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## ASSESSMENT OF LOCAL COMMUNITY KNOWLEDGE AND ATTITUDES TOWARDS THE CRITICALLY ENDANGERED MOUNTAIN BONGO IN MOUNT KENYA WILDLIFE CONSERVANCY AREAS

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### **ABSTRACT**

The study focused on assessing local community knowledge and attitudes towards Mountain Bongo (*Tragelaphus eurycerus isaaci*) in Mt Kenya Forest using a descriptive research design. It was conducted in the community neighboring Mount Kenya Wildlife Conservancy in March 2020. We used interview schedules to assess respondent's knowledge on the species habitat requirements, feeding habits, threats and conservation value of the animals within Mount Kenya. Colored photographs of the Mountain Bongo and 12 other selected mammals found in the region were used to assess respondent's ability to identify the animals and their knowledge on vernacular names of the animals. Interview results from a sample size of 142 informants were analyzed. The results showed that 71.8 % of the respondents could identify the mountain bongo but only 18.3% were aware of its vernacular name. Knowledge on habitat requirements, feeding habits, threats and conservation value differed significantly from what was expected ( $p < 0.05$ ). Based on logistic regression the knowledge could be predicted based on gender and age and whether one had a previous interaction with the animal. We found that 57% supported bongo conservation whereas 40.8% were undecided due to lack of knowledge about the animal. In addition, 27.5% liked mountain bongo because of attracting tourists, 12.0% felt that the antelope was attractive, 8.5% its size, 4.2% source of products such as bush meat, 4.2% aggressiveness and 0.7% its interesting behaviour. Support for conservation was associated with gender, age and knowledge of the animal. The bongo is well known but basic knowledge of the animal's ecology is limited. A pro-conservation attitude exists in the community, but utilitarian value attached to it and its habitat could be a constant threat to its conservation in the area.

**Keywords:** Knowledge, Endangered, Attitude, Community, Conservation

### **INTRODUCTION**

Biodiversity has numerous social, economic and ecological functions from which present and future humans could benefit. However, threats such as destruction of habitats (Chase et al., 2020), overexploitation of species (Rosser and Mainka, 2002), spread of invasive species [Shabani et al., 2020; Duenas et al., 2021], diseases (Morand, 2020) and climate change (Morelli et al., 2020; Maru et al., 2020) are prominently deflating these benefits. Since most of these threats are anthropogenic in nature, it is recommended to approach biodiversity conservation from a socio-ecological perspective (Maru et al., 2020; Morales-Reyes et al., 2019; Bennett et al., 2017). One of the scopes of socio-ecological perspective is the recognition of indigenous communities' knowledge on local flora and fauna (Lauer and Aswani; 2009; Reyes-García et al., 2019) which is crucial to conservation of biodiversity and ecosystems. Local community knowledge on threatened species has the potential to influence attitudes and behavior of the community towards wildlife (Zhang et al., 2020) which ultimately affects the effectiveness of conservation efforts (Afonso et al., 2020; 2020).

Interest on traditional knowledge about native flora and fauna has increased recently with realization that conservation of endangered species hinges on the support of local people (Etiendem et al., 2011). Appreciating their traditional systems of biodiversity conservation is therefore important. Information on indigenous knowledge systems including classification and naming of native plants and animals can provide valuable insights, observations, and interpretations relating to the state of the biological, physical, and spiritual environments [Lyver et al., 2018]. In wildlife conservation, the knowledge can also guide habitat restoration in order to prevent further loss of biodiversity and support species recovery (Reyes-García et al., 2019; Wilder et al., 2016). In addition, assessing

local people's knowledge on endangered species is important for the planning and implementation of environmental education programs, and addressing community based conservation issues which guarantees an effective engagement of local residents in conservation efforts (Stanturf et al., 2019; Echenique-Díaz et al., 2014).

Despite the need to promote and safeguard local ecological knowledge, there is emerging evidence that the knowledge is slowly being lost in most communities of the world (Wilder et al., 2016; Aswani et al., 2020; Harrison et al., 2020). This indigenous knowledge is mostly undocumented and therefore at risk of being lost to future generations (Kaya and Masoga, 2005). This loss can be demonstrated for instance when community members fails

to identify, describe and give cultural values of native flora and fauna. - Among the factors that have been suggested to cause this loss include gaps in human development (Zarger and Stepp, 2004; Godoy et al., 2005), limited economic opportunities for native people (Godoy et al., 2005), education systems that do not recognize traditional knowledge and culture (Harrison et al., 2020; Koster et al., 2016; Turi, 2016; Wester and Yongvanit 2005), limited land rights (Gray et al., 2008; Turner and Turner, 2008), urbanization (Aceituno-Mata et al., 2020), rural-urban migration of youth, passing on of elders, and lack of respect for traditional knowledge as a knowledge system (Echenique-Díaz et al., 2014; McCarter et al., 2014; Koster et al., 2016).

In our current study, the main interest was assessing the local community knowledge and attitudes towards Mountain Bongo in areas adjacent Mt Kenya Wildlife Conservancy and the Mt Kenya Forest. Presently, limited information is available about the status of Mountain bongo populations in the wild (Sandri 2020) despite being listed as critically endangered in the IUCN Red listing (IUCN SSC Antelope Specialist Group. 2017). Currently, there has been efforts to reintroduce the species in Mt Kenya Forest. However, recent studies have shown that the local communities engage in activities such as farming, grazing and hunting in the forest which is a threat to a released bongo population (Fundi 2020). Additionally, there are concerns about limited data on local community knowledge and perceptions about the species that can be used to identify specific threats and opportunities for engaging the native community in conserving the species.

According to Ali *et al.* (2020) the knowledge-attitude-behaviour framework can be used to gauge public knowledge and attitudes towards threatened species as well as the public's current actions and willingness to act in favour of conservation outcomes. Given that attitudes are a strong predictor of a person or group's intentions to behave in a particular manner (Fundi, 2020; Mohamad et al., 2020; Santori et al., 2021) such as complying with wildlife protection regulations, assessing attitudes and perceptions of humans toward wildlife provides insights on the degree to which people are willing to support conservation of wildlife (Ariya and Momanyi 2015). In the case of the Mountain Bongo, there is paucity of knowledge on local community awareness on the plight of the species and their attitudes towards its conservation. Given this background, the current study was undertaken to assess local community's basic ecological knowledge of the Bongo and gauge their attitudes towards the species in comparison with twelve other wildlife species found in the region. Our findings provide important new insights into the status of local community knowledge on the critically endangered bongo and their perception towards the species that can promote future conservation planning for the species in Mt. Kenya forest.

## **MATERIALS AND METHODS**

### **Study Area**

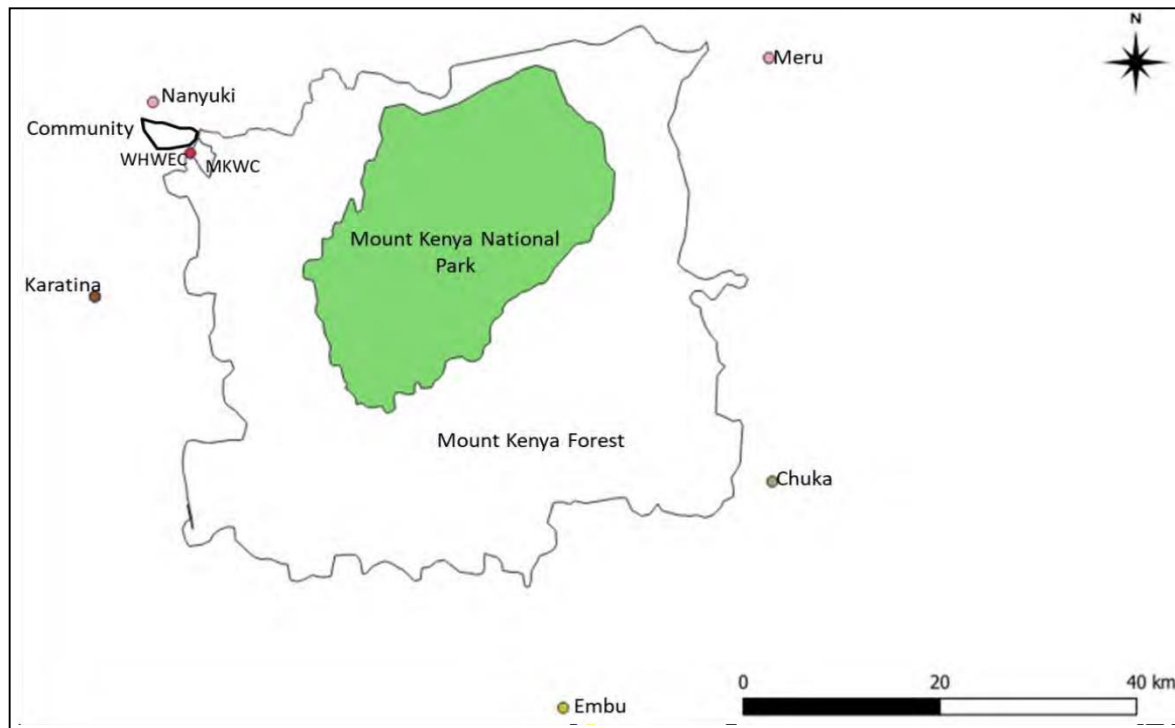
The data was collected in north western part of Mt Kenya Wildlife Conservancy (MKWC) at a location between latitude 0°2'1.77"S to 0°2'9.55"S and longitude 37°6'51.55"E to 37°6'24.70"E (Figure 1). The local communities (Canyons, Kwamwea and Kwahuku) in this area largely comprise of Kikuyu tribe and occupy land adjacent to MKWC, Mt Kenya Forest, and the William Holden Wildlife Education Center. Mount Kenya Wildlife Conservancy is a private enterprise and it offers a breeding facility for the Mountain Bongo and an animal orphanage offering refuge to different species of wild animals rescued from different parts of the country. The Mt Kenya Forest is managed by the Kenya Forest Service. In the year 2020, a bongo sanctuary was established in the forest with the aim reintroducing the mountain bongo for *in-situ* conservation. The William Holden Wildlife Education Center is located adjacent to the MKWC and it offers conservation education and training to the local community, learning institutions and visitors from around the country and beyond. The main economic activity of the residents is small scale holder farming. Some of the residents grow food crops within the forest based on Shamba System where they are allowed to grow crops in between growing rows of replanted tree plantations. The locals are also known to depend on the forest for grazing pasture, firewood and bush meat which are illegal activities.

### **Sampling**

We conducted a survey to collect information on sociodemographic characteristics of informants and their level of traditional ecological knowledge about the mountain bongo and 12 other species of wildlife found in the mountain region. These included lion, leopard, Black and white colobus, wildebeest, buffalo, waterbuck, hartebeest, eland, Impala, baboon, elephant, and common zebra. We targeted approximately 500 households in the area of less than 3 kilometers from the conservancy and forest boundary. Households were considered as sampling units and these were selected using systematic random sampling technique where one household was selected after every 3 households.

Only one participant (>15 years) in each of the selected households was interviewed. The interviews were conducted in a semi-structured manner with open-ended questions to encourage discussions. We used colored photos of the

animals to aid in identification. Generally, we sought information about whether the informant had a previous encounter with the real animal and whether the informant could tell the vernacular name of the animal, habitat of the animal, and then a general assessment of his or her attitude towards the animal.



**Figure 1: Map indicating the locations of Mount Kenya Forest, Mount Kenya Wildlife Conservancy (MKWC), William Holden Wildlife Education Center (WHWEC), surveyed community and the major towns around the mountain**

### Data Analysis

Data entry, coding and analyses was done using the Statistical Package for Social Sciences (SPSS). We used descriptive statistics of numerical variables and frequencies. Chi-square test for goodness of fit was used to test for differences between expected and observed frequencies of variables and Chi-square test for associations was used to test for association between the demographic characteristics of respondents and their knowledge and attitudes towards wildlife. Logistic regression was used to predict knowledge and attitudes towards wildlife species based on the demographic characteristics of the respondents. We used odds ratios (OR) to interpret the models.

## RESULTS

### Demographic characteristics of the respondents

Data from 142 informants were used for the analyses. Out of these, 51.4% (73) were females whereas males were 48.6% (69). The age categories were; below 18 years (36.6%, n=22), 18 to 35 years (31.7%, n=36.6%), 35 to 55 years (31.7%, n=45) and above 55 years (16.2%, n=23). The main economic activity for most of the respondents was farming (47.2%, n=67), those in formal employment were 10.6% (n=15), those in business were 23.9% (n=34) whereas 18.3% (n=26) were learners in schools and colleges. Most respondents had attained primary level of education (43.0%, n=61), whereas 37.3% (n=53) had secondary education, 12.0% (n=17) had college or university level and 7.7% (n=11) had not gone to school.

### Community knowledge on bongo

There was a significant difference in the numbers of respondents who could tell the vernacular names of the 13 common animal species found in the region ( $\chi^2 = 289.257$ ,  $df=12$ ,  $p=0.00$ ). Out of 142 informants, only 18.3% could tell the local name of the mountain bongo. Almost all the respondents (96.48%) could tell the local name of the African elephant (Table 1) but only 6% of the respondents could tell the local name of the wildebeest resident at the

conservancy. The ability to tell the vernacular name of a species was significantly correlated with ‘having seen’ the actual animal ( $r=0.619$ ,  $p=0.024$ ). As shown in Table 1, animals that most of the respondents had seen included baboon, the black and white colubus monkeys, buffaloes and the zebra. The results also showed that 71.8 % could relate mountain bongo to specific taxa. Out of these, 59.2% had a previous opportunity to see the actual animal. The respondents said they had come across the species at the Mt Kenya Wildlife Conservancy and none had seen bongo in the forest.

**Table 1. Assessment of community knowledge of vernacular animal names**

Common name	Scientific name	Vernacular name	Have ever seen the animal		Know the vernacular Name	
			Frequency	Percent	Frequency	Percent
Lion	<i>Panther leo</i>	Simba/Muruthi	41	29	83	58
Leopard	<i>Panther pardus</i>	Ngare	76	54	67	47
BWcolobus	<i>Colobus abyssinicus</i>	Thero/nguyo	97	68	96	68
Wildebeest	<i>Connochaetes taurinus</i>	Nyumbu/Ngunu	61	43	8	6
Buffalo	<i>Syncerous caffer</i>	Mbogo	95	67	99	70
Waterbuck	<i>Kobus ellipsiprymnus</i>	Koru	68	48	18	13
Hartebeest	<i>Alcelaphus buselaphus</i>	Thwariga	63	44	27	19
<b>MT bongo</b>	<i>Tragelaphus eurycerus</i>	<b>Ndongoro</b>	<b>84</b>	<b>59</b>	<b>26</b>	<b>18</b>
Eland	<i>Taurotragus oryx</i>	Thuruai	65	46	20	14
Impala	<i>Aepyceros melampus</i>	Thwariga ya weru	65	46	38	27
Baboon	<i>Papio anubis</i>	Ngima/Nugu	130	92	128	90
Elephant	<i>Loxodonta africana</i>	Njogu	87	61	137	96
Zebra	<i>Equus quagga</i>	Wamishore Wamiridu	90	63	69	49

We used logistic regression to understand whether knowledge on the local name of the Mt Bongo could be predicted based on gender, age and previous opportunity to see the animal (Table 2). The model test results showed that these variables significantly predicted the dependent variable (Wald  $\chi^2 = 30.155$ ,  $df=5$ ,  $p=0.00$ ). In the case of gender, men were 3.434 times more likely to know bongo’s local name. Increase in respondent’s age was associated with increasing odds of knowing the local name. Respondents who had previously seen the animal were also significantly more likely to know the local name; odd ratio was 0.064.

**Table 2: Logistic regression analysis of some predictors of the ability to know vernacular name of the bongo**

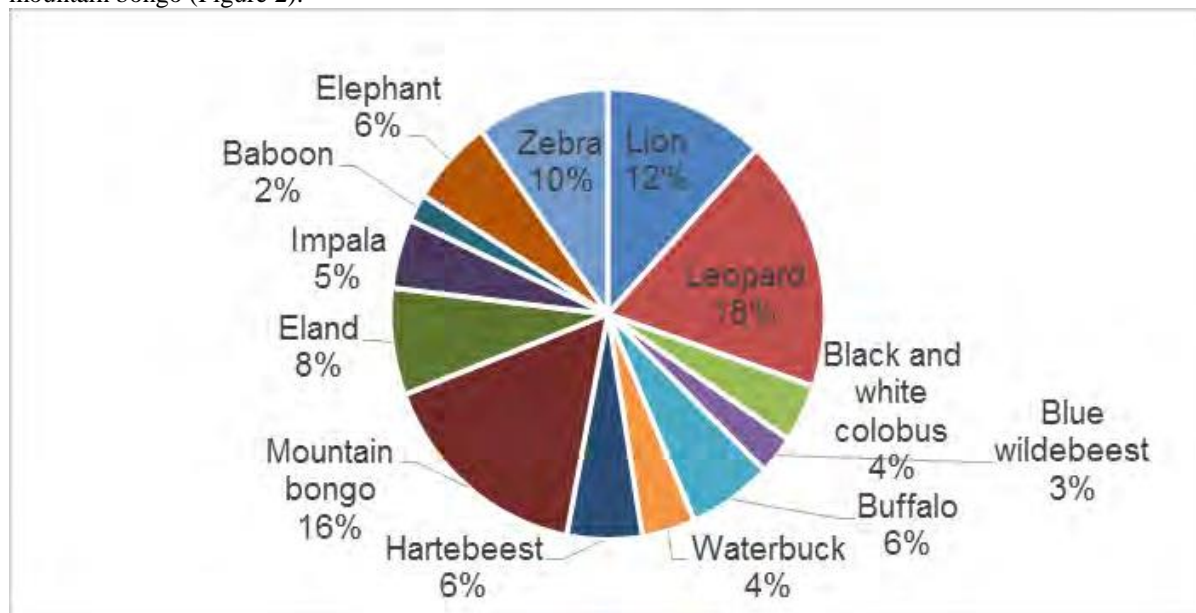
Independent variables (Reference category in brackets)	<i>B</i>	<i>S.E.</i>	<i>Wald</i>	<i>df</i>	<i>Sig.</i>	<i>Exp(B)</i> (Odds ratio)
Gender (Male)						
Female	1.234	.467	6.994	1	.008	3.434
Age (Over 56 years)			1.061	3	.787	
Below 18 years	.607	.924	.431	1	.511	1.834
18-35 years	-.083	.791	.011	1	.916	.920
36-55 years	.010	.802	.000	1	.990	1.010
Seen the animal previously (Yes)						
No	-2.756	.674	16.695	1	.000	.064
Constant	2.595	.844	9.466	1	.002	13.400

Generally, 76.8 % (109) respondents believed that the mountain bongo could only be found in Mt Kenya wildlife conservancy whereas 23.2 did not have any idea of where they can be found. The respondents differed significantly ( $\chi^2 = 249.620$ ,  $df=2$ ,  $p=0.000$ ) about the diet of the species. Fifty-three percent of the respondents believed that the mountain bongo fed on grass, 6% said that they fed on trees, whereas 41% had no idea. We found that the majority of the informants (53%) felt that the mountain bongo could be a source of bush meat while 20% didn’t see bongo as a bush meat source. Additionally, most of the respondents (57%) were not aware of any threats the mountain bongo population. However, thirty percent of those interviewed pointed hunting as the main threat to the survival of the mountain bongo while 11% cited climate change and 3% blamed translocation by the government.

**Table 3: Assessment of local community basic ecological knowledge of the Bongo**

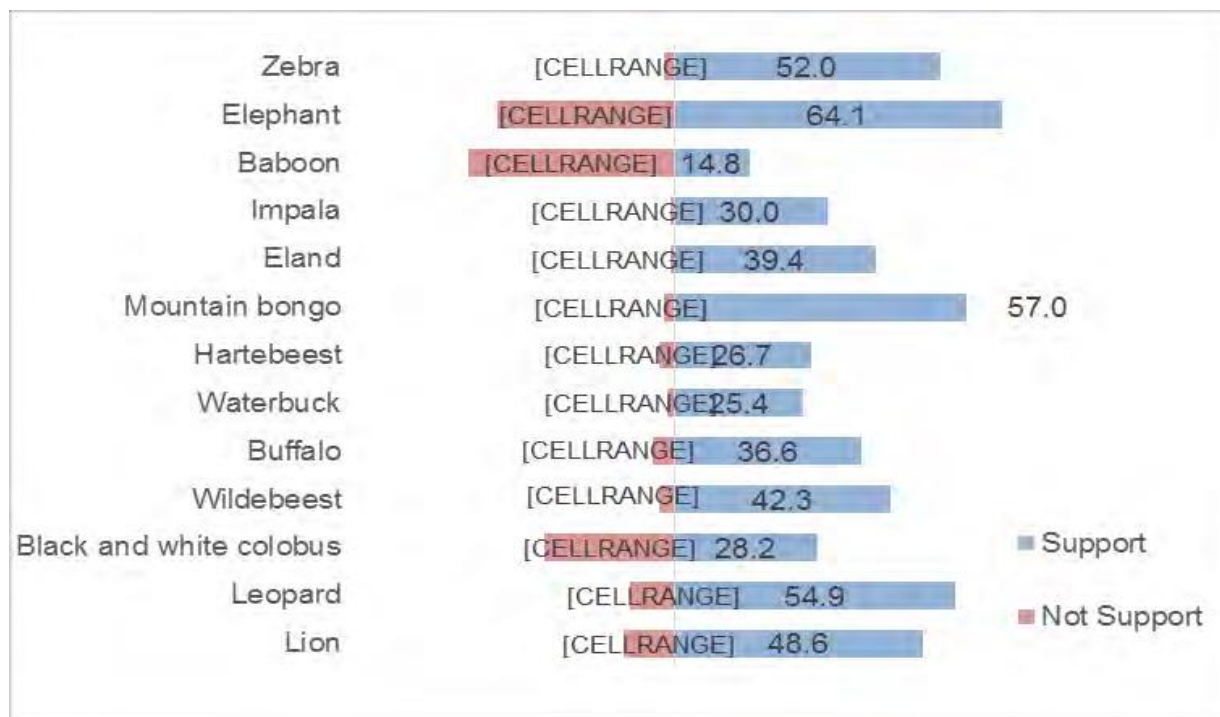
Question	Responses	Frequency	Percentage	X <sup>2</sup> statistic
1. Have you ever seen a live Bongo?	No	58	40.8%	4.761, df=1, p=0.029
	Yes	84	59.2%	
2. Have you ever seen or heard about the Bongo?	Yes	102	71.8%	27.070, df =1, p=0.000
	No	40	28.2%	
3. Where do you find Bongos?	Mt Kenya Wildlife Conservancy	109	76.8%	40.676, df=1, p=0.000
	I don't know	33	23.2%	
4. What do Bongos feed on?	Grass	75	52.8%	49.620, df=2, p=0.000
	Trees	9	6.3%	
	I don't know	58	40.8%	
5. What do you think is the biggest threat to survival of Bongos	Climate change	15	10.6%	99.296, df=3, p=0.000
	Hunting	42	29.6%	
	I don't know	81	57.0%	
6. Do you think people kill Bongos for meat?	Destruction of the forest	4	2.8%	27.099, df=2, p=0.000
	Yes	76	53.5%	
	No	28	19.7%	
	I don't know	38	26.8%	

On the preferred animal among the thirteen species presented, we found that the respondents differed significantly ( $\chi^2 =$ ,  $df =12$ ,  $p=.000$ ) with the majority of the respondents (18%) picking the leopard while 16% preferred the mountain bongo (Figure 2).



**Figure 2. Preference of bongo in comparison with other selected wildlife species around Mount Kenya Wildlife Conservancy**

A pro-conservation attitude towards the animals was observed (Figure 3). As for the mountain Bongo, 57.0% of the respondents would like the antelope to be conserved. The support for elephants (51.4%), lion (48.6%) and the leopards (40.0%) conservation was high. Comparatively, a higher proportion of the respondents did not support conservation of baboons (48.6%), the black and white colobus monkeys (40.0%) and also the elephant (34.5%). These animals were considered destructive (Table 4).



**Figure 3: Assessment of support for conservation of bongo in comparison with other selected wildlife species**

As summarized in table 4, the respondents differed significantly concerning their reasons for supporting conservation specific species of animal ( $\chi^2 = 38.0070$ ;  $df=4$ ,  $p=0.000$ ). Tourist attraction was the main reason for supporting most of the animals' conservation followed by the perception that the animal was charismatic. Those supporting bongo conservation (27.5%) felt that it was attracting international tourists in the area. In addition, 12.0% felt that the antelope was attractive to them, 8.5% its outstanding size, 4.2% source of meat, 4.2% aggressiveness and 0.7% interesting behaviour. A binary logistic regression was run to predict support for conservation of the mountain bongo based on gender, age and knowledge of the animal. These variables statistically significantly predicted support for conservation (Wald  $\chi^2 =28.030$ ,  $df=5$ ,  $p<0.001$ ) of a reintroduced population. The results showed that men were 4.418 times more likely to support conservation compared to women whereas those who had knowledge of the antelope were 9.389 times more likely to support conservation of the antelope (Table 5).

**Table 4: Summary of the main reasons given for supporting conservation of selected wildlife species**

	Support conservation and reasons							Don't support	UD
	Attract tourists	Pro	Attractive	Size	AB	IB	Total		
Lion	32(22.5)	0(0.0)	3(2.1)	17(12)	17(12.0)	0(0.0)	69(48.6)	14(9.9)	41.5
Leopard	30(21.1)	3(2.1)	26(18.3)	9(6.3)	10(7.0)	0(0.0)	78(40)	12(8.5)	36.6
BW colobus	8(5.6)	6(4.2)	19(13.4)	1(0.7)	1(0.7)	5(3.2)	40(28.2)	36(25.4)	46.5
Wildebeest	28(19.7)	1(0.7)	6(4.2)	11(7.7)	14(9.9)	0(0.0)	60(42.3)	4(2.8)	54.9
Buffalo	25(17.6)	3(2.1)	7(4.9)	9(6.3)	8(5.6)	0(0.0)	52(36.6)	6(4.2)	59.2
Waterbuck	27(19.0)	2(1.4)	5(3.2)	2(1.4)	0(0.0)	0(0.0)	36(25.4)	2(1.4)	73.2
Hartebeest	6(4.2)	2(1.4)	0(0.0)	7(4.9)	6(4.2)	0(0.0)	21(14.8)	4(2.8)	82.4
Bongo	42(29.6)	6(4.2)	17(12.0)	12(8.5)	6(4.2)	1(0.7)	84(59.2)	3(2.1)	40.8
Eland	27(19.0)	2(1.4)	7(4.9)	13(9.2)	7(4.9)	0(0.0)	56(39.4)	1(0.7)	59.9
Impala	6(4.2)	3(2.1)	21(14.8)	3(2.1)	1(0.7)	0(0.0)	34(23.9)	1(0.7)	88.0
Baboon	11(7.7)	0(0.0)	3(2.1)	4(2.8)	5(3.2)	6(4.2)	29(20.3)	57(40.1)	39.4
Elephant	29(20.4)	4(2.8)	4(2.8)	20(14.1)	16(11.3)	0(0.0)	73(51.4)	49(34.5)	14.1
Zebra	31(21.8)	9(6.3)	6(4.2)	7(4.9)	3(2.1)	2(1.4)	58(40.8)	3(2.1)	57.0

**Table 5: Logistic regression analysis of some predictors of local community attitudes towards conservation of the Mountain Bongo**

Independent variables (Reference category in brackets)	B	S.E.	Wald	df	Sig.	Exp(B) (Odds ratio)
Gender (Male)						
Female	1.122	.571	3.854	1	.050	3.070
Age (Over 56 years)	-	-	5.460	3	.141	-
Below 18 years	-2.201	1.311	2.819	1	.093	.111
18-35 years	-.068	.802	.007	1	.933	.935
36-55 years	-1.010	.877	1.326	1	.250	.364
Know the animal (Yes)						
No	2.240	.558	16.111	1	.000	9.389
Constant	-4.866	1.129	18.579	1	.000	.008

## DISCUSSION

Our findings suggest that the majority of the local community members have seen or heard about the mountain bongo. Though, a few individuals of mountain bongo are believed to occur in Mt Kenya Forest (Sandri 2020; Ali *et al.*, 2020; IUCN SSC Antelope Specialist Group, 2017) no encounters with wild bongos in the forest was reported in this study. The level of popularity of the selected 13 wildlife species varied significantly in the community. The ability to tell the vernacular name of animals was used as a first step to assess indigenous knowledge about local fauna. The results showed that some animal names were well known using the local dialect. Generally, this knowledge was significantly associated with previous encounters with the animal. However, despite that more than half of the respondents had seen the mountain bongo, only a few of them could tell its vernacular name. The results showed that knowledge about bongo could be predicted on the bases of gender, age and exposure to the animals. Men were more knowledgeable on the bongo compared to women, a pattern of knowledge distribution that is also seen for other species [Zhang *et al.*, 2020; Nyhus and Tilson 2003]. Level of education did not statistically correlate with the ability to tell the local name. This was not surprising given that local names are not used in the formal education system which means that those who had never gone to school could still know the names. This view is supported by the observation that the ability to tell the local name was significantly associated with increase in respondents' age. The aged had little or no formal education and were more likely to know the local name of the antelope. Traditional knowledge is deprioritized in favour of scientific knowledge and notions of rationality and practicality in many parts of the world (Turi (2016).

The study established that there were more people who could tell the vernacular names of the African elephant, buffalo and the lion despite revealing that they had never seen the real animals. This was due to a strong cultural attachment they have with these animals. In many cultures in the world certain animals are favoured by people because they are friendly (Liordos *et al.*, 2020) or useful or due to perceptions, beliefs, and experiences that societies have built around them over the years (Castillo-Huitrón *et al.*, 2020). Such animals would be widely known among the members of the community. In this study, the African elephant, buffalo and the lion are among the most respected animals in many African societies and are largely associated with aggression, courage and strength. These animals predominantly feature in traditional folklore, myths and beliefs of the local communities.

Generally, most of the informants believed that the mountain bongo is only found within the conservancy and none in the wild. This could be as a result of lack of opportunity to see bongos in any other place including the Mt Kenya Forest. In Kenya however, the subspecies has been described in Cherengani Hills, Londiani forest and crater, Mau highland forest, Aberdare mountain range, the mountain area of Ol Doniyo Eburru and Mt Kenya. Ali *et al.*, 2020; IUCN SSC Antelope Specialist Group, 2017; Kingdon 2015) where they are principally browsers (Wright *et al.*, 2011; Ralls, 1978; Estes *et al.*, 2011). In our study 41% of the respondents were unaware of the bongo diet pointing on the need of including feeding habits of the antelope in future outreach programmes. Additionally, most of the informants were not aware of any challenges to the conservation of bongos. The precise cause of the subspecies decline [from over 1000 to less than 100) in the wild is still uncertain, but the rapid human population growth, increased hunting pressure, habitat loss and epizootic events are likely causes (Estes *et al.*, 2011; Prettejohn, 2008; Lambrechts, 2003; Kock *et al.*, 1999). Informants however pointed Illegal hunting, climate change and translocation as the only threats to bongo population. Apparently, majority of the respondents believed that the bongos could serve as a source of meat and are suitable for hunting. This revelation is worrying given that hunting is believed to



be the primary cause for bongo population decline and local extinction in Kenya (Duporge *et al.*, 2020, Fundi, 2020 and could jeopardize reintroduction efforts.

We found that more than half of the informants had a pro-conservation attitude towards mountain bongo conservation. Although according to the results bongo conservation received greatest support compared to the other animals, it was surprising to find that a relatively high proportion of the respondents were undecided on whether to support its conservation or not. The attitude towards a species was strongly associated with perception of the benefits that could be derived from the animal such as the ability to attract tourists. Animals with attributes of charisma (aesthetic) and an attraction to tourists were found to be more liked. It has been established that animal's beauty was associated not only with the respondents' willingness to protect the species but also with its attributed dangerousness and usefulness (Landová *et al.*, 2018; Treves *et al.*, 1999). It is recognized that human societies have a long and complex relationship with wild animals, varying between appreciation, reverence, retaliation, utilization and acceptance (Manfredo *et al.*, 2020). The development of such cultural predisposition for emotional reactions toward wild animals is linked to either positive or negative effects depending on the species (York, 2017; Nabhan *et al.*, 19993). Understanding such attitudes is important in the management of the species since it could be used to predict intentions which in turn are predictors of actual behaviour (Manfredo *et al.*, 2020). The finding that bongos provide products such meat raises concern about the high value that the community attaches to bushmeat which could be a serious threat to restoration of bongos in the Mount Kenya Forest.

For the case of the mountain Bongo, almost two-thirds of the respondents showed a pro-conservation attitude and this was linked to the appreciation of the antelope as a tourist attraction and the perception that the animal was beautiful. Physical characteristics have been useful to classify animals depending on the emotions they produce on people (Landová *et al.*, 2018). For example, large charismatic species that have traditionally been regarded as dangerous but intelligent at the same time motivate emotions that may result in actions for their protection, as it has occurred for lions (*Panthera leo*) and leopards (*Panthera pardus*) (Landová *et al.*, 2018). In addition, we found that animals that were deemed as destructive such as baboons, the black and white colobus monkeys and also the elephant had the least support for conservation. Such attitudes towards wildlife are connected to individual and collective idiosyncrasies (Herzog *et al.*, 1988) that are correlated with emotions caused by a particular relationship with the animal Castillo-Huitrón *et al.*, 2020; Frynta *et al.*, 2013). The attitudes of a population can affect its tendencies toward eco-friendly behaviors and policies (Manfredo *et al.*, 2020).

Attitudes towards wildlife differ among individuals according to variables such as gender (Casaló and Escario 2018; Collado *et al.*, 2017) age, (Casaló and Escario, 2018), education level (Collado *et al.*, 2017 and individual's emotional state and affective responses (Bruskotter and Wilson, 2014). In our model, we found that men were more likely to support conservation of bongos compared to women. An increase in age was associated with increased odds for supporting conservation and those who had knowledge of the mountain bongo were more likely to support its conservation.

### **Conservation implications**

This study attempts to assess local community's knowledge of the critically endangered mountain bongo including their attitudes towards conservation of the subspecies. Findings from this study suggest existence of scarce ecological knowledge of the bongo in the community given that less than a quarter of the respondents could tell the vernacular name of the subspecies. It would be valuable to use vernacular name in addition to common and scientific names when creating awareness about a species. Understanding, acknowledging and promoting residents' knowledge and perceptions about wildlife is an important part of a process of engaging with them and building constructive relationships in support of conservation. Such awareness and education programs should address the low scores observed concerning basic knowledge about the antelope including its ecological requirements and threats. The findings also suggest the need to improve on understanding of the antelope especially among women and the young members of the community. The findings from this study revealed that mountain bongo is valued owing to the perception that it supports tourism in the area due to its charisma. This appreciation of bongo by the community could mean that a combined strategy aimed at improving local participation in bongo conservation initiatives (like establishment the Mountain Bongo Sanctuary), initiation of public education and awareness campaigns will boost bongo conservation in the region. In particular, the pro-conservation attitude towards conservation of bongo in the study area is encouraging but the overarching perception of the bongo as source of bushmeat raises concern about the potential of illegal hunting of the antelope.

## REFERENCES

- Aceituno-Mata, L., Tardío, J., & Pardo-de-Santayana, M. (2020). Persistence of flavor: Past and present use of wild food plants in Sierra Norte de Madrid, Spain. *Frontiers in Sustainable Food Systems*, 4, 271.
- Afonso, A. S., Roque, P., Fidelis, L., Veras, L., Conde, A., Maranhão, P., ... & Hazin, F. H. (2020). Does Lack of Knowledge Lead to Misperceptions? Disentangling the Factors Modulating Public Knowledge About and Perceptions Toward Sharks. *Frontiers in Marine Science*, 7, 663.
- Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation*, 241, 108224.
- Ali, L., Grey, E., Singh, D., Mohammed, A., Tripathi, V., Gobin, J., & Ramnarine, I. (2020). An evaluation of the public's Knowledge, Attitudes and Practices (KAP) in Trinidad and Tobago regarding sharks and shark consumption. *PloS one*, 15(6), e0234499.
- Ariya, G., & Momanyi, S. (2015). Assessing wildlife consumption awareness and the attitudes of the local Lambwe Valley community towards Ruma National Park, Kenya. *Journal of Tourism & Hospitality*, 4(3), 1-6.
- Aswani, S., Ferse, S. C., Stähler, M., & Chong-Montenegro, C. (2020). Detecting change in local ecological knowledge: An application of an index of taxonomic distinctness to an ethnoichthyological classification in the Solomon Islands. *Ecological Indicators*, 119, 106865.
- Bennett, N. J., Roth, R., Klain, S. C., Chan, K., Christie, P., Clark, D. A. & Wyborn, C. (2017). Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biological Conservation*, 205, 93-108.
- Bruskotter, J. T., & Wilson, R. S. (2014). Determining where the wild things will be: using psychological theory to find tolerance for large carnivores. *Conservation Letters*, 7(3), 158-165.
- Casaló, L. V., & Escario, J. J. (2018). Heterogeneity in the association between environmental attitudes and pro-environmental behavior: A multilevel regression approach. *Journal of Cleaner Production*, 175, 155-163.
- Castillo-Huitrón, N. M., Naranjo, E. J., Santos-Fita, D., & Estrada-Lugo, E. (2020). The importance of human emotions for wildlife conservation. *Frontiers in Psychology*, 11, 1277.
- Chase, J. M., Blowes, S. A., Knight, T. M., Gerstner, K., & May, F. (2020). Ecosystem decay exacerbates biodiversity loss with habitat loss. *Nature*, 584(7820), 238-243.
- Collado, S., Evans, G. & Sorrel, M. (2017). The role of parents and best friends in children's pro-environmentalism: Differences according to age and gender. *Journal of Environmental Psychology* 54:27-37.
- Duenas, M. A., Hemming, D. J., Roberts, A., & Diaz-Soltero, H. (2021). The threat of invasive species to IUCN-listed critically endangered species: A systematic review. *Global Ecology and Conservation*, e01476.
- Duporge, I., Hodgetts, T., Wang, T., & Macdonald, D. W. (2020). The spatial distribution of illegal hunting of terrestrial mammals in Sub-Saharan Africa: a systematic map. *Environmental Evidence*, 9(1), 1-14.
- Echenique-Díaz, L.M., Ohdachi, S., Kita, M., Begué-Quiala, G., Páez, R.B., Labañino, J.L.D., & SAITO, C. (2014). Assessing local people's knowledge of the endangered Cuban solenodon (*Solenodon cubanus*) in Alejandro de Humboldt National Park, Cuba. *環境教育研究紀要*, 16, 89-95.
- Frynta, D., Šimková, O., Lišková, S., & Landová, E. (2013). Mammalian collection on Noah's ark: the effects of beauty, brain and body size. *PloS one*, 8(5), e63110.
- Estes, L. D., Mwangi, A. G., Reillo, P. R., & Shugart, H. H. (2011). Predictive distribution modeling with enhanced remote sensing and multiple validation techniques to support mountain bongo antelope recovery. *Animal Conservation*, 14(5), 521-532.
- Etiendem, D. N., Hens, L., & Pereboom, Z. (2011). Traditional knowledge systems and the conservation of Cross River gorillas: A case study of Bechati, Fossimondi, Besali, Cameroon. *Ecology and Society*, 16(3).
- Fundi, P. (2020). Potential Opportunities and Threats to a Reintroduced Critically Endangered Mountain Bongo Population and Its Habitat at Mount Kenya Forest. *International Journal of Natural Resource Ecology and Management*, 5(3), 102.
- Godoy, R., Reyes-García, V., Byron, E., Leonard, W. R., & Vadez, V. (2005). The effect of market economies on the well-being of indigenous peoples and on their use of renewable natural resources. *Annu. Rev. Anthropol.*, 34, 121-138.
- Gray, M., Coates, J. and Bird, M.Y. eds., (2008). *Indigenous social work around the world: Towards culturally relevant education and practice*. Ash gate Publishing, Ltd.
- Harrison, H. L., Rybråten, S., & Aas, Ø. (2018). Hatching knowledge: a case study on the hybridization of local ecological knowledge and scientific knowledge in small-scale Atlantic salmon (*Salmo salar*) cultivation in Norway. *Human ecology*, 46(4), 449-459.
- Herzog Jr, H. A., & Burghardt, G. M. (1988). Attitudes toward animals: Origins and diversity. *Anthrozoös*, 1(4), 214-222.

- IUCN SSC Antelope Specialist Group. (2017). *Tragelaphus eurycerus ssp. isaaci*. The IUCN Red List of Threatened Species 2017: e. T22057A50197212. <http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T22057A50197212.en>
- Landová, E., Poláková, P., Rádlová, S., Janovcová, M., Bobek, M., & Frynta, D. (2018). Beauty ranking of mammalian species kept in the Prague Zoo: does beauty of animals increase the respondents' willingness to protect them? *The Science of Nature*, 105(11), 1-14.
- Lyver, P. O. B., Richardson, S. J., Gormley, A. M., Timoti, P., Jones, C. J., & Tahi, B. L. (2018). Complementarity of indigenous and western scientific approaches for monitoring forest state. *Ecological Applications*, 28(7), 1909-1923.
- Kaya, H. O., & Masoga, M. (2005). Balanced literacy: Enhancing the school curriculum through African indigenous knowledge system. *IKS Programme. North West University*.
- Kingdon, J. (2015). *The Kingdon field guide to African mammals*. Bloomsbury Publishing.
- Kock, R.A., Wambua, J.M., Mwanzia, J., Wamwayi, H., Ndungu, E.K., Barrett, T. & Rossiter, P.B. 1999. Rinderpest epidemic in wild ruminants in Kenya 1993-97. *Veterinary Record*, 145(10):275-283.
- Koster, J., Bruno, O., & Burns, J. L. (2016). Wisdom of the elders? Ethnobiological knowledge across the lifespan. *Current Anthropology*, 57(1), 113-121.
- Lambrechts, C., Woodley, B., Church, C., & Gachanja, M. (2003). Aerial survey of the destruction of the Aberdare Range forests. *Division of Early Warning and Assessment, UNEP*.
- Lauer, M., & Aswani, S. (2009). Indigenous ecological knowledge as situated practices: understanding fishers' knowledge in the western Solomon Islands. *American Anthropologist*, 111(3), 317-329.
- Liordos, V., Foutsas, E., & Kotsiotis, V. J. (2020). Differences in encounters, likeability and desirability of wildlife species among residents of a Greek city. *Science of The Total Environment*, 739, 139892.
- Manfredo, M. J., Urquiza-Haas, E. G., Carlos, A. W. D., Bruskotter, J. T., & Dietsch, A. M. (2020). How anthropomorphism is changing the social context of modern wildlife conservation. *Biological Conservation*, 241, 108297.
- Manfredo, M. J., Teel, T. L., Don Carlos, A. W., Sullivan, L., Bright, A. D., Dietsch, A. M., ... & Fulton, D. (2020). The changing sociocultural context of wildlife conservation. *Conservation Biology*, 34(6), 1549-1559.
- Maru, Y., Gebrekirstos, A., & Haile, G. (2020). Indigenous ways of environmental protection in Gedeo community, Southern Ethiopia: A socio-ecological perspective. *Cogent Food & Agriculture*, 6(1), 1766732.
- McCarter, J., Gavin, M. C., Baerleio, S., & Love, M. (2014). The challenges of maintaining indigenous ecological knowledge. *Ecology and Society*, 19(3).
- Mohamad, M. M., Rosli, D. I., Abdullah, N. H. L., Nusa, F. N. M., & Ahmad, A. (2020). STUDENT'S Reflection On Environmental Conservation: The level of knowledge, attitude, and behavior. *Journal of Critical Reviews*, 7(6), 334-337.
- Morales-Reyes, Z., Martín-López, B., Moleón, M., Mateo-Tomás, P., Olea, P. P., Arrondo, E., ... & Sánchez-Zapata, J. A. (2019). Shepherds' local knowledge and scientific data on the scavenging ecosystem service: Insights for conservation. *Ambio*, 48(1), 48-60.
- Morand, S. (2020). Emerging diseases, livestock expansion and biodiversity loss are positively related at global scale. *Biological Conservation*, 248, 108707.
- Morelli, T. L., Barrows, C. W., Ramirez, A. R., Cartwright, J. M., Ackerly, D. D., Eaves, T. D., ... & Thorne, J. H. (2020). Climate-change refugia: biodiversity in the slow lane. *Frontiers in Ecology and the Environment*, 18(5), 228-234.
- Nabhan, G. P., St Antoine, S., Kellert, S., & Wilson, E. (1993). The loss of floral and faunal story: The extinction of experience. *The biophilia hypothesis*, 229-250.
- Nyhus, P. J., & Tilson, R. (2003). Wildlife knowledge among migrants in southern Sumatra, Indonesia: implications for conservation. *Environmental conservation*, 30(2), 192-199.
- Prettejohn, M. (2008). On the trail of the Mountain Bongo. *Swara*, 31(1), 38-45.
- Reyes-García, V., Fernández-Llamazares, Á., McElwee, P., Molnár, Z., Öllerer, K., Wilson, S. J., & Brondizio, E. S. (2019). The contributions of Indigenous Peoples and local communities to ecological restoration. *Restoration Ecology*, 27(1), 3-8.
- Ralls, K. (1978). *Tragelaphus eurycerus*. *Mammalian species*. Rosser AM, Mainka SA. Overexploitation and species extinctions. *Conservation Biology*. 2002 Jun 1;16(3):584-6.
- Sandri, T. (2020). *Ecology and Conservation Genetics of the Endangered Mountain Bongo*. PhD Thesis Manchester Metropolitan University & North of England Zoological Society (Chester Zoo).

- Santori, C., Keith, R. J., Whittington, C. M., Thompson, M. B., Van Dyke, J. U., & Spencer, R. J. (2021). Changes in participant behaviour and attitudes are associated with knowledge and skills gained by using a turtle conservation citizen science app. *People and Nature*, 3(1), 66-76.
- Shabani, F., Ahmadi, M., Kumar, L., Solhjoui-fard, S., Tehrani, M. S., Shabani, F. & Esmaeili, A. (2020). Invasive weed species' threats to global biodiversity: Future scenarios of changes in the number of invasive species in a changing climate. *Ecological Indicators*, 116, 106436.
- Šorgo, A., Špur, N., & Škornik, S. (2016). Public attitudes and opinions as dimensions of efficient management with extensive meadows in Natura 2000 area. *Journal of Environmental Management*, 183, 637-646.
- Stanturf, J. A., Kleine, M., Mansourian, S., Parrotta, J., Madsen, P., Kant, P., ... & Bolte, A. (2019). Implementing forest landscape restoration under the Bonn Challenge: a systematic approach. *Annals of Forest Science*, 76(2), 1-21.
- Svengren, H., Prettejohn, M., Bunge, D., Fundi, P., & Björklund, M. (2017). Relatedness and genetic variation in wild and captive populations of Mountain Bongo in Kenya obtained from genome-wide single-nucleotide polymorphism (SNP) data. *Global ecology and conservation*, 11, 196-206.
- Treves, A., & Naughton-Treves, L. (1999). Risk and opportunity for humans coexisting with large carnivores. *Journal of human evolution*, 36(3), 275-282.
- Trew, B. T., & Maclean, I. M. (2021). Vulnerability of global biodiversity hotspots to climate change. *Global Ecology and Biogeography*, 30(4), 768-783.
- Turi, E. I. (2016). *State steering and traditional ecological knowledge in reindeer-herding governance: Cases from western Finnmark, Norway and Yamal, Russia* (PhD. Thesis, Umeå University).
- Turner, N. J., & Turner, K. L. (2008). Where our women used to get the food: Cumulative effects and loss of ethnobotanical knowledge and practice; case study from coastal British Columbia. *Botany*, 86(2), 103-115.
- Wester, L., & Yongvanit, S. (1995). Biological diversity and community lore in northeastern Thailand. *Journal of Ethnobiology*, 15, 71-88.
- Wilder, B. T., O'meara, C., Monti, L., & Nabhan, G. P. (2016). The importance of indigenous knowledge in curbing the loss of language and biodiversity. *BioScience*, 66(6), 499-509.
- Wright, D. J., Omed, H. M., Bishop, C. M., & Fidgett, A. L. (2011). Variations in Eastern bongo feeding practices in UK zoological collections. *Zoo Biology*, 30(2), 149-164.
- York, R., & Longo, S. B. (2017). Animals in the world: A materialist approach to sociological animal studies. *Journal of Sociology*, 53(1), 32-46.
- Zarger, R., & Stepp, J. (2004). Persistence of botanical knowledge among Tzeltal Maya children. *Current Anthropology*, 45(3), 413-418.
- Zhang, L., Guan, Z., Fei, H., Yan, L., Turvey, S. T., & Fan, P. (2020). Influence of traditional ecological knowledge on conservation of the skywalker hoolock gibbon (Hoolock tianxing) outside nature reserves. *Biological Conservation*, 241, 108267.