal lands in southern Africa (Funston et al., 2013; Lindsey et al., 2013a). As there is growing evidence of the threat that wild meat hunting poses to biodiversity in African savannas, there is need for concerted efforts to research dynamics of wild meat hunting and consumption in savanna ecosystems, as well as the interventions aimed to mitigate associated impacts (van Velden et al., 2018).

4.1.1 Wild Meat Consumption as a Threat to Giraffe

Across sub-Saharan Africa, total numbers of giraffe (*Giraffa* spp.) have been reduced up to 40% over the past three decades, but there is variance in population trends for different giraffe species and local populations (Muller et al., 2018). Though southern giraffe (*Giraffa giraffa*) populations are mostly stable or increasing (Marais et al., 2018), there have been overall declines of giraffe in East Africa. This includes an approximate 50% decrease in populations of both reticulated giraffe (*Giraffa reticulata*) (Muneza et al., 2018) and Masai giraffe (*Giraffa tipppelskirchi*) (Bolger et al., 2019). Primary reasons for giraffe population declines include loss of habitat from degradation, development, and land conversion, as well as overexploitation from illegal hunting (hereby referred to as poaching) (Muller et al., 2018).

Though poaching has been identified as a key threat, the use and trade of giraffe parts and products are not well understood. A recent study by Dunn et al. (*in prep*) utilized key informant interviews and systematic literature review to describe the uses, users, and scales involved in giraffe trade. Varying giraffe population trends based on species and regions, as well as the diverse regulatory contexts in giraffe range counties, highlight the need to understand relevant threats for giraffe at local and national levels. Though there is limited data on prevalence of giraffe part usage and how those levels of use impact giraffe populations, all giraffe species were placed on Appendix II by the Convention on International Trade in Endangered Species (CITES) in 2019, based on precautionary measures. Furthermore, the preliminary research of Dunn et al. (*in prep*) showed that giraffe meat is the most common giraffe product used in East Africa. There is a clear need for research on consumptive uses of giraffe, as well as refinement of the methods utilized to measure corresponding prevalence of use. Outcomes of such research are relevant to conservation policy and practice. For one, these outcomes serve to identify areas in which giraffe

part usage poses a higher relative threat. In addition, this research can evaluate on-going conservation interventions aimed at poaching and use of parts.

The purpose of this study is to accurately estimate the prevalence of reticulated giraffe meat use in northern Kenya, between 2017 and 2019. This type of research into part consumption, as well as the levels of giraffe poaching, is embedded in some countries' conservation management strategies. Reticulated giraffe, which are limited in range mostly to northern Kenya (O'Connor et al., 2019), have special considerations in Kenya Wildlife Service's National Recovery and Action Plan for Giraffe. In their plan, a key conservation target is to "reduce the proportion of giraffe illegally killed by 50% [by 2022]" (Kenya Wildlife Service, 2018, p.31). Ability to monitor progress toward this goal rests in part on the application of appropriate methods for measuring giraffe poaching and related consumption.

4.1.2 Sensitive Behavior and Conservation

Rules that limit or restrict human use of natural resources is a frequent practice in conservation policies and programs (Keane et al., 2008). A lack of data on non-compliance with conservation rules hinders collective understanding of motivations for both rule-following and rule-breaking, and in turn, conservationists' ability to address non-compliance issues. The illicit nature of poaching and illegal use of wildlife products means the actors involved are reticent to identify themselves (Solomon et al., 2007). Alternative methods to direct questioning can reduce the errors associated with social desirability and non-response biases (Gavin et al., 2010; St. John et al., 2010). Nuno & St. John (2015) reviewed specialized questioning techniques (SQT) to elicit more accurate estimates of illegal behaviors. Methods such as Randomized Response Technique (Warner, 1965) and Unmatched Count Technique (Droitcour et al., 2004), add layers of

anonymity for research participants and remove the possibility of self-incrimination by respondents.

Randomized Response Technique (RRT) utilizes a randomization device, such as a dice, to add an element of probability into individuals' responses. Interviewers instruct participants to direct their responses based on the randomization device (e.g. answer of "yes" when the device prompts that response OR when the device prompts a truthful answer and the individuals' response is "yes"). The device is shielded from the interviewer, so that an affirmative response to a sensitive behavior cannot be deciphered as to whether or not that response was forced by the device. Further, affirmative responses cannot be connected to an individual, protecting respondents from self-incrimination. Prevalence of the sensitive behavior within a sample is estimated using probability theory. RRT has been utilized in various conservation settings, including studies that estimated levels of illegal killing of carnivores in Taiwan (St. John et al., 2015) and illegal take of natural resources in Uganda (Solomon et al., 2007). Each of these examples produced higher estimated levels of the sensitive behavior than through direct questioning methods. There have also been instances, however, in which RRT did not yield higher estimates of the sensitive behavior. This divergence could occur when the behavior of interest is not perceived to be sensitive, as was the case for illegal wild meat consumption in Madagascar, where regulatory knowledge of protected species was low (Razafimanahaka et al., 2012). Efficacy of RRT can also depend on respondents' understanding of how to operate the randomization device, as well as respondents' level of trust in the technique. In a study estimating prevalence of bear part use in Cambodia, respondents appeared both to struggle with the instruments used to conduct RRT, and their perceived trust of the techniques, both of which potentially skewed estimates (Davis et al., 2019).

Unmatched Count Technique (UCT) involves the use of lists to isolate the sensitive behavior in question. The sample is evenly spilt into control and treatment groups. The control group is presented with a list of non-sensitive items. The treatment group receives the same list of items, with the addition of the item/behavior of interest. All respondents are asked to respond with the number of items that are relevant to them, but not to identify which items they are including in their total count. Estimated prevalence is calculated by removing the mean difference of the control group from that of the treatment group. Like RRT, applications of UCT in conservation research have yielded higher levels of sensitive behaviors. Nuno et al. (2013) estimated 18% of households to be involved with wild meat hunting in the western Serengeti, presenting a higher estimate than previous studies in the area. They also reported that the majority of respondents felt the UCT protocols were easily understood. Simplicity in the design of UCT can be an advantage when applying the method in contexts with low literacy or numeracy (Nuno & St. John, 2015). However, UCT is often characterized by high variability, which can make targeted estimates of a sensitive behavior challenging (Davis et al., 2020; Olmedo et al., 2019). Moreover, if a behavior is relatively low prevalence, UCT can also fail (e.g. Ibbett et al., 2019), or as with RRT, if individuals distrust the method, as happened in one site in Davis et al.'s study (2019).

4.1.3 Aims of the Study

Though SQTs are now increasingly applied in conservation settings, the methods are likely to have variable success in different contexts (Davis et al., 2019). There are limited instances of SQTs used for research in East Africa, and to our knowledge, no published studies that utilize multiple SQTs to monitor levels of illegal wild meat consumption over time. The main purpose of this study is to provide estimates for giraffe meat consumption at multiple time

points. A key distinction, from other studies, is that the SQTs were designed to estimate prevalence of consumption, rather than involvement with poaching. This choice was made because giraffe part consumption was expected to be a more widespread behavior, due to common local practice of sharing meat with one's family. Beyond the comparison of SQTs in an East African context, an aim of this study was to trial the application of RRT and UCT as monitoring tools for conservation management of reticulated giraffe in northern Kenya. Prevalence estimates of giraffe meat consumption will, in turn, support regional efforts to monitor the trends of giraffe populations in Kenya. As conservation planning is implemented within dynamic systems, longitudinal studies are important to detect change over time, but few studies have reported levels of illegal behaviors with a temporal component.

4.2 Materials and Methods

4.2.1 Study Area

The study area included communities within Naibunga, Ol Dnyiro, and Kirimon Community Conservancies that border Loisaba Conservancy in Laikipia County, Kenya, and villages within the Nalowuon and Ngilai units of Namunyak Conservancy in Samburu County, Kenya. Population estimates within the study areas included 1,400 adults in the communities around Loisaba and 4,500 adults in Namunyak. The communities within our study area were comprised predominantly of Samburu and Maasai ethnicities, with societal practices characterized by semi-nomadic pastoralism. Though livestock rearing is the primary livelihood for the majority of community members within the study area, additional livelihoods include wildlife-based occupations, nature-based tourism operations, and small business ownership. These community areas function as collectively owned and governed conservancies, led by locally elected boards and committees. Community conservancies share the landscape with wildlife, differing from

government-managed protected areas that lack human settlements. The study area falls within the southern range of reticulated giraffe (O'Connor et al., 2019).

4.2.2 Data Collection

Preceding data collection, the research team met with community leadership to obtain permission to conduct this study. A questionnaire was used during face-to-face interviews to collect data. Maa is the shared language among community members in the study area. Questionnaire items were originally constructed in English, and then translated to Maa. The translation process was completed by a team of research assistants, consulting with additional staff at conservancy headquarters when needed to reach agreement on translation for each question. Items were back-translated to English during the instrument design and pilot testing phases to ensure reliability of item wording. The questionnaire instrument was pre-tested in October 2016. Data were collected from November 2016– July 2017 for the first sample and from July-December 2019 for the second sample. The questionnaire included additional items for HDW variables examined in Chapters 2, 3, and 5, which were less sensitive than questions about giraffe part usage. These non-sensitive items were asked in the beginning of the interview, so the flow of the interview built toward the SQTs. The questionnaires are included in Appendices A and B.

The direct question (DQ) about giraffe meat consumption was asked in the middle of the interview, along with additional questions about frequency of part usage in each respondent's lifetime and recent nearby poaching instances. During the 2016/17 data collection, the DQ item was presented as, "*When was the last time you consumed giraffe meat or parts?*" In 2019, DQ items concerning giraffe meat and giraffe parts were asked separately and later combined for the purposes of these analyses. Responses for the DQ in both time periods were recorded as

categorical variables with the following response options: *never, within the last year, between 1-5 years ago, between 6-10 years ago, more than 10 years ago*. Responses were recoded as a dichotomous variable, based on whether the respondent reported to have consumed giraffe meat. GPS locations were not collected at individual household sites. Instead, GPS locations central to a manyatta area were associated with responses to the DQ, so that affirmative responses to giraffe meat consumption could be mapped, but not linked to individual respondents. Following demographic information, items for UCT and RRT were asked at the end of the interview, as they required additional instructions and materials. The entire interview lasted approximately 40-45 minutes. Exact wording for the DQ and SQT items are listed in Table 1.

4.2.3 Specialized Questioning Techniques

Materials used for UCT and RRT are included in Appendix C. The interviewer recited instructions for each method and began with a practice question to gauge respondents' understanding. If the interviewer gauged a lack of respondents' comprehension (e.g. asked numerous questions, revealed which color dice was rolled, or named animals on the UCT cards), the interview was concluded without administering the SQTs.

For UCT, the sample was split into two groups to receive treatment and control cards. Interviewers alternated assignment of control and treatment cards with each interview. Respondents were asked to review a set of cards that listed animals with written names and accompanying pictures. They were instructed to respond to the item prompt with only a number and refrain from identifying to which animals they were referring. The card used for the control interviews had a set of four animals that included livestock and wild animals; the treatment card included the same animals and the addition of giraffe. Pictures of each animal were used on the cards to account for varying levels of literacy. Animals were selected based on probability of

consumption, to ensure the list included items with high likelihood (e.g. goat) and low likelihood (e.g. zebra, which are taboo to consume in Samburu or Maasai communities). These items were selected to avoid floor and ceiling effects, where individuals either answer affirmatively to none of the behaviors or all, thus negating the anonymity of the test (e.g. Hinsley et al., 2019).

Table 4.1. Item Wording. Listed for measurement of giraffe part consumption, in order of appearance during the interviews.

Direct Questioning (DQ)	
2016/17	When was the most recent time you used giraffe meat or other parts of giraffe?
2019	When was the most recent time you used giraffe meat? When was the most recent time you used other parts of giraffe besides meat?
Response options	Never, within the last 12 months, between 1-5 years ago, between 6-10 years ago, more than 10 years ago; Recoded as dichotomous (0) no and (1) yes for within the last 12 months
Unmatched Count Technique (UCT)	
I want you to tell me how many of these animals you or a member of your household has eaten in the last 12 months. Please do not tell me which ones.	
Control	Treatment
Goat	Goat
Cattle	Cattle
Dik dik	Dik dik
Zebra	Zebra
	Giraffe
Randomized Response Technique (RRT)	
Have you eaten giraffe meat in the last 12 months?	

To administer RRT, a dice was used as the randomization device. Interviewers asked the participant to shake the dice and keep view of which face the dice landed on within the opaque cup to him or herself. For the 2016/17 survey, the dice contained two red faces, two green faces,

and two blank/white faces. There was a 1/3 probability of forced truth responses. For the 2019 survey, interviewers used an adjusted dice that contained one red face, one green face, and four blank/white faces, so that the probability of forced truth was 2/3 of responses. For each question and dice roll, the respondent answered by holding up a paddle with their response as "*yes*" or "*no*" (Appendix C).

4.2.4 Sampling Strategy

Quota sampling was utilized for this study. Targets for each community and manyatta area (village) were selected based on total household estimates gathered from community elders and conservancy management. The target for total interviews during each survey was set at approximately 600, based on resources available for this study. The research team approached manyatta areas and the surrounding grazing areas to invite study participants.

The majority of the population in the study area had not completed primary school, so based on literacy levels, written consent protocols were not appropriate. Interviewers obtained verbal consent with a protocol that included the purpose of the study, explanation of measures to ensure confidentiality, the voluntarily nature of participation in the study, right to cease participation at any time, and contact information for where questions or concerns could be directed. All research team members received training prior to interviews on ethical research protocols. Interview training also included techniques for how to reduce biases during interviews, record data, and instruct participants on specialized questioning techniques. Ethical approvals were reviewed and approved by the Institutional Review Board (IRB# 02156e) of Miami University, Ohio.

4.2.5 Data Analysis

Estimates for behavioral prevalence of giraffe meat consumption were calculated with the following formulas for each method. For Direct Questioning, prevalence was calculated as the proportion of total respondents that reported "*within the last 12 months*" as the most recent time they had consumed giraffe meat or parts.

Estimated prevalence from UCT methods was calculated using the formula:

$$\pi = \bar{\chi}_A - \bar{\chi}_B$$

Where π is proportion of the sample that included the sensitive behavior in their list count, $\bar{\chi}_A$ represents the mean list count number given by the treatment group, and $\bar{\chi}_B$ reflects the mean list count of the control group (Droitcour et al., 2004).

For RRT, prevalence of giraffe meat consumption was estimated using the following equation:

$$\pi = \frac{\lambda - \theta}{s}$$

Where π is proportion of the sample that had truthfully reported to have done the sensitive behavior, λ is the total proportion of the sample that reported "*yes*, " θ is the probability of forced "*yes*" responses, and s is the probability that respondents were prompted to respond truthfully (Hox & Lensvelt-Mulders, 2004; Nuno & St. John, 2015).

All data analyses were performed in the software program R (R Core Team, 2016) and figures were created using the package ggplot2 (Wickham, 2016). The package "zapstRR" was used to calculate RRT (Chang & Maarten, 2017). Confidence intervals for 95% were calculated for each prevalence estimate, in lieu of null hypothesis significance testing (Greenland et al., 2016).

4.3 Results

4.3.1 Sample Characteristics

The total sample sizes for direct questioning (2016/17, *n*=576; 2019, *n*=676), UCT (2016/17, *n*=578; 2019, *n*=680), and RRT (2016/17, *n*=568; 2019, *n*=675) were slighter larger in 2019. The estimate for total number of households generated by Namunyak Management increased in 2019, so additional interviews were conducted in that study area. Demographics for respondents in the sample are summarized in Table 2. The demographic profiles of the two samples are very similar (Appendix D).

Table 4.2. Demographics for 2016/17 and 2019 Samples.

Demographics		2016/17	2019
Gender	Male	50.9% (*n*=295)	50.4% (*n*=344)
	Female	49.1% (*n*=284)	49.6% (*n*=338)
Age	Range	18-88	18-90
	Mean	38	42
	Median	35	40
Education	None	65.1% (*n*=377)	65.7% (*n*=445)
	Primary	23.8% (*n*=138)	14.0% (*n*=95)
	Secondary	6.9% (*n*=40)	16.1% (*n*=109)
	University	4.1% (*n*=24)	4.1% (*n*=28)
Occupation	Livestock herder/pastoralist	85.3% (*n*=493)	80.2% (*n*=538)
	Livestock broker	n/a	7.6% (*n*=51)
	Tourism worker	2.8% (*n*=16)	4.2% (*n*=28)
	Business (non-livestock)	5.9% (*n*=34)	4.3% (*n*=29)
	Wildlife-related	0.6% (*n*=4)	2.1% (*n*=14)
	Other	5.4% (*n*=31)	1.6% (*n*=11)

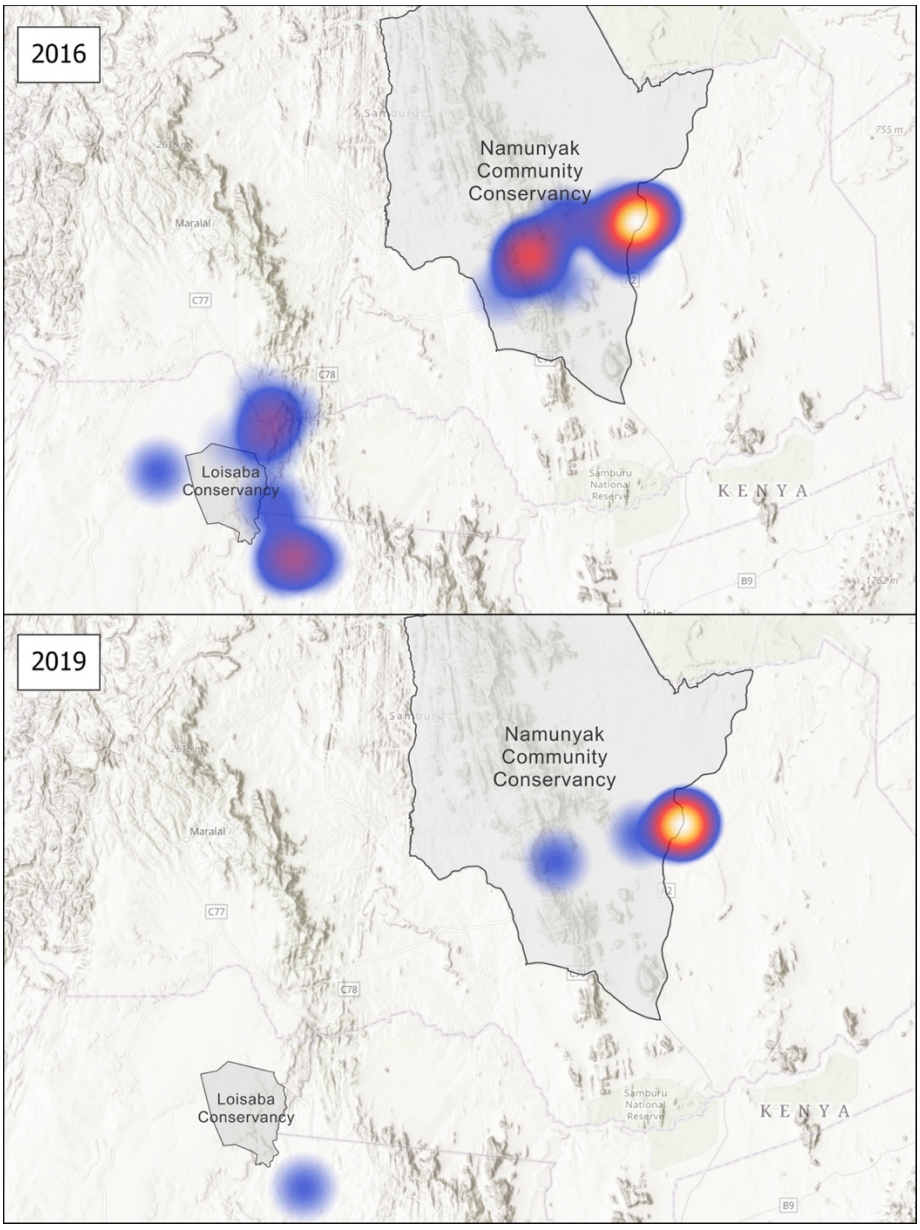

Figure 4.1. Heat Map of Giraffe Meat Consumption. Warmer areas display higher concentration of affirmative response to the direct question about giraffe meat consumption within the previous year. GPS locations represent a central marker for the larger manyatta area associated with respondents.

4.3.2 Estimates of Giraffe Meat Consumption

The prevalence estimates for both the 2016/17 and 2019 surveys provide a range for the proportion of community members sampled that had consumed giraffe meat within the previous

12 months (Figures 2 & 3). For both surveys, RRT yielded the highest estimated prevalence of giraffe meat consumption; the RRT estimate was 36.5% in 2016/17 (CI=23.6%-49.3%; SE=.065) and 7.8% in 2019 (CI=0-18.4%; SE=.054). Direct questions yielded 22.3% prevalence in 2016/17 and 3.2% prevalence in 2019. Figure 4.1 demonstrates the spatial distribution of affirmative responses to the DQ about past meat consumption. The estimates based on UCT estimated the prevalence to be between those obtained through DQ and RRT at 27.7% prevalence in 2016/17. Results from UCT then reduced to an estimated prevalence to 1.2% in 2019. Comparisons between the two samples yielded significant differences across all three methods, with confidence intervals distinctly divergent between years (Figure 4.2).

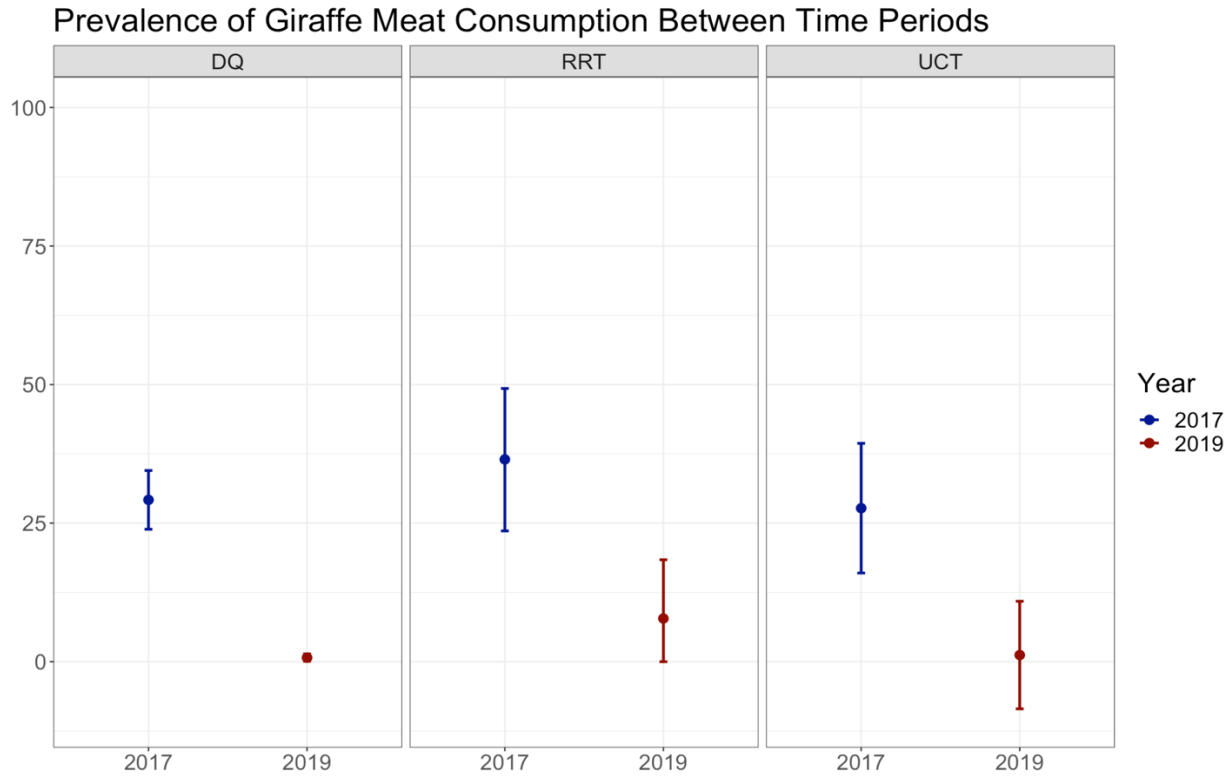

Figure 4.2. Levels of Estimated Prevalence. Bars depict 95% confidence intervals of prevalence based on direct questioning, randomized response technique, and unmatched count technique methods.

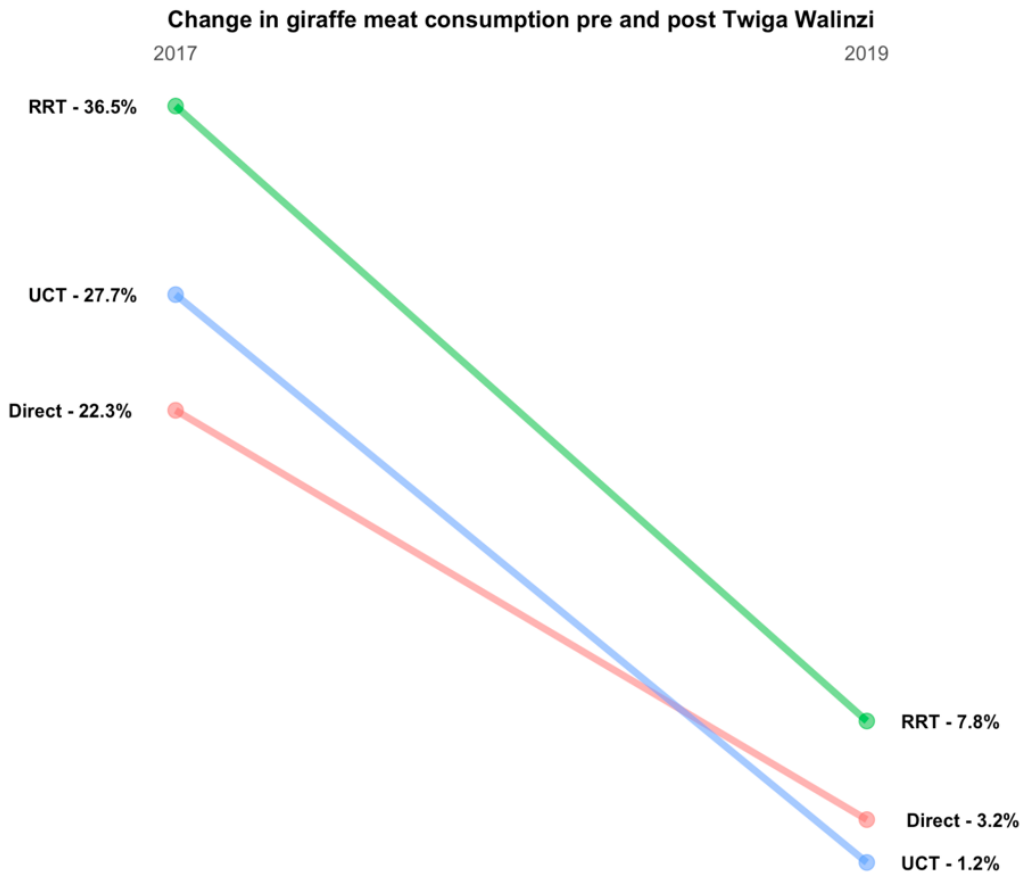

Figure 4.3. Slope Graph. Lines depict the decline in prevalence estimates for giraffe meat consumption between the 2016/17 and 2019 samples.

4.4 Discussion

Poaching is identified as a key threat to some giraffe species and local populations, but there is limited work to document the extent that giraffe part and meat consumption is driving that pressure. Such research is of broader importance as well, as wild meat hunting has been increasingly recognized as a threat to savanna ecosystems, coupled with numerous social implications (van Velden et al., 2018). To monitor illegal uses of wildlife and direct conservation efforts, there is a need to measure illicit behaviors related to wildlife so as to provide appropriate and accurate bases for possible future conservation interventions (Veríssimo and Wan, 2019).

The aim of this study was to estimate levels of giraffe meat consumption through the use of specialized questioning techniques (SQTs) with the overarching aim of providing baseline estimates that can be utilized in possible demand reduction campaigns.

4.4.1 Application of Specialized Questioning Techniques

Specialized Questioning Techniques (SQT) are increasingly applied for conservation purposes. As these methods are in continual refinement, results should be contextualized for each study. Here, we discuss our measurement approach, and potential factors that influenced our results. We compared estimated levels of giraffe meat consumption by utilizing direct questioning (DQ), unmatched count technique (UCT), and randomized response technique (RRT). Based on our findings, there was an observed decline in giraffe meat consumption, as measured through these three methods over the two survey time periods of 2016/2017 and 2019.

Estimated prevalence from SQTs were higher than the results of DQ for the 2016/17 survey. This difference between direct questioning and SQT methods is consistent with other studies. For instance, St. John et al. (2010) reported that RRT and another SQT, the nominative technique (NT), produced higher estimates of rule-breaking among fly fishers, suggesting that the use of SQT can elicit more honest responses about sensitive behaviors. Similar findings were reported for illegal resource use in Uganda (Solomon et al., 2007) and bear part use in Cambodia (Davis et al., 2019). Both of these examples had used face-to-face methods for data collection, so the use of SQTs addressed potential biases from social desirability and non-response. It is possible that those biases do not exert as much pressure when data about sensitive behaviors are not collected in person. Hinsley et al. (2017) note how the non-significant differences between UCT and DQ regarding compliance with CITES regulations for orchid trade may be due to the heightened anonymity of respondents in their self-administered online survey. Our higher

estimates of giraffe meat consumption from both RRT and UCT in the 2016/17 survey support the utility of SQTs in studies when data collection methods are limited to face-to-face interviews. In a location like northern Kenya, face-to-face data collection is often most practical and appropriate for obtaining representative samples, so researchers working in similar contexts should consider the use of SQTs for reducing sample biases.

Though RRT outperformed the other two methods during both surveys, the estimates for consumption from UCT were slightly lower than DQ in 2019. Our results suggest that the prevalence of giraffe meat consumption did decline between the two surveys, and the low prevalence of our behavior of interest in 2019 likely affected the utility of the SQT methods. UCT is not recommended for measuring rare behaviors, as the variances and standard errors associated with this indirect technique are larger than those expected with direct questioning (Droitcour et al., 2004; Ibbett et al., 2019; Thomas et al., 2015). The low precision of UCT means that large sample sizes are needed (Ulrich et al., 2012), which can still yield wide margins of error (e.g. Nuno et al., 2013). Though our sample size was lower than some studies that use UCT, there was no overlap in the confidence intervals from the two samples, likely pointing to an actual difference in prevalence of the behavior over time.

A primary assumption underlying SQTs is that respondents will be more likely to offer truthful responses about illicit behaviors and sensitive topics if they feel their responses are protected from self-incrimination or social judgement. Thus, how the questioning techniques are perceived by research participants is likely to affect the accuracy of solicited responses. For instance, respondents in Cambodia indicated higher trust of RRT over other SQT methods, but the estimates from RRT were lower than other methods, suggesting that respondents may have trusted RRT to shield deceitful responses (Davis et al., 2019). Alternatively, individuals could

have trusted the method, but not fully understood it, as individuals in Cambodia stated that they understood UCT more than RRT (Davis et al., 2019). The anonymity of responses inherent to RRT is such that an interviewer cannot differentiate forced "yes" responses from admission of the sensitive behavior. This distinction makes the instruction phase for SQTs particularly important. Misunderstanding of the methods and response types in different scenarios can introduce additional error in the sample. In our study the interview team noted that the UCT instructions were more readily understood by participants. The UCT protocol was simpler in design and the randomized element (assignment of control versus treatment cards) was controlled by the interviewer, rather than the research participant. Our research team also noted additional questions were asked during the instruction for RRT, and the practice round of RRT was helpful to decipher respondents' understanding. In only a few instances did interviewees refuse to participate in the RRT portion. Of note, these select interviews were with older women, who dismissed RRT when framed as a game (an effect noticed in Cambodia as well (Davis et al., 2019)). This highlights the importance of training research teams and considering how the props, instructions, and elements of SQTs operate and are received within social and cultural contexts.

4.4.2 Decline in Giraffe Meat Consumption

We have strong reason to believe that there was a true reduction in giraffe meat consumption between the two survey periods, according to the significant disparity between years in three separate measures of giraffe meat consumption prevalence (Figure 4.2). The observed decline prompts the question of what caused this change. A key difference between the two surveys was the introduction and expansion of Twiga Walinzi, a community-based giraffe conservation program, in the study areas. The program involves ecological monitoring of reticulated giraffe, community engagement activities, and documentation of locations and suspected causes of

giraffe mortalities. It is not possible to discern with existing data which elements of the Twiga Walinzi program instigated change in the study area.

There are, however, aspects of Twiga Walinzi similar to other conservation programs that demonstrated progress toward their intended conservation outcomes. Based on meetings with community leadership, we have reason to believe that giraffe meat is more likely to be sourced from local kills than purchased and transported back to communities within the study area. Thus, poaching events were likely to precede the instances of giraffe meat consumption included in our prevalence estimates. Poachers are less likely to act with increased risk of detection (Leader-Williams & Milner-Gulland, 1993). The regular monitoring performed by Twiga Walinzi, and community members' perception of increased vigilance due to these activities, may have influenced a would-be poacher's decision to act. Piel et al. (2015) reported findings about snare encounter rates as proximate to a research base that suggested a deterrence effect from researcher presence. The Twiga Walinzi education and outreach activities, including school-based wildlife lessons, community gatherings, and annual festivals, comprise another set of potential influences on levels of giraffe meat consumption. Some studies have demonstrated reduced poaching pressures (Steinmetz et al., 2014), improved knowledge of conservation rules (Keane et al., 2011), and community support for wildlife tolerance (Western et al., 2019), as tied to interventions guided by conservation education and outreach. In addition, conservation jobs becoming simply more embedded within a community may shift social norms against poaching (e.g. Cooney et al., 2017)

The observed change in giraffe meat consumption could have been driven (alternatively or collectively) by factors beyond those embedded in the Twiga Walinzi program. Increased law enforcement and prosecution can deter poaching activity. Some studies have shown that illegal

activities are inversely related to perceived risk of detection and punishment (St. John et al., 2015). There could also have been fluctuations in food security correlated with drought, or other factors, that influenced use of wild meat in Kenya. There is limited research based in Kenya on the use of wild meat, and whether wild meat is consumed out of necessity, preference, or other motivations. Changes in livelihood practices may have influenced levels of wealth, shown to be connected with wild meat consumption (Mgawe et al., 2012). Ecological factors may have also played a role in reduced consumption. Lower abundance of giraffe or variable movement patterns could decrease opportunities to obtain giraffe meat.

Though program evaluation for Twiga Walinzi is beyond the scope of this study, recent attention and efforts have been put toward evaluation of conservation interventions (Baylis et al., 2016; Bottrill et al., 2011; Margoluis et al., 2013). Counterfactual approaches, which delineate the difference between outcomes of an intervention and those that occur in the absence of the same intervention, come with challenges in practice; namely, observation of a comparable control group can be difficult based on the limited resources of many conservation programs and ethical considerations of engaging with a community as a control (Travers et al., 2019). For the case of Twiga Walinzi, data to serve as a control has been unobtainable, both in terms of comparable timeframe and social characteristics similar to communities within the program area. Qualitative evaluation offers an alternative approach. In the absence of baseline data, qualitative evaluation can give insights to the causal processes that lead to observed outcomes (Chen, 2012). Salazar et al. (2019) applied qualitative methods, General Elimination Methodology (GEM), to evaluate conservation efforts to protect a threatened parrot species in Bonaire. GEM can be used for evaluation by guiding the development of theories of change with relevant stakeholders and the elimination of alternative explanations to systematically isolate cause and effect relationships

(Scriven, 2008). A similar qualitative approach could assess the potential program impacts of Twiga Walinzi and additional factors that have reduced levels of giraffe meat consumption in northern Kenya.

4.4.3 Limitations of the Study

To note, there are a few limitations to the application and comparison of SQTs in this study. One potential source of error comes from discrepancies in item wording. The first difference is in regards to which giraffe products are included in the three methods. In 2016/17, the direct questioning item included giraffe "meat or other parts," whereas the SQT questions referred to meat only. Even with the broader scope for the DQ item, the estimated prevalence was lower than the SQTs. In 2019, the reference to meat and other parts were split. Very few instances of part usage were reported, and those cases were combined with the meat DQ to be comparable with the first survey. The UCT item questioned behavior at the household, rather than the individual, level. This may have increased the estimated prevalence by UCT, though the estimate was still lower in 2019 than the other two methods. All three methods utilized the previous 12 months as a relevant time frame. Recall bias (Junger-Tas & Marshall, 1999) may have introduced error for those that had more difficulty bounding their past behavior within that time frame. Finally, respondents with color blindness could have faced difficulty with the dice and paddles used for the RRT. We could not find information on the rates of color blindness in Samburu and Maasai communities. Additional factors and covariates associated with part use were beyond the scope of this study, including the estimated prevalence for use of other giraffe parts, motivations for usage, and supply routes.

4.4.4 Recommendations for Future Research

The use of SQT for monitoring the threat that poaching and part usage is placing on giraffe populations will require implementation at broader levels. Research efforts guided by Kenya's National Action and Recovery Plan for Giraffe can adapt the methods trialed during this study to provide wider scale estimates of giraffe part use, and of giraffe poaching. Such research should also include potential explanatory variables for giraffe meat consumption so that conservation interventions can be designed to address drivers of illegal behaviors (Travers et al., 2019). Hinsley et al. (2017) tested for differences in compliance with CITES among orchid traders based on demographic variables, providing an example of how multivariate analysis can be used with SQTs to test for predictive variables on estimated prevalence. Conservationists have increasingly recognized the need to understand and influence human behavior (Nilsson et al., 2020). Therefore, in areas where giraffe part consumption continues to be widespread, we suggest the application of SQTs as well as targeted consumer research, to ensure behavior change initiatives have a well-founded base (Burgess et al., 2020). Subsequently, behavior change initiatives could incorporate key principles from approaches such as social marketing (Veríssimo & Wan, 2019) to address the human demand for and uses of giraffe that are contributing to wild population declines.

4.5 Conclusions

Direct exploitation and illegal uses of wildlife pose serious threats to global biodiversity. The ability to understand and monitor these pressures depends on accurate data regarding human behavior. Specialized questioning techniques provide an alternative to self-reported data for information that people may be reticent to share. This study demonstrates an application of specialized questioning techniques to estimate levels of giraffe meat usage in northern Kenya

and detects a decline of giraffe meat consumption after the introduction of local giraffe conservation efforts.

CHAPTER 5: DETERMINANTS OF INTENTION TO CONSUME GIRAFFE MEAT

5.1 Introduction

Global biodiversity is in continued decline, largely due to the simultaneous threats of habitat destruction and direct exploitation (Schipper et al., 2008). One type of exploitation for human use is wild meat, also known as bushmeat. Though many ethnic groups have long histories of wild meat hunting for subsistence, this practice has become less sustainable as human populations increase and efficiencies of hunting improve with technologies and infrastructure (Ripple et al., 2016). Large-bodied mammals are often targeted for hunting and vulnerable to unsustainable offtakes (Ripple et al., 2015), including giraffe which have long life histories and slow reproductive rates (Dagg, 2014). Some countries have instated regulations that limit or ban hunting for meat or other consumptive uses to address declines of wildlife populations. Kenya adopted this approach, prohibiting all hunting of wildlife in 1977. Any killing of wildlife in Kenya can result in penalties; convictions are more severe when endangered species are involved, with life imprisonment as a penalty for poaching endangered species (Government of Kenya, 2013).

Despite severity of consequences, regulations to limit wildlife crime are not always effective deterrents and illegal activities still occur (Kahler et al., 2013; Solomon et al., 2015), especially when drivers of illegal wildlife use are not addressed (Challender & MacMillan, 2014). Recent research has refined methods for estimating occurrence of wildlife crime so that such activity can be monitored and evaluated over time (Conteh et al., 2015; Gavin et al., 2010; Solomon et al., 2007). However, there is not only a need to describe when illegal hunting occurs, but also to describe the conditions under which it occurs and examine the factors that influence decision making around rule-breaking (Rizzolo et al., 2017).

Reticulated giraffe (*Giraffa reticulata*) are listed as Endangered on the IUCN Red List, recently moved from the Vulnerable category after assessments had estimated population declines to be more than 50% over the last three decades (Muneza et al., 2018). This rate of decline is consistent with giraffe populations across sub-Saharan Africa, with observed declines of combined populations to be about 40% over the same time period (Muller et al., 2018). Currently, reticulated giraffe are limited in range to northern Kenya. It is likely that small, fragmented populations occur in western Somalia and southern Ethiopia, but are not confirmed due to data deficiencies. Only 5% of reticulated giraffe range exists within government-managed protected areas (O'Connor et al., 2019). Therefore, there is a need for applied conservation with community-owned and private conservancies and reserves where the large majority of giraffe range occurs.

Effective conservation requires addressing and reducing pressures on wildlife populations. There are only 11,000-15,000 individual reticulated giraffe remaining in Kenya, so there is a critical need to understand the threats the species is facing. Primary reasons for giraffe population declines are habitat loss and degradation, climate change impacts, and poaching (Muller et al., 2018), but there is limited published literature from the conservation social sciences that assess these anthropogenic threats. Habitat loss and fragmentation are largely considered as the primary causes for threatened biodiversity and land degradation (Wilson et al., 2016), which is likely to be exacerbated by climate change (Pecl et al., 2017). Some conservation projects lack resources or capacity to plan for landscape level conservation needed to address wider scale changes, and instead focus efforts on more proximate threats to biodiversity (St. John et al., 2011). This holds true for giraffe conservation; the IUCN Redlist assessment for giraffe lists harvest and trade management as needed areas for conservation management (Muller et al.,

2018). The purpose of this study is to better understand the conditions around giraffe poaching and part consumption among a community that share the landscape with reticulated giraffe in northern Kenya, by reviewing the relationships between social-psychological and background factors and behavioral intention to consume giraffe meat.

5.1.1 Theoretical Background

Social-psychological characteristics of individuals can illuminate some drivers of human behavior. Approaches from social-psychology theories became more readily integrated into the field of conservation upon recognition that people do not make decisions using purely economic rationales (Vaske & Manfredo, 2012). In such approaches, an individual's evaluations and perceptions of surrounding social pressures exert influence on behavior. Perhaps more than any other model, the Theory of Planned Behavior (TPB), has been applied in conservation contexts to understand human behavior (Miller, 2017).

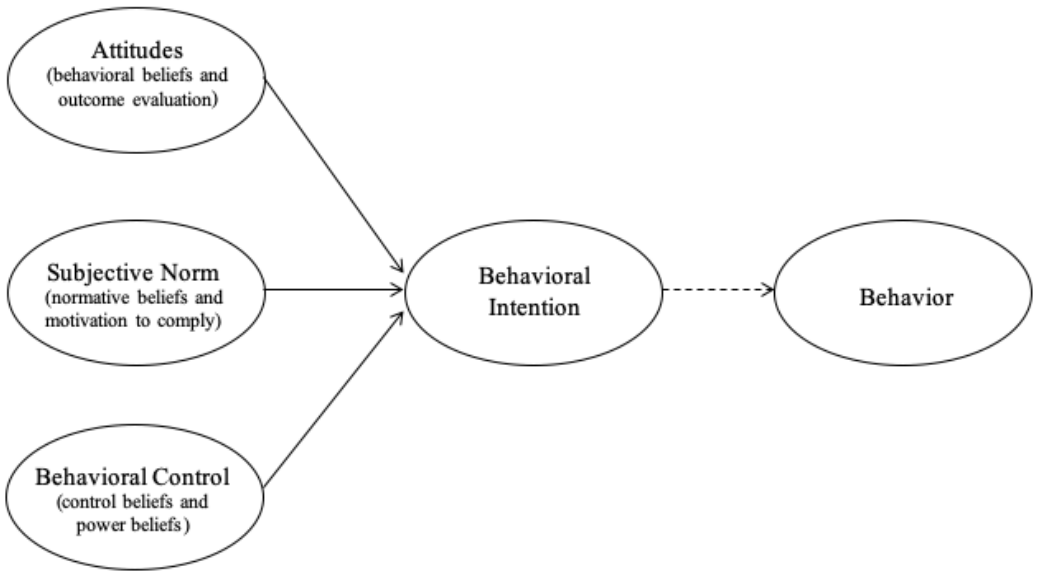

Figure 5.1. Theory of Planned Behavior Model. TPB posits that (1) attitudes, (2) subjective norms, and (3) perceived behavioral control influences behavioral intention, and likelihood to perform the behavior.

TPB proposes that behavior is a function of behavioral intention, which is directly influenced by an individual's (1) attitude toward the particular behavior, (2) subjective norm about how others will view his or her performance of that behavior, and (3) perceived behavioral control of enacting the behavior (Ajzen, 1991; Figure 5.1). Attitudes are formed as positive or negative evaluations of an attitude object (Manfredo, 2008), which, for applications of TPB, refers to evaluation of the behavior itself. In these instances, attitudes are based on beliefs about the behavior and outcome(s) to follow (St. John et al., 2011). Within this current study, such beliefs refer to whether consuming giraffe meat is good and a source of meat for their household, which form attitudes. Subjective norms, or the perceived social pressure of whether or not to perform a behavior, are comprised of normative beliefs and motivation to comply. In a case of giraffe poaching, normative beliefs would negatively influence the decision to illegally hunt if an individual believes that community members (e.g., an elder, family member, classmate) disapprove of the behavior. If the normative belief construct controls directionality, then motivation to comply determines the degree of influence. For instance, if a village elder disapproves of hunting giraffe, but a young person does not perceive the elder's approval as important, motivation to comply would not serve as a strong deterrent. Attitudes and subjective norms were originally proposed in the Theory of Reasoned Action (TRA; Ajzen & Fisbbein, 1974) to explain behavior, and then Ajzen (1991) added perceived behavioral control as an extension, thought to improve predictability of the model. Perceived behavioral control combines proximity to or access of resources that facilitate the behavior (e.g. having giraffe live nearby) and the perceived necessity of such resources to perform the behavior (e.g. increased likelihood of giraffe meat consumption if giraffe live nearby). The relative influence of attitudes, subjective norms, and perceived behavioral control will be relative to the behavior itself. Applying TPB to

scenarios that involve human-wildlife relationships helps to narrow in on which factors have greater influence within certain contexts and inform planning for the conservation interventions that target such factors. Inclusion of additional background factors can improve predictability of TPB models and explain greater variance by accounting for context and individual characteristics (Marchini & Macdonald, 2012).

Examples of TPB in conservation contexts highlight varying levels of predictability of the model, limitations of TPB, and directions for future work. In North American contexts, TPB has been used to understand hunter (Hrubes et al., 2001; Shrestha et al., 2012) and rancher activities (Willcox et al., 2012), recreationists in natural areas (Bowes et al., 2017; Martin & McCurdy, 2009; Miller et al., 2019), and behaviors related to human-wildlife coexistence (Campbell, 2012). There are recent applications of TPB in global contexts for natural resource and wildlife management, including fishers' intentions to adapt to changing systems in Tanzania (Lowe et al., 2019), participation in protected area governance in Madagascar (Ward et al., 2018), motivations that drive hunting and deforestation in Brazil (Castilho et al., 2018), and intention to kill jaguars in the Amazon and Pantanal (Marchini & Macdonald, 2012). Consistent with Ajzen's (1991) description of TPB, the relative importance of the three predictors varied based on situation and context. Many of these examples highlight a key limitation to use of TPB. Behavioral intention is used as a proxy for behavior but is not always a good indicator of behaviors in practice. Direct observations of behavior, however, are often difficult if not impossible to record (Nilsson et al., 2020), and measures of behavior through self-reports have high potential for biases (Floress et al., 2018; Tarrant et al., 1993). Sutton (1998) conducted a meta-analysis and reported that TRA/TPB models explain 40-50% variance in intention,

compared to 19-38% variance in behavior. The extent to which that difference is acceptable is up for deliberation (Miller, 2017).

Appropriateness of measurement is another necessary consideration when applying TPB in diverse conservation contexts. Robustness of the models relies on how the included constructs are operationalized and measured. There is discussion within the literature about conceptualization of attitudes, norms, and behavioral control and the appropriate levels of specificity relative to the intended behavior (Whittaker et al., 2006). Analyzing model fits require continuous variables, and Likert-type agreement scales can have challenges when used cross-culturally (Gore & Kahler, 2015). Researchers using quantitative social science data must take care to validate items and reduce potential for biases. Alternatively, qualitative approaches to understanding human-wildlife interactions may be more appropriate in areas where collection of scale-based data is not feasible. There is a need for testing human dimensions of wildlife (HDW) theories and concepts in diverse cultural contexts for the field to develop, as has been demonstrated by the progress in understanding applications of research that utilizes wildlife value orientations (Teel et al., 2007). Better understanding of how social-psychology models can be useful for conservation management comes from testing these models empirically in novel contexts.

5.1.2 Aim and Hypotheses of the Study

The purpose of this study is to understand determinants of behavioral intention to consume giraffe meat, as observed in a community conservancy living with reticulated giraffe in northern Kenya.

H_1: As attitudes toward giraffe meat consumption become more positive, behavioral intention to consume giraffe meat will increase.

H_2: As subjective norms about of giraffe meat consumption increase in acceptability, behavioral intention to consume giraffe meat will increase.

H_3: As perceived behavioral control around obtaining and consuming giraffe meat increases, behavioral intention for future consumption will increase.

H_4: Inclusion of socioeconomic background factors will improve the predictability of the proposed model that explains behavioral intention to consume giraffe meat.

5.2 Methods

5.2.1 Study Area

This study was conducted in two of the three units (Ngalai and Nalowuon) within Namunyak Community Conservancy, located in central Samburu County, Kenya (Figure 5.2). The community-owned conservancy is legally registered to Namunyak Wildlife Conservation Trust and governed by a locally-elected board of directors and local management. Since 1995, the conservancy has been affiliated with the Northern Rangelands Trust, a membership organization that supports the establishment and development of community conservancies in aspects of governance, security, resource management, and sustainable business enterprises (Pellis et al., 2015). The conservancy spans 384,024 ha and has an approximate population of 25,000. Samburu are the primary ethnic group of the Namunyak population. Habitat is characterized by arid acacia bushland, and key species of local wildlife include elephants

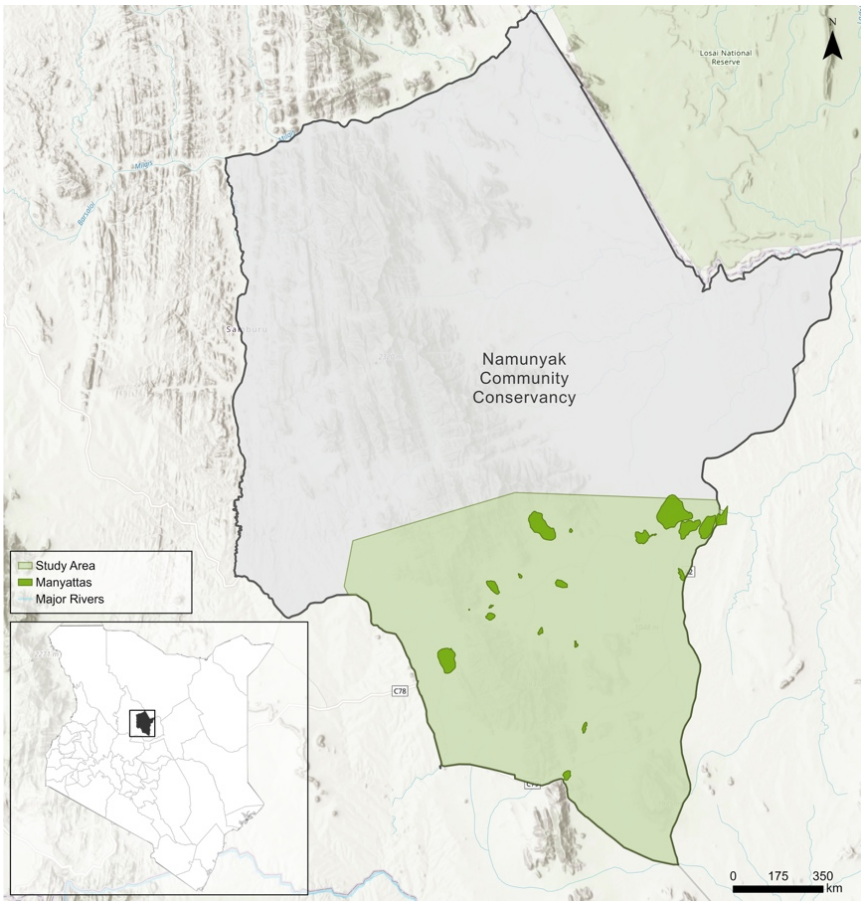

Figure 5.2. Map of Study Area. Darker shading denotes manyatta areas included in sampling plan.

(*Loxodonta africana*), gerenuk (*Litocranius walleri*), lions (*Panthera leo*), cheetah (*Acinonyx jubatus*), African wild dog (*Lycaon pictus*), Grevy's zebra (*Equus grevyi*), and buffalo (*Syncerus caffer*) (Northern Rangelands Trust, 2019).

5.2.2 Data Collection

Data were collected between July and November 2019, using a structured questionnaire administered through face-to-face interviews. The questionnaire instrument was adapted from a previous study, so that item wording and measurement were appropriate for use with the local language and context. Questionnaire items were developed in English, translated to Maa, and

back-translated by the local research team to ensure reliability of wording and consistency within the instrument. Each interview was conducted by two trained research assistants, with one facilitating the interview by asking questions, and the other recording data on an iPad tablet and with KoboToolbox software. The complete questionnaire contained 105 items and interviews took approximately 45 minutes to complete (see Appendix B for full questionnaire).

The sampling frame was developed using estimated household numbers by manyatta area (village), as informed by community elders and conservancy management. Target quotas were set so that approximately 30% of estimated adults within a manyatta area were interviewed, with the exception of Wamba Town, which had a target quota of 10% of household based on the resources available for this study. Wamba has the largest population within Namunyak, more permanent homes, and less proximity to giraffe populations, so this sample target was set lower than other manyatta areas.

The interviewers approached individuals over 18 years old within the manyatta area and after sharing the purpose of the study, invited them to participate. Study methods, data collection instruments, and verbal consent protocols were reviewed and approved by the Institutional Review Board (IRB Protocol # 02156e) of Miami University, Ohio.

5.2.3 Analysis Variables

For this study, the questionnaire included 15 items for the TPB that measured four latent constructs: (a) attitudes toward giraffe meat (3 items), (b) subjective norms about acceptable behaviors (6 items), (c) perceived behavioral control (3 items), and (d) behavioral intention to consume giraffe meat (3 items). Each item was presented to participants to respond to with level of agreement, coded on a 5-point Likert scale from *Strongly Disagree (1)* to *Strongly Agree (5)*. Exact wording for each item is presented in Table 1. Attitudes were measured with items about

behavioral beliefs and outcome evaluations related to giraffe meat. Items for the subjective norms construct included statements that reflect normative beliefs, descriptive norms, and motivation to comply with social norms. Behavioral control was measured with items framed around access to giraffe meat as a resource and autonomy over obtainment of giraffe meat. Items to measure behavioral intention included a statement about next opportunity to eat giraffe meat, intention in the next year as a reference time period, and desire to eat giraffe meat. Demographic variables were measured for gender, age, age group (categorical), wealth, occupation, ownership of livestock, and primary types of income. Gender was measured as a dichotomous variable [Male (0), Female (1)]. We recorded age (continuous) and age group (categorical variable), based on meaningful groupings for gender and age in Samburu society: moran (young male), junior elder (male), elder (male), senior elder (male), siankikan (young female), kidemi (female), ntassasti (senior females). Wealth was assessed by asking if respondents owned a series of 13 items (radio, solar panel, mobile phone, computer/laptop, motorbike, car/van, television, torch/flashlight/spotlight, fridge, gas cooker, bicycle, wheelbarrow, mattress), and responses were coded as no (0) and yes (1). A summative index (0-13) was computed for wealth. Occupation (livestock herder/pastoralist, livestock broker, tourism worker, non-livestock business, wildlife-related, or other) was coded into discrete categories. Respondents were asked about top two sources of family income (livestock sales, subsistence from livestock, tourism, wildlife-related, or business), and income types were coded as a dichotomous variable [no (0), yes (1)] for each respondent. Ownership of different types of livestock was measured as a dichotomous variable for cattle, donkeys, sheep/goats, camels, and chickens. We measured whether the respondent has previously consumed giraffe meat as an additional background factor. This variable was measured with the direct question, “When was

the most recent time you used giraffe meat?" Categorical response options were: *never, within the last 12 months, between 1-5 years ago, between 6-10 years ago,* and *more than 10 years ago*. Responses were recoded into a dichotomous variable: have (1) or have not (0) previously used giraffe meat.

5.2.4 Data Analysis

Confirmatory factor analysis (CFA) was used for verifying the validity of item fit with each latent construct. Factor loadings determined which items were to be included in the remaining analyses, and a threshold of .40 was used. Goodness-of-fit indices for the CFA included χ^2/df, Comparative Fit Index (CFI), Normed Fit Index (NFI), Goodness-of-Fit Index (GFI), and Root Square Mean Residual (RMR). Acceptable fit is indicated by a χ^2/df value between 2 and 5 (Marsh & Hocevar, 1985), values greater than .90 for CFI, NFI, and GFI (Kline, 1998), and RMR between the range of .05 to .10 (Jöreskog & Sörebom, 1989). Internal reliability of items that loaded as factors for attitudes, subjective norms, behavioral control, and behavioral intention were assessed using Cronbach's alpha ($\alpha > .65$ included in mean scale) (Vaske, 2008). Mean variables for the four latent constructs were computed with a minimum of two items with valid responses for inclusion.

Multiple linear regression (enter method) was used to test for directionality and strength of influence on behavioral intention as the dependent variable. The model was structured *a priori* based on the TPB model. A second linear regression model was run with the same theorized components of TPB and additional background factors as independent variables (age, gender, wealth index, ownership of livestock types, and previous meat consumption behavior). Comparisons within demographic groups of behavioral intention to consume giraffe meat were made using chi-square tests. An alpha level of $p < 0.05$ was used for significance. The effect size

index used for the multiple linear regression model was correlation coefficient (R), and standardized β was used to assess each path. For the chi-square tests, effect sizes were determined with Eta (η), for variables with more than two categories of respondents, and Cramer's V for categorical variables with two groups. Levels for the effect sizes were interpreted using recommendations from Vaske (2008). The confirmatory factor analysis was performed in R 3.6.2 (2019) using the lavaan package (Rosseel, 2012). All other analyses were conducted in Statistical Package for Social Sciences (SPSS), version 26.0.

5.3 Results

5.3.1 Sample Characteristics

The sample consisted of 495 individuals (95.8% response rate) in 21 manyatta areas and two towns in Namunyak Conservancy. The gender ratio in the sample was evenly split (50.3% female; 49.7% male). Livestock herder/pastoralist was the most common occupation in the sample (81.5%). The proportions for other occupations were livestock broker (6.2%), tourism worker (3.9%), wildlife-related (1.7%), and business (non-livestock) (4.8%). The range of respondent ages was from 18 to 90, with an average age of 41.08 (SD ± 14.36). For the 13-point wealth index, the mean index score was 3.70 (SD ± 2.74). Frequencies for types of livestock ownership include cattle (92.1%), donkeys (56.0%), goats/sheep (96.6%), camels (45.4%), and chickens (62.1%). Within the sample, the top two primary incomes sources varied: livestock sales (79.6%; n=393), subsistence from livestock (75.7%; n=374), income from tourism (7.9%; n=39), wildlife-related employment (7.7%; n=38), and other business (13.0%; n=64).

5.3.2 Confirmatory Factor Analysis

The CFA supported that the constructs were associated with the intended variables. Observed variables loaded with latent constructs and factor loadings >.4 (Table 5.1). Two items associated with subjective norms had factor loadings <.4 and were excluded from subsequent analyses. The fit indices for the model were acceptable (χ^2/df =3.783, p<.001, CFI (.935), NFI (.914), GFI (.931), and RMR (.067)). Cronbach's alpha values (Table 5.1) were acceptable (Vaske, 2008). The majority of respondents (91.5%) held negative attitudes toward giraffe meat (*M*=1.71, *SD*±.77). Responses for subjective norms were normally distributed, and the mean variable was close to neutral (*M*=2.97, *SD*±1.15). Most respondents (91.2%) felt low behavioral control (*M*=1.89, *SD*±.79), and reported low intention to consume giraffe meat in the future (*M*=1.84, *SD*±.91). For the mean behavioral intention variable, and 80.9% of respondents were on negative end of the scale, 2.2% were neutral, and 16.7% of the sample held positive intention.

5.3.3 Predicting Intention

Applicability of the TPB to understand giraffe meat consumption was tested with multiple linear regression. Attitudes toward giraffe meat, subjective norms, and perceived behavioral control were all significant predictors of behavioral intention (Figure 5.3). When the three latent variables were entered in a single step as independents variables regressed onto behavioral intention as the dependent variable, all three had positive associations with behavioral intention, explaining 27.0% of the variance. Perceived behavioral control had the highest effect on the dependent variable (β=.33), followed by attitudes toward giraffe meat (β=.26). Subjective norms also had a significant relationship with behavioral intention, but a weaker effect (β=.13). These results support all hypotheses: there were positive associations between behavioral intention to

consume giraffe meat and attitudes (H_1), subjective norms (H_2), and perceived behavioral control (H_3).

Table 5.1. Confirmatory Factor Analysis. Items included in Confirmatory Factor Analysis (CFA) for latent constructs in Theory of Planned Behavior model, mean scores and standard deviations for items on a 5-point scale, Cronbach's alpha values for reliability, and CFA factor loadings.

Variables	Mean	SD	Cronbach's alpha	CFA factor loading
Attitudes	1.71	.77	.72	
I would be happy if a giraffe was killed so I could eat the meat.	1.77	1.05		.44
A giraffe provides meat for my family.	1.66	.88		.87
Eating giraffe meat is good for my family.	1.71	.92		.73
Subjective Norms	2.97	1.15	.86	
Behaving how the community elders expect me to is important to me.	3.90	1.45		.65
Community elders eat giraffe meat.	2.82	1.31		.89
Most of my community thinks that eating giraffe meat is acceptable.	2.95	1.39		.81
People in my community eat giraffe meat.	3.13	1.34		.81
Behavioral Control	1.89	.79	.67	
It is easy for me to kill giraffe to get meat for eating.	1.79	.96		.62
The decision whether to eat giraffe meat is up to me.	2.07	1.12		.64
Having giraffe live nearby makes it more likely for giraffe to be killed for meat.	1.80	.93		.65
Behavioral Intention	1.84	.91	.82	
Next time I have a chance, I will eat giraffe meat.	2.11	1.29		.89
I plan to eat giraffe meat in the next 12 months.	1.52	.66		.60
I want to eat giraffe meat.	1.89	1.13		.92

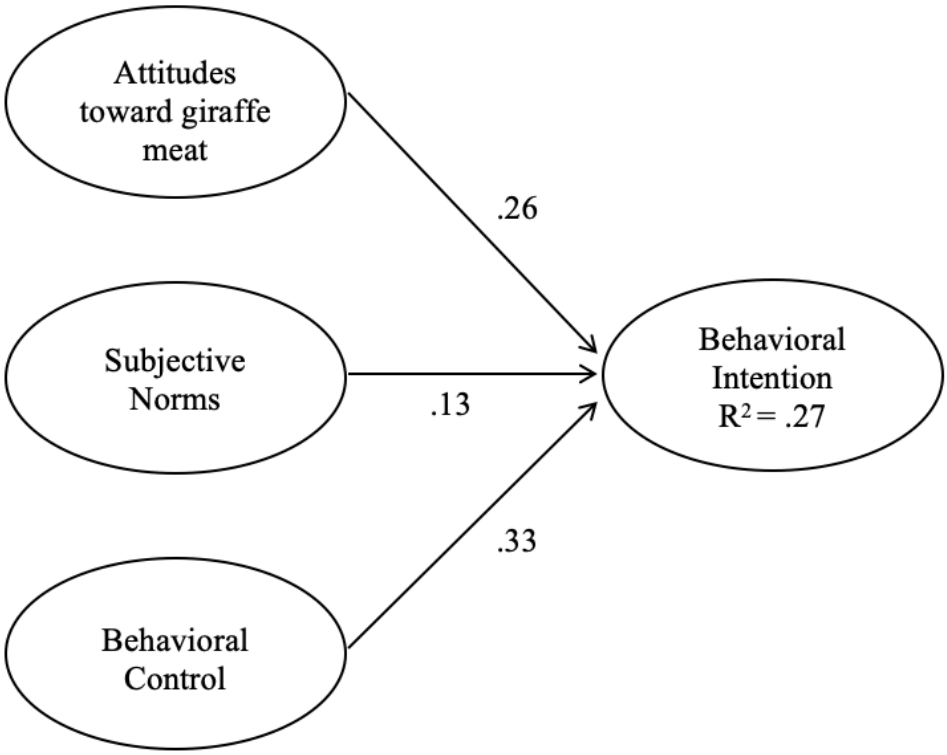

Figure 5.3. Theory of Planned Behavior Model for Intention to Consume Giraffe Meat.

The second regression model with additional background factors included as independent variables improved predictability of the model, explaining 44.3% variation of behavioral intention in the sample (Table 5.2). The three constructs from TPB remained significant predictors of behavioral intention. Past meat consumption had significant positive association (β=.098, *p*=.034) with future intention. Wealth index (β=-.278, *p*<.001) and cattle ownership (β=-.093, *p*=.036) had negative associations. The remaining background factors included in the model did not have significant effect on mean scores for behavioral intention.

Table 5.2. TPB Multiple Regression. Model with background factors added to the TPB model (R^2 = .443).

Predictor Variable	*β*	*SE*	*p*
Attitudes	**.218**	**.063**	**<.001**
Subjective Norms	**.304**	**.042**	**<.001**
Perceived Behavioral Control	**.269**	**.060**	**<.001**
Age	-.004	.003	.926
Gender	-.002	.078	.963
Wealth Index	**-.278**	**.017**	**<.001**
Past Meat Consumption	**.098**	**.092**	**.034**
Cattle Ownership	**-.093**	**.138**	**.036**
Donkey Ownership	-0.59	.094	.245
Goat/sheep Ownership	-.008	.210	.849
Camel Ownership	-.016	.088	.737
Chicken Ownership	.004	.084	.921

Behavioral intention differed between segments of the sample population, based on certain demographic variables (Table 5.3). Significant differences were observed based on occupation. Respondents that work in the tourism industry had the lowest mean score for intention, and livestock herders/pastoralists had the highest average. Behavioral intention also differed based on age groups within the sample. Respondents with primary forms of income from livestock sales or subsistence from livestock were more likely to have higher intention to consume giraffe meat, whereas those that had tourism or wildlife-related income reported lower intention to consume giraffe meat. Behavioral intention did not significantly differ based on gender or whether non-livestock business was a primary form of income.

Table 5.3. Demographics x Intention. Chi square analyses to compare behavioral intention to consume giraffe meat based on demographic variables.

Variable	Mean	SD	χ^2	p	η	V
Gender			17.92	.083		.191
Female	1.93	.92				
Male	1.74	.89				
Occupation			75.04	.038	.282	
Livestock herder/pastoralist	1.97	.94				
Livestock broker	1.27	.45				
Non-livestock business	1.39	.77				
Tourism worker	1.17	.61				
Wildlife-related	1.33	.44				
Age Group			97.24	<.01	.175	
Moran (young male)	1.66	.91				
Junior elder (male)	1.96	.99				
Elder (male)	1.66	.83				
Senior elder (male)	1.67	.85				
Siankikan (young female)	2.06	1.01				
Kidemi (female)	1.86	.83				
Ntassasti (senior female)	1.91	.84				
Income – Livestock Sales			75.38	<.001		.391
Yes	1.99	.93				
No	1.27	.55				
Income – Subsistence from livestock			27.36	<.01		.236
Yes	1.93	.96				
No	1.57	.68				
Income – Tourism			31.18	<.01		.251
Yes	1.39	.81				
No	1.88	.91				
Income – Wildlife			31.44	<.01		.253
Yes	1.55	.96				
No	1.87	.90				
Income – Other Business			8.75	.654		.133
Yes	1.82	.91				
No	1.85	.91				

5.4 Discussion

Poaching poses a primary threat to biodiversity, and the ability to effectively address poaching relies in part on understanding the motivations of those that use wildlife parts. There has been an increased focus on understanding the complexities of wildlife product use (Veríssimo & Wan, 2019). Better understanding of social-psychological factors that influence behavioral intention can inform strategies and be in alignment with social contexts. The purpose of this study was to assess how different factors influence behavioral intention to consume giraffe meat, as meat is the primary giraffe part used in Kenya. Here, we discuss our findings in relation to theoretical implications for the use of Theory of Planned Behavior in cross-cultural contexts and applications for giraffe conservation.

5.4.1 Theoretical Implications

Given the common use of TPB in research on the human dimensions of conservation, empirically testing TPB can improve how it is used and applied for wildlife and natural resource management. Though the relative influence of attitudes, subjective norms, and perceived behavioral control is expected to vary based on situation, there is need for robust study design (St. John et al., 2014) and quality quantitative measurement (Vaske, 2008) to obtain valid results that are useful when developing conservation strategies.

Our results contribute to discussion of how components of the TPB are operationalized in wildlife conservation research. The confirmatory factor analysis (CFA) demonstrated that items intended to measure attitudes, subjective norms, perceived behavioral control, and behavioral intention loaded together as separate factors, and that the observed measurements reflected the intended latent constructs. Results from the CFA identified two individual items to be excluded from further analysis, even though the Cronbach's alpha value was above the acceptable

threshold for reliability when those two items were included. Our questionnaire included more items to measure subjective norms, and reliability coefficients can increase as scales include more items (Brown, 2001). Cronbach's alpha does not test dimensionality, highlighting the need for additional analysis (e.g. confirmatory factor analysis) to demonstrate whether multiple items cluster as discrete variables (Shelby, 2011).

The predictive value of attitudes is dependent on three factors: specificity (degree to which attitudes and behavior match in level of focus), salience (accessibility of an attitude in an individual's mind), and strength (degree of intensity and resistance to change) (Manfredo, 2008). Not all TPB studies match the attitudes measurement with the behavior in terms of specificity (Ajzen & Driver, 1991). Our measurement for attitudes was built around the behavior of interest, consumption of giraffe meat, and also integrated both behavioral belief (*"a giraffe provides meat for my family"*) and outcome evaluation (*"eating giraffe meat is good for my family"*). Specificity was important for our study, as attitudes toward giraffe are very positive in the region (Chapter 2), so attitudes toward giraffe would not be a good proxy for this application of TPB. Many previous HDW studies across Africa include measures of general attitudes toward wildlife and conservation (Browne-Nuñez & Jonker, 2008). More specific measurement, however, can provide valid results to inform conservation and communication strategies, increasing the utility of HDW research.

Researchers have noted the need for additional examination of how subjective norms are operationalized (Armitage & Conner, 2001). Two items in our scale reflected descriptive norms – perceptions of which behaviors are typical (Cialdini et al., 1991). In a study that examined illegal killing of wildlife in Taiwan, different types of norms were shown to have varying levels

of influence on behavior (St. John et al., 2015). In our analyses, these descriptive norm statements loaded as a single factor with motivation to comply and an injunctive norm statement.

Perceived behavioral control (PBC) refers to likelihood of performing a behavior based on available resources. Some influences on PBC relate to external factors (e.g. whether access to wild meat is nearby), partially accounting for factors that are beyond the individual actor as they evaluate a behavioral choice. Ajzen (1991) asserts that this construct includes self-efficacy, an individual's cognitive perception of his/her own volition. We included items that were framed around access to giraffe meat as a resource, but also autonomy over their decision to engage in the behavior.

5.4.2 Applied Implications

Behavioral intentions to consume giraffe meat increased as attitudes toward giraffe meat, subjective norms about consumption, and perceived behavioral control became more positive. Though all three components of the traditional TPB model have significant predictive relationships with intention, the strongest determinant of behavioral intention was perceived behavioral control.

In this case, the strong influence of perceived behavioral control highlights how opportunity to perform the behavior is important in contexts that include poaching and use of wildlife products as threats to species populations. For cases of giraffe meat in our study area, the product is very likely sourced from local kills, rather than through purchase at a market or other location and brought back to manyattas. As such, behavioral intentions to consume giraffe meat in conservancy study areas are preceded by a local event of a giraffe killed by targeted poaching or another cause of death (e.g. collision with fencing or roads), so it is important to contextualize findings in relation with local poaching activity. As Carter et al. (2017) present in their

framework for understanding illegal killing of large carnivores, poaching events occur within complex socio-ecological systems, when social context and individual factors overlaps with animal behaviors and landscape context for an opportunity to hunt. Opportunity to poach is acted upon when motivations align in space and time with a target and its lack of protection (Eliason, 2012). Perceived behavioral control is formed by individuals' perceptions of proximity and access to the resources needed to perform a behavior, so intersection of the social and ecological factors that make giraffe meat available are important to understand. Respondents did not report that obtaining giraffe meat is easy, but they also did not agree with self-efficacy around the decision to consume meat, suggesting that community members may find it difficult to turn down an opportunity to consume meat if offered. Respondents also disagreed with the power belief component of perceived behavioral control that having giraffe nearby increases the likelihood they will be killed for meat. This tendency is desirable for conservation planning, as reticulated giraffe populations trends need to stabilize or increase to meet conservation goals and down list its "Endangered" conservation status.

In the context of our study area, reducing the opportunity to consume giraffe meat comes with successfully addressing poaching activities. Such outcomes require meaningful engagement with numerous actors. To combat illegal wildlife trade, many resources have been directed toward regulations, enforcement, and anti-poaching efforts (Duffy, 2013; Duffy et al., 2015), but these approaches can fail to address the underlying social, cultural, and economic drivers of poaching (Challender & MacMillan, 2014). Community-level approaches can be important to changing the conditions that enable poaching (Biggs et al., 2017), and can complement top-down enforcement practices to effectively address illegal hunting (Cooney et al., 2017). Increasing the level of protection for wildlife, as well as individuals' perceptions of its legitimacy, would

address the component of perceived behavioral control that concerns accessibility of the resource.

Though subjective norms had lower relative influence on behavioral intention, community acceptability of giraffe meat consumption may be related to PBC in how individuals perceive the ease of finding giraffe meat. The item that measured motivation to comply had the most positive score, suggesting that communication through community elders could exert influence on individuals' evaluation of giraffe meat consumption. It is possible that the condemnation from elders about consumption could decrease PBC, if there was increased perception that giraffe meat is difficult to obtain, based on a social norm against its use. Normative communication strategies, however, should be used carefully, as the use of descriptive norms (e.g. describing the prevalence of giraffe meat consumption in a given community) may inadvertently increase the unwanted behavior (Cialdini et al., 2006). This possibility is important for conservationists to acknowledge, as the worst outcomes for conservation strategies are not lack of change, but actually exacerbating the undesirable behavior(s) (Pfeiffer, 2004). Therefore, conservation interventions, including those that utilize normative messaging, must be developed with consideration for sociocultural contexts and are likely to be improved by pilot testing.

Additional variables that had significant influence on behavioral intention were wealth, past meat consumption behavior, and ownership of cattle. The wealth index had a negative relationship with intention. This differs from other studies that report levels of wild meat consumption increase with wealth (Foerster et al., 2012; Rogan et al., 2018) or that wealth has no effect (Ceppi & Nielsen, 2014; Kiffner et al., 2015). Potential reasons for the positive association between wealth and consumption could be increased accessibility to weapons (St. John et al.,

2013), preference, or other reasons. Our results show that intention to consume giraffe meat decreases when individuals have lower levels of wealth. This finding prompts an important question as to whether wild meat is an aspect of food security among pastoralist communities during difficult times of drought or other hardships that affect herd health, a primary source of protein. Ownership of cattle also had a negative influence on behavioral intention, though with a smaller effect size than the wealth index. Cattle hold great social and economic significance to pastoralist families (Reid, 2012), and pastoralists with lower wealth tend to keep more small stock like goats and sheep, relative to cattle, likely due to drought resilience, ability to sell small stock and contribution to household food security (Unks et al., 2019). As such, it is possible that cattle ownership and higher levels of wealth have negative influences on behavioral intention for similar reasons.

Past behavior was also a significant predictor of future intention, but with a smaller effect than other significant variables. In their application of TPB to understand illegal jaguar killing, Marchini & Macdonald (2012), show that those that have performed the behavior of interest in the past were more likely to have higher future intentions. For our case, this relationship could be due to a few factors, including preference (Lindsey et al., 2011) or lowered risk perceptions due to increased familiarity from past behavior.

Additional consideration of background and contributing factors can allow for targeted interventions toward those within a community that are most likely to engage in the behavior of interest. In our comparison of behavioral intention among subgroups in the sample, there were significant differences based on occupation, age group, and primary sources of income. Respondents with occupations in, and main income from, wildlife or tourism sectors reported lower intention to consume giraffe meat than those that identified livestock sales and subsistence

as primary income and occupation. These results support the idea that diversified livelihoods and opportunities tied to wildlife conservation can be important for reducing illegal use of wildlife (Biggs et al., 2017; Rogan et al., 2018).

The relationship between age group and behavioral intention suggests a minimum to typical relationship. Our results differ from other studies in the region that have reviewed human-wildlife interactions based on age and gender. Morans are frequently considered most likely to engage in negative interactions with wildlife, but in our case, women of all age groups reported higher intention to consume giraffe meat. It is worth nothing that morans are still possibly more likely to engage in hunting behavior, as poaching and consumption are not mutually exclusive, nor interchangeable.

5.4.3 Limitations of the Study

Though this study provides insights to factors that influence giraffe meat consumption, there are limitations to its generalizability to other contexts where use of wild meat and products are a conservation concern. First, this study population is limited in scope to one community area, which is influenced by a number of contextual factors. Due to the semi-nomadic practices of the community that own Namunyak Conservancy, randomized sampling based on household addresses was not possible for our sampling strategy. Instead, we sought representation across the study area by setting quota target for interviews in each area, determined by household estimates gathered from Conservancy management.

Second, we did not include a measure of actual behavior to test the full TPB model in how intention translates to actual behavior. Our protocols approved for human subjects research did not include recording of unique identifiers, making it impossible to connect observed behaviors following the survey with individuals' responses and reports of intention. There would

be a number of ethical issues with such research practice, and given the increased use of social sciences for conservation, there needs to be a corresponding increase in care for protection of research participants (Brittain et al., 2020).

Lastly, there is potential for biases from social desirability when conducting research on human behavior, particularly around behaviors related to illegal wildlife killing and use. Specialized questioning techniques that help to protect the respondent and avoid biases of self-reported data have been increasingly used for conservation (Nuno & St. John, 2015), and applied in conjunction with TPB (Fairbrass et al., 2016).

5.4.4 Recommendations for Future Research

Additional research is needed to help reduce poaching and part usage as a threat to reticulated giraffe. Our results suggest those with lower wealth are more likely to consume giraffe meat. Further work should explore the extent to which this association is driven by food insecurity, building toward subsequent strategies that address this concern. Some of such work can focus on the conditions under which certain behavioral choices are made. Discrete choice experiments (Subroy et al., 2018; Tait et al., 2017) can assess which scenarios demonstrate higher likelihood to consume giraffe meat. Not only would such research highlight instances in which wealth and livestock herd composition influence consumption, but also other motivations such as preference or social practices. Since perceived behavioral control was the strongest influence on future intentions to consume, and it is heavily influenced by accessibility to the resource, future research should explore aspects of giraffe meat sourcing and control. For instance, researchers can investigate whether people are more likely to consume giraffe meat when carcasses are found after predation or indiscriminate killing from fences or roads, versus when giraffe are targeted and poached. More in depth research can explore the differences between social groups,

including the reasons why women reported higher intentions and how income sources and wealth indices influence decision making around consumption.

5.5 Conclusions

Our study provides insights into the social and background factors that influence future intentions to consume giraffe meat. Access to giraffe meat is an important component of perceived behavioral control, which exerted the strongest influence on behavioral intentions. These findings point to the need for conservation interventions to reduce opportunities for take of wild meat through increased enforcement and monitoring of illegal hunting from multiple approaches that include community-based responses. Multiple background and social-psychological variables determined significant variance in behavioral intentions to consume giraffe meat. This not only demonstrates applicability of the TPB model to scenarios with illegal use of wildlife products, but also shows the need to incorporate social aspects of human-wildlife relationships into conservation strategies, along with economic or regulatory approaches.

CHAPTER 6: CONCLUSION

6.1 Discussion

Balancing human activities with biodiversity conservation will necessitate societal engagement at multiple scales (Ellis, 2019) and integration of evidence from multiple disciplines (Mascia et al., 2003). More than ever, there is indeed a need for conservation policies and programs to reflect the dynamic nature of complex systems (Liu et al., 2007) and the socio-ecological contexts in which conservation challenges exist (Gavin et al., 2015). Within the conservation field, there is steadily more recognition of the value that social science approaches bring to conservation planning (Bennett et al., 2017; Sandbrook et al., 2013). Increased understanding is needed about the social factors that influence both passive support for conservation programs and active changes in human behaviors that are tied with the threats that species face. HDW research aims to improve planning and process for management of wildlife and natural resources by using findings from studies about human interactions with, and views toward, wildlife. Combined insights from social science disciplines, such as HDW, and those from the natural sciences can guide management decisions and conservation interventions so that they are suited for particular contexts. The integration of HDW with management is critical for planning under dynamic conditions and with diverse communities. Thus, the HDW field has expanded from its North American roots to support conservation efforts in diverse global settings. The research presented in this dissertation focuses on the human dimensions of giraffe conservation and describes interactions between people and giraffe among pastoralist communities.

This research was situated in northern Kenya, where conservation consists both of local governance for community conservancies and landscape-level planning through coordination between conservancies, private landowners, and government agencies. Continuity of habitat is

critical for protection of Kenya's wildlife, as the majority occur outside of national parks and reserves (Western et al., 2009). Since community-based approaches to conservation have been increasingly recognized and utilized in Kenya, some research in the area has focused on how community-based conservation (CBC) programs are implemented and what outcomes occur. Intended outcomes of CBC can result in social and ecological changes, targeting tangible and intangible benefits for communities and improved conditions for wildlife (Brooks et al., 2013). The Twiga Walinzi ("Giraffe Guards" in Swahili) Initiative was established—in partnership with Loisaba Conservancy, Namunyak Conservancy, San Diego Zoo Global, and others—to help protect northern Kenya's reticulated giraffe and enhance capacity within communities to lead a socio-ecological conservation and research program. An overall program goal, co-developed by community leadership and program partners, was to reduce the direct giraffe mortalities driven by desire for giraffe parts. This dissertation focused on HDW research to inform the community engagement and conservation strategies for the Twiga Walinzi program. As this is the first program of its kind for reticulated giraffe conservation, this dissertation also provides a framework for understanding human-giraffe interactions and behaviors associated with threats to giraffe that can be applied for giraffe conservation where needed in other contexts. Chapters 2 through 5 address how key cognitions influence support for giraffe conservation, how perceived benefits relate to attitudes and behaviors within contexts where CBC approaches are utilized, how to estimate the prevalence of giraffe part consumption, and how social-psychological and background factors influence future intention to consume giraffe meat.

This dissertation is structured around four research manuscripts. The following sections will outline research outputs from the four manuscripts as related to the objectives of this

dissertation. Key contributions to the HDW field and recommendations for applied conservation will also be discussed.

6.1.1 Human Dimensions of Giraffe Conservation

There is a need for HDW research to expand and focus on understudied species and wildlife management in diverse contexts. One objective for this dissertation, and as part of the broader Twiga Walinzi program, was to establish baseline measurements of community members' knowledge, perceptions, attitudes, and beliefs held about reticulated giraffe. Chapter 2 examined key cognitions related to human-giraffe interactions to better understand the influences on support for giraffe conservation.

Knowledge of giraffe population trends was low, and the majority of respondents reported local increases in reticulated giraffe populations. This perception of population trend was influenced by exposure to giraffe; the more frequently respondents reported giraffe sightings, the more likely they were to think that local giraffe populations were increasing. Overall, attitudes toward giraffe, beliefs in the importance of giraffe, and normative beliefs in support of giraffe conservation were very positive. Normative belief about what should happen to future giraffe populations was examined as a dependent variable; path analyses showed that the strongest influences on normative belief differed by site. At Namunyak, a community conservancy, attitudes and existence value had significant positive associations with normative belief. Results from the sample from communities around Loisaba, a private conservancy, suggested that perceptions of benefits, such as conservation employment or functional role in the ecosystem, can influence normative belief. These differences highlight that situational factors can change how people think and feel about giraffe and their conservation. For instance, in areas where community development projects have recently been funded by wildlife-based revenue,

highlighting how local giraffe are connected with tangible benefits is more likely to be impactful. Conservation messaging and interventions must consider how interventions will be received within particular contexts and can be tailored for the intended audiences.

6.1.2 Giraffe Conservation as Part of Community-based Conservation

As an applied field, research on the human dimensions of wildlife is often developed to inform conservation and management practices for particular contexts and specific situations. In northern Kenya, community-based conservation (CBC) has been adopted as an approach to integrate governance of community conservancies and protection of wildlife across the northern rangelands. Within many programs that incorporate principles from CBC, an aim is to reduce costs of living with wildlife and/or increase benefits associated with wildlife conservation. An undying presumption is that by shifting the cost/benefit ratio, attitudes toward wildlife will become more positive and the ways that people act toward wildlife will become more aligned with conservation goals. However, the connections between wildlife benefits and cognitions (i.e. attitudes and behavior) as outcomes for conservation are not well understood. An objective of this dissertation was to examine how perceptions, attitudes, and behaviors are related to one another within communities that utilize CBC as a conservation model.

The research in this dissertation assessed the links between perceived benefits from local giraffe populations with the attitudes held toward giraffe and past behaviors of consuming giraffe meat/parts. Results not only provided evidence that attitudes toward giraffe were more positive when conservation benefits were perceived, but also showed that community members that perceived conservation benefits were just as likely to have consumed giraffe meat. Further, the influence of perceived benefits on attitudes and behaviors varied by type of benefit. These findings are important when considering how tangible and intangible benefits are incorporated

into conservation planning. Greater specificity and intention are needed in regards to which benefits are prioritized for resource allocation and distribution, whether such benefits reflect socio-ecological contexts, and how benefits relate to intended conservation outcomes. In some cases, increasing positive attitudes toward wildlife can be an objective of CBC (Brooks et al., 2006). When attitudes toward wildlife are the target for conservation messaging and interventions, wildlife-related benefits can be used as an avenue to increase positive attitudes. More often, however, meeting conservation goals will necessitate some change in human behavior (Nilsson et al., 2020).

6.1.3 Prevalence of Giraffe Consumption in Communities

The drivers of human behavior are complex. The first steps in planning for behavior change strategies revolve around defining the conservation challenge. Fundamental questions to understanding an issue include which behavior(s) is (are) most relevant, which actors or groups are engaging in the behavior, and what are the baseline levels of prevalence (Reddy et al., 2017). Collecting accurate information can be difficult when the behavior in question is illicit or otherwise sensitive in nature. Specialized questioning techniques (SQT) have been adapted for conservation purposes to reduce the possibilities for social biases and increase the likelihood of collecting valid data. Another objective of this dissertation was to utilize SQTs to quantify levels of the use of giraffe parts and products in the study area. By applying two SQTs (the randomized response technique and unmatched count technique) along with direct asks about past giraffe part consumption, estimated prevalence of that behavior could be tracked through multiple methods.

The research in this dissertation measured the prevalence of giraffe meat consumption through two surveys in 2016/17 and 2019. The estimated levels of prevalence were significantly reduced between the two time periods across all three methods. A key change between the two

surveys was the establishment of Twiga Walinzi. Though there were many components of the program that could have individually or collectively influenced community members' decisions to consume giraffe meat, particular program elements correspond with other programs that have demonstrated reductions of poaching pressures. These program components, which include regular ecological monitoring and community engagement strategies, could have changed social norms around the acceptability of giraffe poaching and consumption. In addition, poaching activity may have declined with an increase in perceived detectability of getting caught. The precise factors that incited this reduction in the usage of giraffe meat need to be examined with an evaluation approach.

This dissertation provides a useful example of how SQTs can be applied within conservation settings to monitor behavior over time. The use of these techniques can be appropriate, and the protocols can be adapted for other locations where the use of giraffe parts is thought to be a direct threat. The evidence presented here suggests that a decline in giraffe meat consumption provides an encouraging example of behavioral change aligned with conservation outcomes. This research helps to define the conservation problem that giraffe poaching and related consumption presents. The next steps needed to best address this threat involve focusing on the key drivers of giraffe consumption behavior.

6.1.4 Determinants of Intention to Consume Giraffe Meat

The reduction of illegal wildlife use relies in part on addressing the drivers of those behaviors, which should be examined from multiple disciplinary perspectives. Research in this dissertation utilizes social-psychological theory to meet another objective—assess key drivers of giraffe meat consumption. The Theory of Planned Behavior (TPB) posits that attitudes, subjective norms, and perceived behavioral control influence the likelihood to perform the behavior of interest. I

applied the TPB model to understand the relative strength of these factors in conjunction with respondents' background factors. For this case of giraffe meat consumption, the strongest determinant of future intention was perceived behavioral control. This demonstrates the importance of opportunity to perform the behavior. Though poaching cannot be fully removed as a threat solely through means of enforcement, the conditions that make poaching more difficult are likely to decrease perceived behavioral control, whether it be tightened security, increased likelihood of conviction upon arrest, increased social costs of acting against community norms, or other factors.

Conservation programs should aim to reduce opportunities to access giraffe meat, most likely through combined efforts of enforcement strategies and community-based approaches. Though perceived behavior control is a strong determinant of behavioral intention in the setting where this research was conducted, the relative strengths of different characteristics in the TPB model are likely to vary by context. As with additional research within this dissertation, such findings highlight the importance of understanding conservation issues within the social and ecological contexts where they exist.

6.2 Limitations and Directions for Future Research

Findings from this dissertation provide initial insights into the perceptions, attitudes, and beliefs held toward giraffe in pastoralist communities. A key finding was that these cognitions differed by community area in relative importance to belief that giraffe populations should increase. Therefore, additional HDW research is needed in other contexts across Africa where giraffe conservation efforts require community support, so that strategies are developed to reflect local contexts. The studies included in this dissertation were all conducted with pastoralist communities in northern Kenya, and the findings are not generalizable to all areas in the 21

giraffe range countries where human communities live with giraffe. Results presented in this dissertation support that conservation strategies need to be designed with local context in mind, including which wildlife-related benefits are promoted, how illicit behaviors are monitored, and what drives intention to consume giraffe meat in a particular community. Based on the research approach and implementation outlined in this dissertation, future research can be designed with improved measurement in cross-cultural contexts.

Additional work is needed on the diverse influences that can drive behavior and motivate behavior change in community-based conservation settings. The research included in this dissertation described human-giraffe interactions and poaching-related threats among community conservancies in northern Kenya. Some chapters utilized constructs (i.e. attitudes, normative beliefs, perceived behavioral control) that have been conceptualized for use in different settings, and predominantly applied for research based in North America. Adaptation for use of these concepts in diverse global settings will require researchers to consider and pilot test how constructs are measured and how data are interpreted. In this dissertation, results in Chapter 2 were limited by the use of single item measurements and, for some variables, less refined scales. The 2019 questionnaire built from the 2016/17 instrument, and additional variables (e.g. perceived behavioral control) were measured on a 5-point scale and tested for validity and inter-item reliability.

Though the research in this dissertation provides initial insights into human-giraffe interactions, additional work in needed. Future research should be directed at improved understanding of the experiences with giraffe that shape how people view and act toward them, and the processes that underlie effective community-based conservation models and behavior change approaches. These efforts necessitate a qualitative approach to HDW research, which can

generate in-depth insights to human-giraffe interactions in community-based conservation settings. As part of the Twiga Walinzi program, upcoming HDW research will integrate qualitative methods to focus on why the decline in giraffe meat consumption has occurred since establishment of the program. The use of qualitative interviews will be most appropriate to understand the conditions, situational factors, and processes that are pertinent to behavior change related to giraffe poaching and part consumption. Specifically, the Twiga Walinzi will utilize General Elimination Methodology, as presented by Salazar et al. (2019), to evaluate the impacts of the Twiga Walinzi community engagement strategies and recent decline of giraffe meat consumption (Chapter 4). The findings can then be utilized to maintain lowered levels of giraffe use in Twiga Walinzi program areas and scale to adjacent communities, so that the area of protection for reticulated giraffe in northern Kenya is expanded.

6.3 Conclusions

To understand and plan for the complex issues that are embedded within wildlife conservation, it will be important to integrate a human dimensions approach into conservation programs. Findings from HDW work can highlight the ways in which people view wildlife and hold opinions on how conservation should operate. Incorporation of human dimensions research can aid giraffe conservation efforts by identifying which social factors are important for generating community support and reducing the threats that giraffe face. In order to reverse the recent trends of declining species populations, better understanding is needed of how people interact with reticulated giraffe and their willingness to protect the species. This is likely to become even more critical in the future, as land use and climate changes impact the habitat available to giraffe, and local populations are pushed in closer proximity to human settlements. Especially for the reticulated giraffe, protected areas do not provide enough habitat to sustain populations in

northern Kenya. Therefore, giraffe conservation on community-owned lands is needed. This dissertation project was in support of the Twiga Walinzi Initiative—a giraffe conservation program that aims to engage with pastoralist communities to protect reticulated giraffe on community lands. The research presented in this dissertation describes the attitudes, beliefs, and perceptions held about reticulated giraffe in northern Kenya. Further, it includes discussion about the factors most important to meeting conservation outcomes, including those related to conservation benefits within community-based conservation contexts and those that influence intention to consume giraffe meat.

This dissertation was structured to present the conservation challenge of declining giraffe populations and the lack of social research and associated strategies to help conserve these species. The research was outlined and discussed in terms of theoretical implications for the HDW field and applied implications for conservation efforts. The four manuscripts reflected key objectives of the dissertation, including baseline measurements and testing of the relationships between key human dimensions cognitions and assessing how such cognitions differ by level of connection with community-based conservation efforts. This research also quantified the levels of giraffe part usage and identified key determinants to giraffe consumption behavior. Each research project exemplified the importance of contextual factors when developing conservation programs, which also supports the need for applied HDW research as part of conservation planning. Advancement of the HDW field requires a broadened scope to understudied species and diverse global contexts. This expansion will improve how human-wildlife relationships are conceptualized and how HDW concepts are measured. Finally, it will heighten the relevance of HDW to conservation practice, and in turn, inform programs that account for social and ecological components of a system.

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APPENDIX A: QUESTIONNAIRE 2016/17 STUDY

The following items were entered onto QuickTap survey software for data collection on iPad tablets.

1A. For each of these animals, can you name the species and state how often do you see them in Namunyak/the Loisaba area? **[Show pictures]**

Species	**ID'd Species** [yes/no]	**Never**	**Few times a year**	**Few times a month**	**Few times a week or more**	**I don't know that animal**	**I don't know how often**
A. Dik-dik							
B. Elephant							
C. Vulture							
D. Giraffe							
E. Hyena							
F. Cheetah							
G. Leopard							
H. Grevy's zebra							
J. Plains zebra							
K. Lion							

1B. Which of these animals are your two **most** favorite? Please state why that animal is your most favorite. *Write animal and reason given in the spaces below.*

A.	
B.	

1C. Which of these animals are your two **least** favorite? Please state why that animal is your least favorite? *Write animal and reason given in the spaces below.*

A.	
B.	

2. To what extent do the following problems affect you? *Please tick one box in each row.*

Threat	**Not at all**	**A little**	**A lot**	**Don't know**
A. Drought				
B. Land degradation				
C. Animal or crop diseases				
D. Conflicts with wildlife				
E. Conflicts with local leaders				
F. Conflicts with government				
G. Conflicts with other tribes				
H. Access to grazing/ land				
J. Access to water				

K. Other				

3. Please rank the following options in order of which you receive the most benefits from, with 1 = greatest benefit and 4 = least benefit. *Give participants cards and ask them to sort from most benefit to least benefit.*

Livestock ____
Crops ____
Conservation ____
Tourism ____
Other ____ *(please state)*

4. Of the following livestock types, please tell me whether or not you own that livestock: *Please mark Yes or No.*

Cattle	Yes □	No □
Goats/sheep	Yes □	No □
Camels	Yes □	No □
Donkeys	Yes □	No □
Chickens	Yes □	No □
Pigs	Yes □	No □

Other *Please state*
None

5a. Ask respondent: Can you please name the areas in which you take your livestock to graze in the wet season? *Record area names:* _____

5b. Ask respondent: Can you please name the areas in which you take your livestock to graze in the dry season? *Record area names:* _____

6. I'm now going to read out some statements that relate to wildlife. I'd like you to indicate how much you agree or disagree, **as you feel in the present**. *Recite the scale (Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree) after reading the statement.*

	SD	D	N	A	SA
a. Eating wild meat in this community is healthier for you than farmed meat					
b. Wild animals in this community are used for medicinal purposes					
c. Wild meat in this community is an important part of my culture					
d. I would be happy if wild animal meat consumption was easy to find in this community					
e. This community would be better if wild animals remained in places far from human settlements					
f. I do not like that wild animals in Loisaba area are killed for meat/food for people					
g. Eating wild animal meat in Loisaba area is causing population declines in wildlife					
h. I like that there are wild animals in Loisaba area					
J. I feel a strong emotional bond with wild animals.					
K. It is possible to live in a world where people can coexist in harmony with wildlife					

7. There are two kinds of zebra that live in Kenya: the Plains zebra and the Grevy's zebra. How many different kinds of <u>giraffe</u> live in Kenya? _____

8. How many different kinds of giraffe live in Namunyak/the Loisaba area? _____

9. Which best describes your feelings towards giraffe that live in Namunyak/the Loisaba area? I'd like you to indicate how much you like or dislike. *Recite the scale (Strongly Dislike, Dislike, Neutral, Like, or Strongly Like) after reading the statement.*

10. How important is it for giraffe to live in Namunyak/the Loisaba area? *Tick one box (Not important, A little important, Very important)*

11. When you see giraffe, what are **<u>they</u>** most often doing? *Write in short answer below.*

_____

12A. *Ask respondent:* In which areas do you see giraffe most often at Namunyak/the Loisaba? *Record area names:*

_____

12B. *Ask respondent:* In which areas do you never see giraffe at Namunyak/the Loisaba? *Record area names:*

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13. Which time of the year are there more giraffe in Namunyak/the Loisaba area? *Write in short answer below.*

---

14. For each of the following, please tell me whether or not you receive that benefit from having giraffe in this community: *Ask each one and get Yes, No, or Don't Know responses*

	YES	NO
a. Money from tourists coming to see them		
b. Job in tourism/conservation		
c. I enjoy seeing them		
d. Meat or other parts of the giraffe		
e. Helps with crops		
f. Helps with livestock		
g. Helps with the working of the savanna		
h. Any other benefits from giraffe we have not said already? *Write in short answer below.*		

15. In the last 5 years, what has happened to the giraffe population in Namunyak/the Loisaba area?
(It has increased, It has decreased, It has stayed the same)

16. In the last 5 years, what has happened to the giraffe population across Kenya?
(It has increased, It has decreased, It has stayed the same)

17. In your opinion, do you think the number of giraffe in Namunyak/the Loisaba area should in 5 years:
(*They should not be here, Be reduced, Stay the same, Increase*)

18. When was the most recent time you used giraffe meat or other parts of giraffe?
(*Never, Within the last 12 months, Between 1-5 years ago, Between 6-10 years ago, More than 10 year ago*)

19. How often have you consumed giraffe parts or products in your life time?
(*Never, 1-10 times, 11-20 times, 21-30 times, more than 30 times*)

20a. Have you heard of giraffe being killed **by a human** in this community? (Yes/No)

20b. Have you heard of giraffe being killed **by a human** in Namunyak/the Loisaba area? (Yes/No)

20c. *If* yes, how long ago was the most recent one killed by a human in Namunyak/the Loisaba area:
(<1 month, 1-3 months ago, 4-12 months ago, Longer than a year ago)

20d. In what area(s)? Record place names below:

_____

20e. How was it/they killed by a human:
(*Gun, Snare, Spear, Poison, Other*)

21. Which best describes your feelings towards leopards living in Namunyak/the Loisaba area? I'd like you to indicate how much you like or dislike. *Recite the scale (Strongly Dislike, Dislike, Neutral, Like, or Strongly Like) after reading the statement.*

22. How important is it for leopards to live in Namunyak/the Loisaba area?
(*Not important at all, A little important, Very important*)

23a. In which areas do you see leopards most at Namunyak/the Loisaba*? Record area names:*

_____

23b. In which areas do you never see leopards at Namunyak/the Loisaba*? Record area names:*

_____

24. Which time of the year are there more leopards in Namunyak/the Loisaba area? *Write in short answer below.*

_____

25. For each of the following, please tell me whether or not you receive that benefit from having leopards in this community: *Ask each one and get Yes, No, or Don't Know responses*

	YES	**NO**
a. Money from tourists coming to see them		
b. Job in tourism/conservation		
c. I enjoy seeing them		
d. Leopard skins or other parts		
e. Kill predators of livestock		
f. Helps with the working of the savanna		
g. Any other benefits from leopards we have not said already? *Write in short answer below.*		

26a. Do leopards cause you any problems? (*Yes/No*)
26b. If yes, what is the **greatest** problem that they cause?

_____

27. In the last 5 years, what has happened to the leopard population in Namunyak/the Loisaba area?
(*It has increased, It has decreased, It has stayed the same*)

28. In your opinion, do you think the number of leopards in Namunyak/the Loisaba area in the next 5 years should:
(*They should not be here, Be reduced, Stay the same, Increase*)

29a. Do you see any value in lions? (*Yes/No*)
29b. If yes, in what way(s) do you consider lions valuable? Please list up to four reasons in order of importance, where 1 is the most significant value for you and 4 is the least significant value for you.

30. In your opinion, do you think the number of lions in Namunyak/the Loisaba area should in 5 years:
(*They should not be here, Be reduced, Stay the same, Increase*)

31. Please can you let me know the number of livestock you would be willing to lose to a lion in one month before you would think it acceptable for you or someone in your family to kill the lion.

a. Shoats			b. Cattle		
Before any livestock are killed	After killed [___] in one month	Never kill a lion	Before any livestock are killed	After killed [___] in one month	Never kill a lion
c. Please explain your answer:					

i. Sex of Respondent: (Male/Female)

ii. Respondent's Main Occupation: (Livestock herder/pastoralist, Crop farmer, Tourism worker, Business owner, Other employment)

iii. Were you born here or in a different community?
(Here, A different community)
iv. If so, where were you born?
v. Since when have you lived in this community?

vi. What is your age?

vii. What is your highest level of completed education?
(*None, Primary, Secondary, University*)

SECTION G: UCT

Before the interview, roll the dice.
-If it lands on green, use the green set of cards for the interview.
-If it lands on red, use the red set of cards for the interview.
-If it lands on the blank face, roll again until you get green or red.
At the beginning of the UCT section, input whether the green or red cards are being used. This is not a question to ask respondents.

Mark which set of cards are being used:
Green ⇒ ☐ Red ⇒ ☐

Then, proceed with:

I am going to use a game with cards to ask about activities that people do. The method ensures that your answers are completely anonymous. For each question, I will ask you to look at the list of things on them. I will then ask HOW MANY of these things you have done over the past 12 months. I don't want to know which ones, just how many.

UCT.1. I will start with a question on animal sightings to show you how the method works. Please Iook at the card. I want you to tell me how many of these animals you have seen in the last 12 months. Please do not tell me which ones you have seen, just the number.

0 1 2 3 4 5

UCT.2. The next card is about food. Please Iook at the card. I want you to tell me **how many** of these animals you or a member of your household has eaten **in the last 12 months**. Please do not tell me which ones.
0 1 2 3 4 5

UCT.3. The next card is about hunting. Please Iook at the card. I want you to tell me **how many** of these animals have been killed by people in this community **in the last 12 months**. Please do not tell me which ones.
0 1 2 3 4 5

UCT.4. The next question is about conflict. Please Iook at the card. I want you to tell me **how many** of these animals have caused problems in your village **in the last 12 months**. Please do not tell me which ones.
0 1 2 3 4 5

UCT.5. *Use the same card as in question UCT.4.* This last question is also about hunting. Please Iook at the card. I want you to tell me **how many** of these animals have been killed by people in this community **in the last 12 months**. Please do not tell me which ones.

0 1 2 3 4 5

SECTION H: RRT – Use of giraffe parts

TO BE READ BY THE INTERVIEWER TO THE PARTICIPANT. Interviewer directions are in *italics.*

Think of this like playing a game. To play this game, here are some dice (***show the dice and beaker to the participant***) and there are some rules to the game.

First of all, you must shake the dice in the cup before answering each question. Based on the color you roll, sometimes you **must** answer "yes", sometimes your answer **must** be "no" and sometimes you must answer **truthfully**. This makes your response secret and anonymous so I won't know if you are telling the truth. This means that your answers cannot be traced back to you.

The rules of the game are:

- shake the dice in the cup **before** I ask a question

- if the dice lands on a **red** spot, your answer is "**NO**" no matter what your real answer is

- if the dice lands on a **green** spot, your answer is "**YES**" no matter what your real answer is

- if the dice lands on a **blank face with no spot**, you must answer **truthfully**

-If your answer is "**yes**" (either if you get a green spot or you have to respond truthfully yes) hold up the **green** paddle

-If the answer is "**no**" (either if you get a red spot or you have to respond truthfully no) hold up the **red** paddle

Do **not** show your dice to anyone when you roll it. This will make sure that your truthful answers will be private.

Do you understand? Let's try a few questions first:

Tell the participant to shake their dice in the cup and look at what it landed on

A) Do you own a goat? (remember, hold up the green paddle for yes or the red paddle for no)
SHAKE THE DICE

B) Do you own a bike?
If the respondent is not understanding the game, review the instructions if needed. If they still do not understand, get them to ask the above questions to you. If they still do not understand, terminate the interview.

1. Do people in your community eat giraffe meat? Yes/No

2. Have you heard of giraffe being killed by people in Loisaba area **in the last 12 months**? Yes/No

3. Have you eaten giraffe meat in the last 12 months? Yes/No

4. Have you heard of leopards being killed by people in Loisaba area **in the last 12 months**? Yes/No

APPENDIX B: QUESTIONNAIRE 2019 STUDY

The following items were entered onto KoboToolbox for data collection on iPad tablets.

1. For each of these animals, can you name the species and state how often do you see them in Namunyak/the Loisaba area? **[Show pictures]**

Species	**Every day**	**Every week**	**Every month**	**Every year**	**Never**	**I don't know**
A. Elephant						
B. Giraffe						
C. Hyena						
D. Leopard						
E. Lion						

2a/b Which animal in the Namunyak area is your **most** favorite? Please state why that animal is your most favorite. *Write animal and reason given in the spaces below.*
Species _____ Reason_____

2c/d Which animal in the Namunyak area is your **least** favorite? Please state why that animal is your most favorite. *Write animal and reason given in the spaces below.*
Species _____ Reason_____

3 What are the top three challenges that affect you and your family the most?
Write response in open text box.

I'm now going to read out some statements that relate to wildlife. I'd like you to indicate how much you agree or disagree, **as you feel in the present**. *Recite the scale*

4a I receive benefits from keeping livestock.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

4b I receive benefits from keeping crops.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

4c I receive benefits from wildlife conservation efforts.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

5a There are two kinds of zebra that live in Kenya: the plains Zebra and the Grevy's zebra. How many different kinds of giraffe live in Kenya? *Enter number* _____

5b How many different kinds of giraffe live in Namunyak? *Enter number*

6 How abundant do you think giraffe are in this area?
Absent, Very rare, Rare, Common, Very common

8a Which best describes your feeling towards giraffe that live in Namunyak?
Strongly Dislike, Dislike, Neutral, Like, Strongly Like

8b I enjoy having giraffe live in this area.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

8c Having giraffe in this area is:
Very bad, Bad, Neutral, Good, Very good

8d I would be happy if no giraffe existed in this area.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

8e How important is it for giraffe to live in the Namunyak area?
Not important, A little important, Very important, I don't know

8f I feel a strong emotional bond with giraffe.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

9a It is possible for both livestock and giraffe to live together in this area.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

9b Tourists would still come to visit Namunyak if there were no giraffe here.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

10a I receive benefits from giraffe through money from tourists coming to see them.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

10b I receive benefits from giraffe through a job in tourism.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

10c I receive benefits from giraffe through a job in conservation.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

10d I received benefits from giraffe because I enjoy seeing them.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

10e I received benefits from giraffe meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

10f I received benefits from other parts of giraffe.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

10g I receive benefits from giraffe because they help with the working of the savannah.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

10h Any other benefits from giraffe that were not said yet?

If yes, enter response.

11 I believe that the giraffe in this area should remain protected.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

12a In the last 3 years, what has happened to the giraffe population in Namunyak?
Decreased a lot, Decreased a little, Stayed the same, Increased a little, Increased a lot

12a In the last 3 years, what has happened to the giraffe population across Kenya?
Decreased a lot, Decreased a little, Stayed the same, Increased a little, Increased a lot

13a How many giraffe do you believe currently live in Namunyak Conservancy? *Enter number*

13b Is this number of giraffe for you in this area:
Far Too Little, Too Little, About Right, Too Many, Far Too Many

13c Do you think the number of **giraffe** in the Namunyak area in the next 3 years should:
Decrease a lot, Decrease a little, Stay the same, Increase a little, Increase a lot

14 What is bad about having giraffe live nearby? *Enter text*

15a When was the most recent time you used giraffe meat?
Never, Within the last 12 months, Between 1-5 years ago, Between 6-10 years ago, More than 10 years ago

15b How often have you consumed giraffe meat in your lifetime?
Every day, Every week, Every month, Every year, Never, I don't know

16a When was the most recent time you used other parts of giraffe besides meat?
Never, Within the last 12 months, Between 1-5 years ago, Between 6-10 years ago, More than 10 years ago

16b How often have you used other parts of giraffe besides meat in your lifetime?
Every day, Every week, Every month, Every year, Never, I don't know

17 Have you heard of giraffe being killed by a human in this community? *Yes/No*

18a Have you heard of a giraffe being killed by a human in Namunyak? *Yes/No*

18b If yes, how long ago was the most recent one killed by a human in Namunyak?
<1 month ago, 1-3 months ago, 4-12 months ago, Longer than a year ago

18c In which area(s)? *Enter text*

18d How was it/they killed by a human?
Gun, Snare, Spear, Poison, I don't know, Other

19a It is possible to live in a world where people can coexist in harmony with wildlife.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

19b Wild meat is an important part of my culture.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

19c I don't like that giraffe in Namunyak are killed for meat for people.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

19d Eating giraffe meat in Namunyak is causing giraffe population declines.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20a I would be happy if a giraffe was killed so I could eat the meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20b A giraffe provides meat for my family.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20c Eating giraffe meat is good for my family.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20d Community elders would approve if I ate giraffe meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20e Behaving how the community elders expect me to is important to me.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20f Community elders eat giraffe meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20g Most of my community thinks that eating giraffe meat is acceptable.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20h People in my community eat giraffe meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20i Most of my community would disapprove if I ate giraffe meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20j It is easy for me to kill giraffe to get meat for eating.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20k The decision whether to eat giraffe meat is up to me.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20l Having giraffe live nearby makes it more likely for giraffe to be killed for meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree
20m Next time I have a chance, I will eat giraffe meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20n I plan to eat giraffe meat in the next 12 months.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

20p I want to eat giraffe meat.
Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree

21a Please indicate to what extent you trust or distrust the following groups of people when it comes to wildlife conservation:

21b School teachers
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

21c Close friends
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

21d Elders
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

21e Elected community leaders
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

21f Close family
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

21g Conservancy employees
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

21h Kenya Wildlife Service
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

21i International Conservation NGOs
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

22a Please indicate to what extent you trust or distrust the following information sources when it comes to wildlife conservation:

22b Facebook
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

22c What's App groups
Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust

22d Radio *Completely distrust, Distrust, Neither trust nor distrust, Trust, Completely Trust*

22e Other _____

These questions are about yourself so we can compare how representative our sample is to the population. Thank you.

D1 Which of these items do you have at home? *Mark all that apply*
Radio
Solar panel
Mobile phone
Computer/laptop
Motorbike
Car

D2 Sex of Respondent

D3 Respondent's Main Occupation
Livestock herder/pastoralist, Livestock broker – buys and sells, Crop farmer, Tourism worker, Business, Other

D4 Does most of your family's income come from:
Livestock sales, Subsitence from livestock, Tourism, Wildlife-related, Business

D5 Tribe

D6 Clan

D7 How many cattle does your family own? *None, 1-5, 6-10, 11-20, 21-50, 51-150, 151-300, 301+*

D8 How many donkeys? *None, 1-5, 6-10, 11-20, 21-50, 51+*

D9 How many shoats? *None, 1-5, 6-10, 11-20, 21-50, 51-150, 151-300, 301+*

D10 How many camels? *None, 1-5, 6-10, 11-20, 21-50, 51-150, 151+*

D11 How many chickens? *None, 1-5, 6-10, 11-20, 21-50, 51+*

D12 How long have you lived in this community?

D13 Total number of adults living in the household

D14 Total number of children living in the household

D15 What is your age?

D16 What is your age group? *Moran, junior elder, elder, senior elder, siankikin – young mamas, kidemi – mamas, ntasati – senior mamas*

D17 What is your highest level of completed education? *None, primary, secondary, university, post-grad*

"Thank you very much for your time today. Once we are done with interviews, we will share a summary with the community."
D19 Manyatta area

D20 End time

APPENDIX C: MATERIALS FOR SPECIALIZED QUESTIONING METHODS

#2	
Mbuzi (goat)	
Ng'ombe (cattle)	
Dikidiki (dik dik)	
Punda (zebra)	

Figure C.1. UCT Cards for the Control Group.

#2

Mbuzi
(goat)

Ng'ombe
(cattle)

Dikidiki
(dik dik)

Punda
(zebra)

Twiga
(giraffe)

Figure C.2. UCT Cards for the Treatment Group.

Figure C.3. Example Interview 1. Daniel Lenaipa (Twiga Walinzi – 2016) describing how to respond to RRT question using the response paddles, based on how the dice lands in the blue opaque cup.

Figure C.4. Example Interview 2. Community member receiving instructions on how to respond to the RRT question, using the red and green paddles, dice, and opaque cup. This photo was taken during a mock interview while the research team was being trained on interview techniques and protocols.

APPENDIX D: COMPARISON OF DEMOGRAPHIC PROFILES IN CHAPTER 4

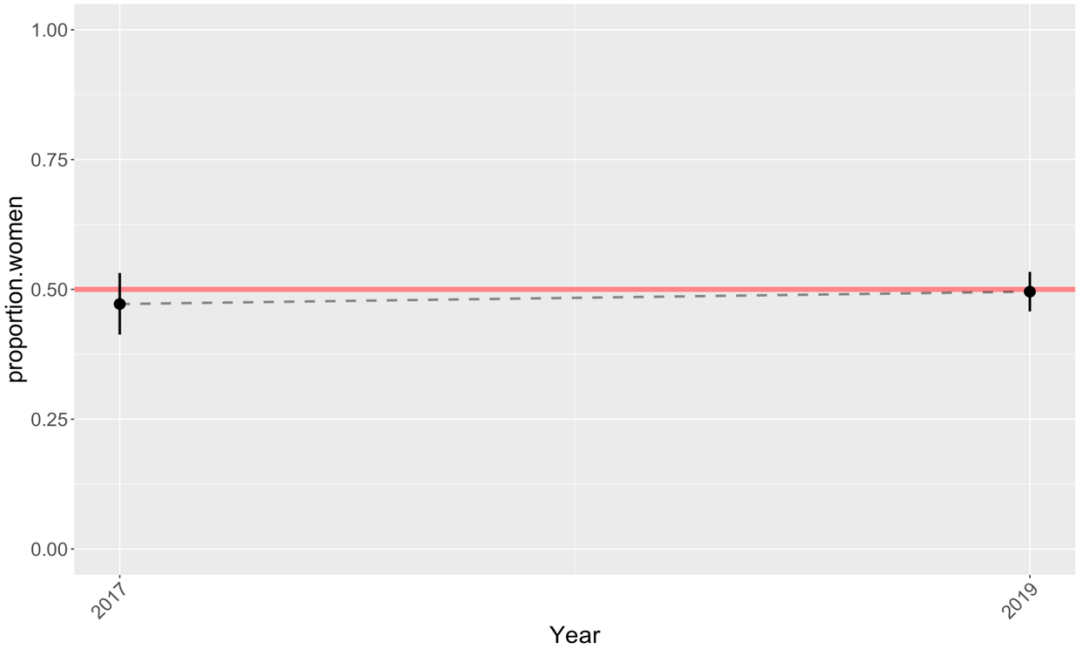

Figure D.1. Proportion of Female Respondents in 2016/17 and 2019.

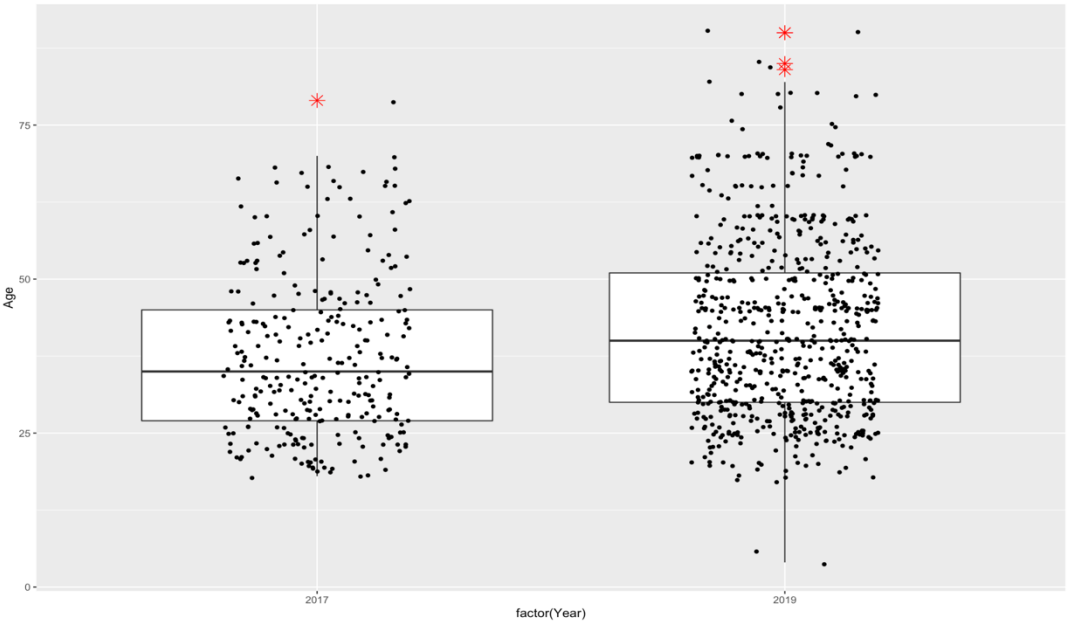

Figure D.2. Distribution of Age between the 2016/17 and 2019 Samples.

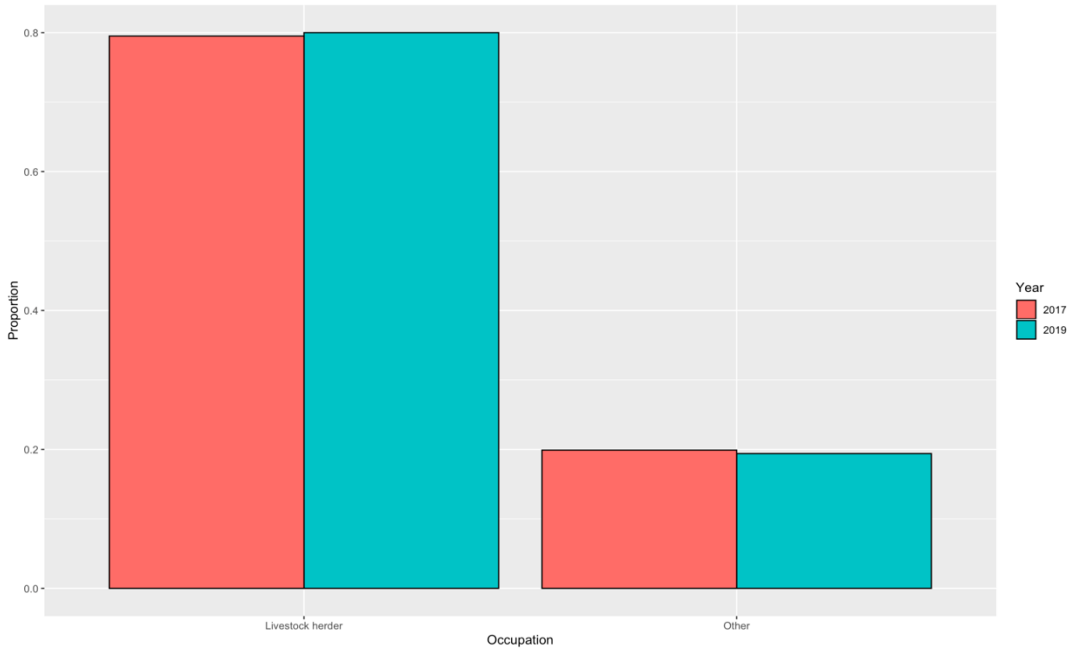

Figure D.3. Relative Frequency of Livestock Herder as Primary Occupation.

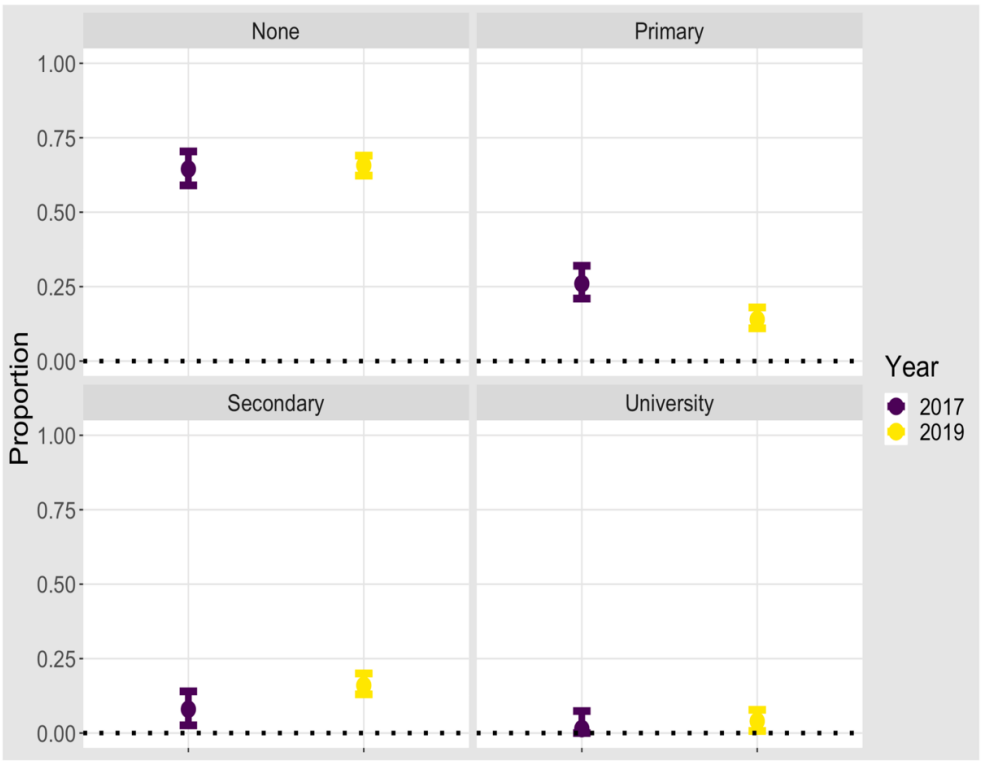

Figure D.4. Levels of Education. Proportion of highest completed levels of education in 2016/17 and 2019 samples.

BIOGRAPHY OF THE AUTHOR

Kirstie Ruppert was born in La Mesa, California in 1990 and raised in the San Diego area. She graduated from the Academy of Our Lady of Peace in 2008. She attended the University of California, Los Angeles where she received a B.S. in Environmental Sciences in 2012. After UCLA, she began work at the San Diego Zoo Institute for Conservation Research. Her first positions at SDZG supported informal conservation learning programs, including teacher professional development workshops and field trip experiences for middle and high school students. Since 2014, she has coordinated and facilitated graduate courses for the Advanced Inquiry Program at Miami University, Ohio, in partnership with SDZG, on environmental stewardship, conservation planning, and community-based conservation. In 2015, she completed a M.A. in Zoology through the Global Field Program at Miami University, Ohio. She then continued work at SDZG as a Researcher, leading the social science and community engagement components for their collaborations in Kenya. Since 2016, her focus has been on species conservation programs that promote coexistence between people and wildlife, including giraffe, leopards, and elephants. After receiving her doctoral degree, she will continue work at SDZG, providing social science capacity for species conservation programs and conservation action campaigns. She is a candidate for the Doctor of Philosophy degree in Ecology & Environmental Sciences from the University of Maine in May 2020.