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A COMPARATIVE STUDY OF ETHIOPIAN WOLF INTERACTIONS WITH HUMANS, DOMESTIC DOGS AND LIVESTOCK IN ARSI MOUNTAINS AND SANETTI PLATEAU, SOUTH CENTRAL ETHIOPIA

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ABSTRACT: A comparative study on the Ethiopian wolf (*Canis simensis*) interactions with human and domestic animals in Arsi Mountains and Sanetti Plateau was carried out from August 2009 to July 2010. Factors that affect the Ethiopian wolf were investigated by direct observations on 15 transects on four wolf packs and by using a questionnaire survey. In the Chilalo-Galama range, 3762 and in the Sanetti Plateau, 890 livestock were sighted in the Ethiopian wolf habitats. The two study areas showed a marked difference (χ^2=38.09, df=1, P<0.05) in the number of livestock affecting the Ethiopian wolves. In the Chilalo-Galama range, nine domestic dogs shared the Ethiopian wolf habitat. In contrast, in the Sanetti Plateau, no domestic dog was observed in the Ethiopian wolf habitat. The two study areas significantly differed (χ^2=100, df=1, P<0.05) in the number of domestic dogs that affect the Ethiopian wolf. In the Chilalo-Galama area, 488 and in the Sanetti Plateau, five individuals were observed affecting the wolves while collecting firewood, grass and herding livestock. Therefore, regular patrolling, scent-marking and defending exclusive territories were not carried out by the Ethiopian wolves in the Chilalo-Galama compared to the Sanetti Plateau wolves.

Key words/phrases: Chilalo-Galama, Ethiopian wolf interactions, Human, Sanetti Plateau.

INTRODUCTION

The interaction between carnivores and humans severely affect their number (Brock, 1996; Johnson *et al*., 1996). The Ethiopian wolf used to occur at lower elevations before becoming subject to severe human persecution (Nowak, 1999). Until the 19th century, this animal lived in most parts of the country (Gottelli *et al*., 2004). At present, the species has become extinct from various parts of Ethiopia. According to Gottelli *et al*. (2004), the Ethiopian wolves are currently restricted to seven isolated populations in the high altitude ecosystem of the country. The population has declined and only fewer than 500 adult individuals exist (Hemson, 2009). Unlike other canids, the Ethiopian wolves have developed an extreme feeding specialization on high altitude rodents, with a narrow ecological range and

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high habitat specificity (Gottelli *et al*., 2004). The species typically forages and feeds on mole rats and grass rats. Rodents account for about 95% of the food of this species (Sillero-Zubiri and Gottelli, 1995; Ray *et al*., 2005).

The attitudes of local people towards the Ethiopian wolf are directly related to their farming and grazing needs (Ray *et al*., 2005; Wang, 2008). Extensive overgrazing by livestock has a significant impact on rodent populations. In the area where small number of rodent population occurs, wolves cannot survive (Stephens *et al*., 2001). People living in the Ethiopian wolf habitat frequently clear and burn the Afroalpine vegetation to grow cereal crops. They also collect firewood and grass and produce charcoal for sale from the wolf habitat. These lead to an increase in conflict between the wolf and humans (Stephens *et al*., 2001; Deresse Dejene, 2003; Mesele Yihune *et al*., 2009). Habitat loss and fragmentation also result in isolation of the wolf population, and increase the rate at which genetic variability is lost (Johnson *et al*., 1996). This has also enhanced the rate of contact of the wolf population with human and domestic animals including dogs. The recent introduction of domestic dogs by humans in the wolf habitat has resulted in the spread of rabies and canine distemper (Johnson *et al*., 1996; Laurenson *et al*., 1997; Evangelista *et al*., 2009). This has also increased the chance of interbreeding (Laurenson *et al*., 1997). The major objective of the study was to identify the effect of competition among humans, domestic animals and the Ethiopian wolves in different habitats to save the endangered species.

MATERIALS AND METHODS

Description of the study areas

Arsi Mountains

The Arsi Mountains of Chilalo and Galama range occur between 7°30' to 8°50'N and 39°20' to 39°35'E, in the central part of Arsi Administrative Zone of Oromia Regional State. Chilalo-Galama Mountain range is one of the Arsi highland massifs occurring at about 60 km east of the Rift Valley lakes and about 230 km southeast of Addis Ababa (Fig. 1).

Bale Mountains National Park

The Bale Mountains National Park (BMNP) is located between 6°29' and 7°10'N and 39°28' and 39°58'E. It is situated in the southeast highlands of the country in the Oromia Regional State about 450 km south of Addis Ababa (Fig. 2).

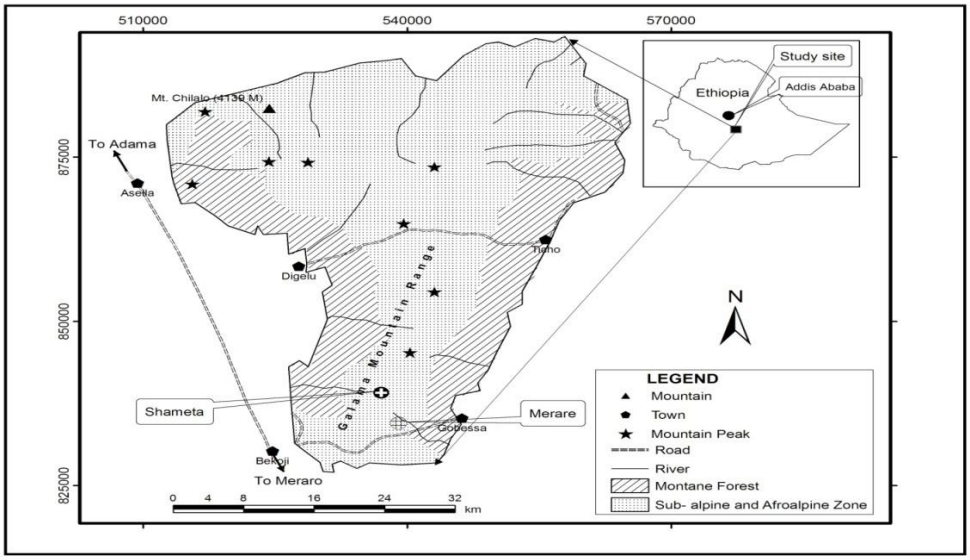

Fig. 1. Map of Chilalo-Galama Mountain range.

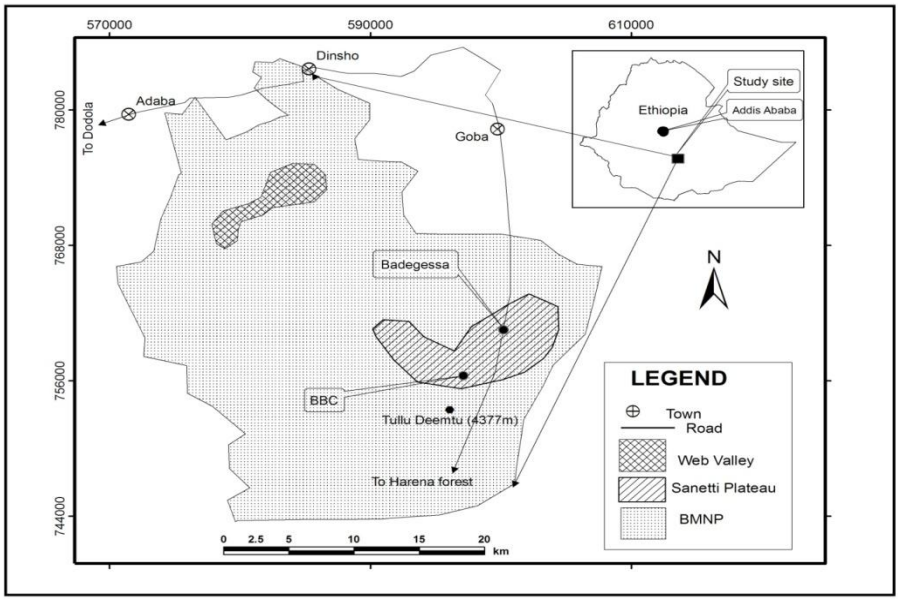

Fig. 2. Map showing Sanetti Plateau.

Methods

Direct observation

To assess the interaction of humans in the Ethiopian wolf habitats, distance sampling (Strip Transect Sampling) method was used (Buckland *et al*.,

1993; Ripple *et al*., 2001). This was carried out by walking along the track lines of a known length, which were set up randomly in straight line and marked using GPS. All observed Ethiopian wolves, humans, domestic dogs and livestock were recorded from distance "w" on either side of the centre of the track (Zerbini, 2006). Foraging, lying down and other behavioural activities of wolves were detected in the presence and absence of humans and livestock. The number and kind of observed animals that occurred within a maximum distance "w" on the left and right sides of the strip transect were distinguished using binoculars. A total of 15 transect lines ranging from 1.58 to 1.62 km length were covered on foot. The length of transect lines was designed for comparative purposes of disturbance to wolf by humans in both of the study areas. Nine transects were designed from Merare and Shameta wolf packs of Arsi Mountains and six from British Broadcast (BBC), the name given to the wolf pack and Badegessa of the Sanetti Plateau. The transect studies were repeated every month during both the wet and dry seasons. The track lines were located at more than 200 m apart to avoid double counting of individuals. Data were analyzed using ANOVA, Tukey test, Spearman correlation coefficient and chi-square test (SPSS version 17).

Questionnaire survey

A total of 59 people were interviewed from the two study areas. Out of them, 51 respondents were selected randomly from the Chilalo-Galama range. In the Sanetti Plateau, comprehensive (available) sampling was used. There were only few inhabitants and as a result only four males and four females were interviewed.

RESULTS

Direct observation

During wet and dry seasons, 334 and 74 individuals of livestock per transect, respectively, grazed in the Ethiopian wolf habitats of the Chilalo-Galama range. Similarly, during wet and dry seasons, 84 and 74 individuals of livestock per transect, respectively, foraged in the Sanetti Plateau. Thus, the two study areas were significantly different ($P<0.05$) in the number of livestock grazed per transect. The Tukey test during the wet season revealed a significant difference between the packs of the Ethiopian wolf between Merare and BBC, Merare and Badegessa, Shameta and BBC, and Shameta and Badegessa ($P<0.05$). But, there was no statistical difference between Merare and Shameta, and BBC and Badegessa. Merare pack carried more livestock while BBC carried the least (Table 1). On the other hand, the

analysis of Tukey test during the dry season confirmed a significant difference between Merare and Shameta only (P<0.05). During the dry season, more livestock were sighted in Merare and least in Shameta.

Table 1. Number of livestock that grazed in the Ethiopian wolf habitats.

Pack	Season	Number of livestock recorded on each transect					Total
		1	2	3	4	5	
Merare	W	473	266	341	211	454	1745
	D	126	98	115	69	201	609
Shameta	W	254	386	347	271	-	1258
	D	18	95	13	24	-	150
BBC	W	48	56	80	-	-	184
	D	62	49	70	-	-	181
Badegessa	W	109	106	45	-	-	260
	D	98	111	56	-	-	265
Ch-Ga	W	3003 (79. 82%)					
	D	759 (20. 18%)					
Sa. Pl	W	444 (49. 88%)					
	D	446 (50. 11%)					
Ch-GaT		3762 (80. 86%)					
Sa. PlT		890 (19. 13%)					

Ch-Ga=Chilalo-Galama Range, Ch-GaT=Chilalo-Galama Total, Sa. Pl=Sanetti Plateau, Sa. PlT=Sanetti Plateau Total, w=wet, d=dry.

In the Chilalo-Galama range, 3003 (79.82%) individual livestock grazed in the area during the wet season and 759 (20.18%) foraged during the dry season. There was a seasonal variation (χ^2=35.56, df=1, P<0.05) in the number of livestock grazed in the area. In the Sanetti Plateau, 444 (49.88%) and 446 (50.11%) livestock were sighted in the wolf habitat during the wet and dry seasons, respectively. There was no seasonal variation (χ^2=0.0006, df=1, P>0.05) in the number of livestock grazed in this wolf habitat. On the other hand, the two study areas showed a marked difference (χ^2=38.09, df=1, P<0.05) in the number of livestock affected the wolf.

In the Chilalo-Galama range, 6 (66.67%) and 3 (33.33%) domestic dogs shared the Ethiopian wolf habitat during the wet and dry seasons, respectively. In contrast, in the Sanetti Plateau, no domestic dog was observed in the Ethiopian wolf habitat. Therefore, the two study areas drastically differed (χ^2=100, df=1, P<0.05) in the number of domestic dogs present (Table 2).

Table 2. Number of domestic dogs recorded in the Ethiopian wolf habitats.

Site	Season	Number of domestic dogs recorded on each transect					Total
		1	2	3	4	5	
Merare	W	2	1	1	-	-	4
	D	2	-	1	-	-	3
Shameta	W	-	2	-	-		2
	D	-	-	-	-		-
BBC	W	-	-	-			-
	D	-	-	-			-
Badegessa	W	-	-	-			-
	D	-	-	-			-
Ch-Ga	W	6 (66. 67%)					
	D	3 (33. 33%)					
Sa.Pl	W	-					
	D	-					

The number of humans in the Chilalo-Galama range wolf habitat per transect during the wet and dry seasons was 28 and 26, respectively. In the Sanetti Plateau, the mean number of human presence per transect during the wet and dry seasons was 0.5 and 0.33, respectively. Therefore, the two study areas showed a marked difference ($P<0.05$) in the mean number of human presence per transect during both seasons. The Tukey test showed a statistical difference ($P<0.05$) between all multiple pairs of the wolf packs except between Merare and Shameta, and BBC and Badegessa (Table 3).

The number of people observed in the Ethiopian wolf habitat in the Chilalo-Galama range was not statistically different ($\chi^2=1.38$, df=1, $P>0.05$) during the wet and dry seasons. In the Sanetti Plateau also, there was no significant difference ($\chi^2=0.2$, df=1, $P>0.05$) in the number of people observed between seasons. However, the two study areas revealed a marked difference ($\chi^2=96.04$, df =1, $P<0.05$) in the number of people that shared the Ethiopian wolf habitats. In the Chilalo-Galama range, 488 people were observed in the Ethiopian wolf habitat during the wet and dry seasons. In contrast, only five people were observed in the Sanetti Plateau (Table 3).

Table 3. Number of people observed in the Ethiopian wolf habitats.

Site	Season	Number of people recorded on each transect					Total
		1	2	3	4	5	
Merare	Wet	36	43	23	25	33	160
	Dry	32	39	10	10	29	120
Shameta	Wet	27	25	15	29		96
	Dry	36	32	34	10		112
BBC	Wet	1	-	-			1
	Dry	-	-	-			-
Badegessa	Wet	-	2	-			2
	Dry	2	-	-			2

The Chilalo-Galama range and Sanetti Plateau wolves significantly differed in the mean time spent on foraging (χ^2=6.21, df=1, P<0. 05), lying (χ^2=5, df=1, P<0.05), walking (χ^2=5.3, df=1, P<0.05), standing (χ^2=4.5, df=1, P<0.05) and running (χ^2=5.4, df=1, P<0.05) during the presence of humans. The Ethiopian wolves spent more time in foraging, lying down and walking as a pack for food in the Sanetti Plateau than in the Chilalo-Galama range during the presence of humans. In contrast, they spent more time standing and running in the Chilalo-Galama range than in the Sanetti Plateau in the presence of humans (Fig. 3).

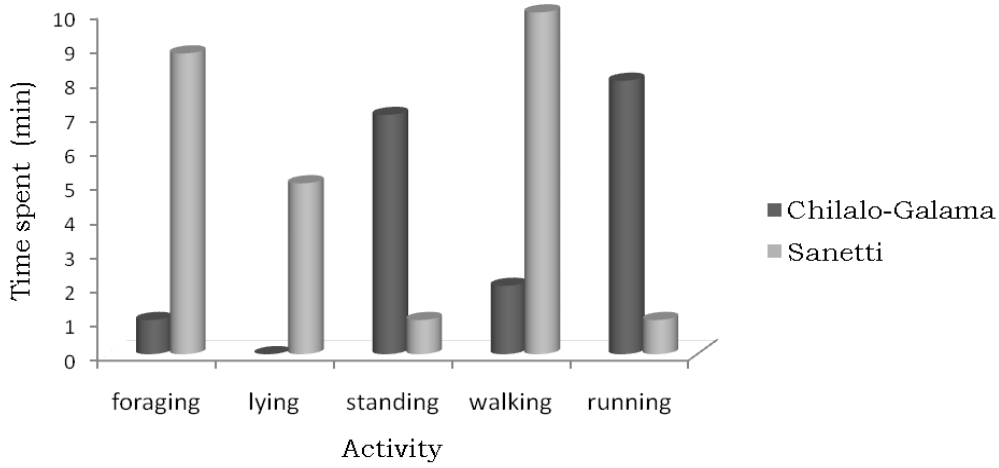

Fig. 3. Estimated mean length of time spent by the Ethiopian wolf for different activities during the presence of humans.

The Sanetti Plateau and the Chilalo-Galama range showed a marked statistical difference in the mean time spent for foraging (χ^2=5.3, df=1, P<0.05), lying (χ^2=4.9, df=1, P<0.05), standing (χ^2=4, df=1, P<0.05) and

walking (χ^2=6, df=1, P<0.05) by the Ethiopian wolf during the presence of livestock. They spent more time to forage, lie down and walk in the Sanetti Plateau than in the Chilalo-Galama range during the presence of livestock. However, the wolves used more time standing in the Chilalo-Galama range than in the Sanetti Plateau during the presence of livestock. On the other hand, the two study areas revealed no significant difference in the mean time spent running (χ^2=1.53, df=1, P>0.05) by the Ethiopian wolf during the presence of livestock (Fig. 4).

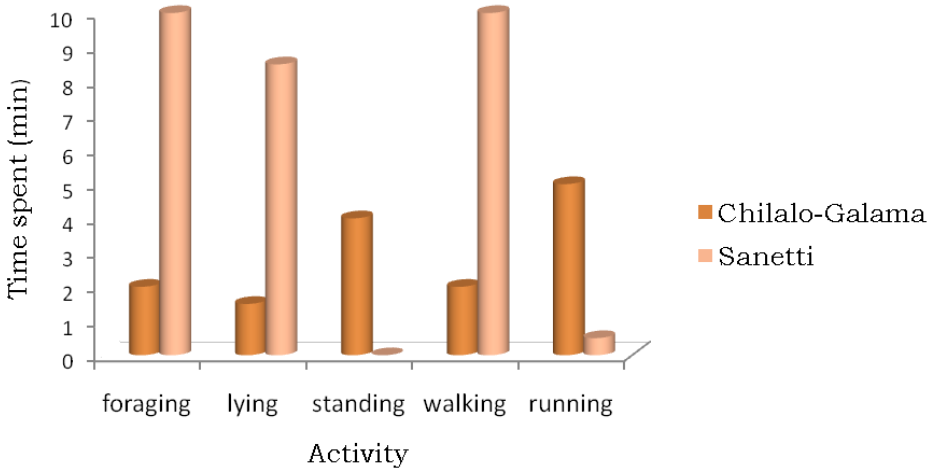

Fig. 4. Estimated mean length of time spent by the Ethiopian wolf for different activities during the presence of livestock.

Questionnaire survey

In the Chilalo-Galama range, 68.6% and in the Sanetti Plateau, 25% of the respondents confirmed that the number of Ethiopian wolf has declined severely. In contrast, 62.5% of the Sanetti Plateau and 5.8% of the Chilalo-Galama range respondents revealed that the population of the wolf has increased. Therefore, the views of the respondents in the study areas differed statistically (χ^2=38.75, df=3, P<0.05) on the current status of the trend of Ethiopian wolf population (Table 4). Respondents whose livestock were not attacked by the Ethiopian wolf had positive attitude whereas those whose livestock were attacked by the wolf had negative attitude. Similarly, 62.7% and 100% of the respondents from Chilalo-Galama range and Sanetti Plateau, respectively, had positive attitude towards the Ethiopian wolf. Hence, the views of respondents in the study areas differed statistically (χ^2=22.92, df=1, P<0.05) in the attitude towards the Ethiopian wolf.

Table 4. Views of respondents on the current status of the Ethiopian wolf population.

Study area	No.	Increase	Decrease	No change	Do not know	Total
Chilalo-Galama	51	5.8%	68.6%	15.6%	9.8%	99.8%
Sanetti Plateau	8	62.5%	25%	12.5%	-	100%

DISCUSSION

High number of livestock disturbance in the habitat of the Ethiopian wolf was sighted in Chilalo-Galama range and less number in the Sanetti Plateau. This might be due to the large number of livestock and people encroaching around the Chilalo-Galama range for grazing. Malcolm and Sillero-Zubiri (1997) also observed that the whole area of the Chilalo-Galama range of the Ethiopian wolf habitat was grazed by livestock. On the other hand, Stephens *et al*. (2001) observed human settlement and livestock in the Sanetti Plateau. In both study areas, livestock were sighted for long periods sharing the areas with wolves. Long grazing duration of livestock in the study areas has a significant impact on foraging and reproductive behaviour of the Ethiopian wolf (Tallents, 2007).

The loss of Afroalpine ecosystem has increasingly fragmented the remaining Ethiopian wolf habitat (Sillero-Zubiri *et al*., 1999). People living in and around the Afroalpine ecosystem have altered the vegetation and wildlife structure of the area. In the Chilalo-Galama range, people were increasingly observed damaging the wolf habitat. Wolves were disturbed by humans when they cut grass, collect firewood, produce charcoal and farm in the area. The animals were also disturbed by human noise in their territory. Sometimes wolves were affected by individuals, either deliberately chasing the animals to harm them or for fun. During the presence of humans, wolves were hindered to carry out their normal behaviour. Diurnal activity of the wolf was altered to partly nocturnal behaviour because of the serious human interaction. Even if disturbances slowed down during early morning and late afternoon hours, wolves were not able to find their prey because of the diurnal activity of the prey.

The most important threat to the Ethiopian wolf population is from domestic dogs (Haydon *et al*., 2006; Evangelista *et al*., 2009). In the present study area, domestic dogs were observed sharing the Ethiopian wolf habitat. Marino (2003) observed no interaction of wolf and domestic dog in the Chilalo-Galama range. During the present study, domestic dogs were documented from Merare and Shameta Ethiopian wolf packs of Chilalo-Galama range and none from Sanetti Plateau. The aim of keeping dogs was

to protect their livestock from hyaena in the Chilalo-Galama range.

It was observed that the Ethiopian wolf spent more time foraging in the Sanetti Plateau than in the Chilalo-Galama range during the presence of humans. In the Sanetti Plateau, wolves preyed on rodents with little attention in the presence of humans. The interaction between humans and wildlife can have harmful effects on the survival of a species (Zelealem Tefera *et al*., 2005). Adequate feeding resource and time determine the reproductive success and litter size of the Ethiopian wolves (Tallents, 2007). During the breeding season, the Ethiopian wolves gave birth in BBC and Badegessa packs of the Sanetti Plateau. But, in the Chilalo-Galama range, breeding season of the Ethiopian wolves was not observed during the present study period.

In the Chilalo-Galama range, wolves were alert in the presence of humans. In contrast, in the Sanetti Plateau, the Ethiopian wolves lied down in their habitats even in the presence of humans. In this area, it is usual to see the species lying down in the morning, mid-day and afternoon hours. During the present study, in the Sanetti Plateau, wolves were observed walking through their territory in the presence of humans to defend and scent-mark their territories. In the Sanetti Plateau, the maximum measure that wolves showed in the presence of humans was alarm call (Zelealem Tefera *et al*., 2005). In the Chilalo-Galama range, wolves walked through their territory for a very short period and were not observed scent-marking, patrolling and defending their exclusive territory regularly. The Ethiopian wolves often stand and make alarm calls at the sight of humans and unfamiliar things (Newey and Sillero-Zubiri, 2002). During the present study, they were observed standing repeatedly for a definite period of time in the Chilalo-Galama range. At high disturbance, wolves were observed running throughout their habitat in the Chilalo-Galama range. On the other hand, in the Sanetti Plateau, wolves were mostly running away in the presence of humans.

The variation in the attitude of people interviewed might be due to the increased encroachment of people and livestock during the current study. The result of the present study showed that the Sanetti Plateau residents had more positive attitude towards the Ethiopian wolf than the Chilalo-Galama range. This could be due to the local acceptance of the animal in BMNP.

The current situation of the Ethiopian wolf population is worse in the Chilalo-Galama range than in the past. During the preliminary visit to the Chilalo-Galama range, only 23 wolves were observed. Similarly, respondents in the Chilalo-Galama range revealed that the number of wolves

has declined in the area. In contrast to this, most of the Sanetti Plateau respondents confirmed that the wolf population has increased in the recent past. During direct observation, the largest Ethiopian wolf pack size observed in the Chilalo-Galama range was four. Marino (2003) observed the largest Ethiopian wolf pack size of nine in the Chilalo-Galama range. In the present study in the Sanetti Plateau, the two packs hosted larger number of the Ethiopian wolves than the Chilalo-Galama range. The large pack size count of the Ethiopian wolves in the Sanetti Plateau could be due to a relatively low disturbance and more abundance of prey (Sillero-Zubiri *et al*., 1995).

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