Asian Journal of Applied Science and Technology (AJAST)
(Open Access Quarterly International Journal) Volume 1, Issue 9, Pages 481-495, 2017

Abundance and Distribution of Lesser Kudu (*Tragelaphus imberbis*, Blyth, 1869) in Tululujia Wildlife Reserve, Southwestern Ethiopia

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Article Received: 30 August 2017 *Article Accepted: 29 November 2017* *Article Published: 27 December 2017*

ABSTRACT

Lesser Kudu is commonly distributed in forest and bush-land habitats of eastern and southern lowlands of Ethiopia. However, their numbers are declining much of its previous range, due to illegal hunting and habitat distraction. Even though, the species occur in study area, inadequate information about Lesser Kudu population. This study was aim to assess abundance and distribution of Lesser Kudu in study area. The study was carried out in stratified study area, forest and wooded grassland habitat types based on land cover feature. The transect line sampling method, that was laid in random fashion in each habitat types were used. The estimated population size of Lesser Kudu was 573 individuals in the study site. The population size was higher during wet season than dry season due to birth calves of Lesser Kudu during wet season. Generally, the distribution in the forest habitat (125±4.97SE) was significantly higher than wooded grassland habitat (105±4.83SE). There was 0.99±0.05SE Lesser Kudu per square km in the study area. The populations of Lesser Kudus were composed of 55.47% of females, 30.11% of males and 14.42% of juveniles in the area. This finding revealed that, a need of further study and conservation measures in study area.

Keywords: Distribution, Forest, Lesser Kudu, Population Size, Tululujia Wildlife Reserve and Wooded Grassland.

1. INTRODUCTION

The wide variety of habitats in Ethiopia, from arid desert, open grassland, and semi-arid savannas to highland forests and Afro-alpine moorlands, supports an exceptionally diverse antelope species [33], [10], [27]. The majority of the wildlife species exist in the mountain extremes of the Semen Mountains and Bale Mountains, and the arid lowlands of the rift valley [33].

Lesser Kudu occurs in forest and bush lands of Ethiopia throughout most of its former range in the eastern and southern lowlands. Its shyness and preference for thick cover enable it to survive considerable hunting pressure. It is found in protected area of the Ethiopia, such as Mago and Geraille National Parks, Chew Bahar, Tama and Alledeghi Wildlife Reserves, Babille and Yabelo Wildlife Sanctuaries, Borana and Murule Controlled Hunting Areas [10], [11]. It is relatively plentiful throughout the Ogaden area in dense bush land, despite widespread, uncontrolled hunting by local people [11], [8]. It also inhabits in large numbers in the southern part of the Awash River valley and in the southern lowlands. Lesser Kudu is abundant throughout all of the bush land areas of Omo National Park even though suffering from poaching along the Omo River and in the southern region of the park [11], [18].

The total population of Lesser Kudus in Ethiopia is more than 14, 640, out of this 5,770 are found in protected areas where as 8,870 are found in other land use types (i.e. 60.59% of population exist out of protected areas and 39.41% in protected area). An average density of Lesser Kudu is 1.0 per square km where the Lesser Kudu is known to be common and 0.05 per square km elsewhere [11]. Although the species has been able to persist in the face of poaching, the numbers are gradually declining over extensive areas of its range due to human settlement [18]. There is long-term population declining, due to illegal hunting and habitat destruction within its remaining range. Its status may eventually decline to threatened species [11], [18], [19].

The settlement programs and agricultural expansion undertake in, around wildlife conservation areas and forest reserved areas pose serious threats to forest and wildlife conservation in Guraferda district [9]. Despite the concern over the species decline, illegal hunting is still performing in Tululujia Wildlife Reserve [2]. Currently, there is inadequate information about Lesser Kudu population abundance and its distribution, consequently little conservation attention. In addition, no any study has been done regarding to Lesser Kudu population condition in Tululujia Wildlife Reserve.

Therefore, this study is indispensable to contribute to filling the gap dealing with abundance and distribution of Lesser Kudu population. It is relevant to develop wildlife management plan and to undertake conservation measures in the area. It also provides baseline information that would lay a foundation for future related research on this species.

This study was aims to 1) to estimate the population size and density of Lesser Kudu in the study area; 2) to identify the distribution of Lesser Kudu in different habitat types of the study area, and 3) to describe the population structure (sex and age categories) of Lesser Kudu in the study area.

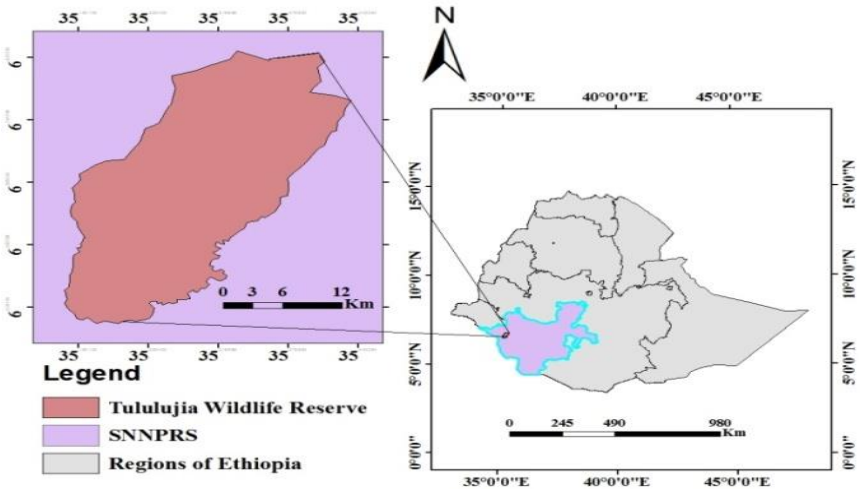

Fig. 1: Location map of study area

2. MATERIALS AND METHODS

2.1 Description of the Study Area

Tululujia Wildlife Reserve is located in Guraferda district, Bench Maji Zone, Southern Nation, Nationalities, Peoples' Regional State (SNNPRS). It is found at about 606 km and 45 km far from Southwest of Addis Ababa and Mizan Teferi town respectively. It is located between $6^0$49'33"-$6^0$51'06" N latitude and $35^0$07'03"-$35^0$25'02" E longitude(Fig.1). It is found an altitude range of 900 to 2000 m a.s.l [13].

Southwestern part of Ethiopia is the wettest for eight rainy months that extend from April to December. The dry seasons starts from December to March [9]. The annual rainfall ranges from1601-2000 mm. The mean annual minimum and maximum temperatures of the area are 20 and 29^{o}C respectively [16].

2.2 Methodology

2.2.1 Sampling Design and Sampling Techniques

A research design was established based on the reconnaissance survey, which was carried out before the commencement of the actual data collection. The study site was stratified in into two habitats types; forest and wooded grassland based on land cover features [29], [21]. Transects lines were placed on the stratified habitat types in a random fashion and proportional to an area of the habitat types to minimize sampling bias, achieve a representative sample and to meet the criteria for probability sampling [29]. The adjacent transects were at least 1500 meters apart and all transect lines were roughly parallel to each other and their ends were not less than 1000 meters' far from the habitat edge [25]. The average transect width was 100 meters in natural forest and 400 meters in wooded grassland habitat type of the study area [6], [15]. The average length of the transect lines was 25 km and 16.4 km in forest and wooded grassland habitat respectively. The transect length was measured and located in the study area with help of GPS. The sample transect was covered 20% of the study area (i.e.115.7 square km).

During the study period, silent detection method was practiced to minimize disturbances and walked along transect on foot. The carful detection and count Lesser Kudu was made with the help of binocular. To minimize the factor affecting effectiveness of the method, index of counts was used (i.e. the population was counted repeatedly over time and season) [31], [32]. The field survey was conducted from September-October to cover wet season and from February to March cover dry season at the time of morning and late afternoon.

2.2.2 Population Size and Distribution

Along stratified habitats, sample line-transect was used to assess the current distribution and abundance of Lesser Kudu, as adopted by [25] for different mammals. Direct count method used along selected sample transects, is effective method to determine population size and its distribution of the species for mobile and has variable group sizes across the season [5]. These characteristics are true for Lesser Kudu population [8].

Lesser Kudu population was counted by direct observation along the sample transect simultaneously to avoid double counting. The sample count was conducted at the time of Lesser Kudu became active, during morning hours (6:00am to 10:00am) and afternoon (2:00pm to 6:00pm) [18], [26]. Any individual of Lesser Kudu observed during the study period was recorded along with its age and sex structure [5], [4]. The distribution of Lesser Kudu was assessed by via ground survey in each habitat type during wet and dry seasons. These surveys were also supplemented with an informal interview [1].

2.2.3 The Density and Population Structure

The following formula as adopted by [4], [1] ,[25] used to calculate the population density of Lesser Kudu.

Density= Number of individuals /Total area….. (1)

Total population =Density X Total area…… (2)

The population structure of Lesser Kudu (i.e. sex and age composition) was determined based on the age and sex categories; adult male & female, sub-adult male & female, and juvenile as followed by [4], [26].

During this study, sex and age composition of Lesser Kudu population was identified by careful observation with the help of binocular in accordance with the following characteristics: Sex identification was made for male and female by observing primary sex characteristics and physical size [26], [21]. There are distinct signs of sexual dimorphism in the Lesser Kudu. Adult male is larger and has horn than that of adult female [17]. Horns are present only on males; the spiral horns are 50-70 cm long and have two to two and a half twists in adult male. Young male begins developing horns from six to nine months, which reach full length after three years [14], [18], [8].

All other individuals considered as juveniles [14], [18]. Fully-grown adult has thick necks and well-developed horns (mostly greater than 4 years old). Sub-adult is young between adult and juvenile age class. Horns about half ear-length to near-adult size (estimated ages 1-3.5 years) and juvenile is young animal mostly less than one-year-old [14], [8].

Hence, age and sex composition of the Lesser Kudu population was determined by physical size and developmental characteristics (i.e. adult female & male, sub-adult female, and male and juvenile) [20], [18].

The sex ratio of Lesser Kudu was calculated by the following formula:

$R=\Sigma Fi / \Sigma Mi$……. (3)

Where, R= Sex ratio. Fi = the number of females observed in the i^{th} survey (i=1…k). Mi = the number of males observed in the i^{th} survey (i=1…k).

2.3 Data Analysis

After data collected**,** it was analyzed by using SPSS software version 16. One-way ANOVA was used to compare the variation of Lesser Kudu population distribution in the two habitats type during two seasons with 95% confidence intervals as employed by [20], [22], [12]. Furthermore, it used to compare variation of density in two-habitat types and during two seasons. It was used to estimation the total population in the study area and compare population size during wet and dry seasons. One sample T-Test was used to compare variation between numbers of males and females, males and unknown sexes and females and unknown sexes.

3. RESULTS AND DISCUSSION

3.1 Population Size of Lesser Kudu

Based on the density of animal in the study area (i.e.0.99 Lesser Kudu per square km) the estimated population size of Lesser Kudu or locally known as "Worebu" by Menit language was 573 individuals in Tululujia Wildlife Reserve (in 578.5 square km area). There was variation population size of Lesser Kudu between wet and dry seasons. Higher numbers of individuals Lesser Kudus were recorded during wet season (136±3.6SE) (SE=Standard error) than dry season (93±5.8SE) (Table 1). The wet season in the study area was perhaps comfortable to reproduce or peak give birth of young as a result more numbers of individuals Lesser Kudus were recorded during wet season than dry season. The populations' growth of Lesser Kudu in the study area may have a relation to the growth of palatable forages and the immigration of Lesser Kudu. The frequency of fire and relatively high habitat disturbance has been occurred during dry season may be the possible reason for lower in numbers of Lesser Kudus during dry season in the study site.

This finding in contrary with [12]; there is no difference of population size of Lesser Kudu in different seasons and months of the year. There are 79 individual of Lesser Kudus is found in Nech-Sar National Park, which is the rarely observed mammals as compared to abundance of other mammals. This finding is similar with [7], even though, no fixed breeding season of Lesser Kudu (births of calves may occur at any time of the year), peak during rainy season therefore, more number of Lesser Kudus during wet season. According to [14], the breeding of Lesser Kudu is partially seasonal in different place (i.e. breeding throughout the year, but there is a seasonal peaks), as a result more number of Lesser Kudu during wet season than dry season.

TABLE 1: POPULATION SIZE OF LESSER KUDU, DURING WET AND DRY SEASONS.

Seasons	**Mean No of individuals (n=10)**	**SD**	**SE**	**95% Confidence Interval for Mean**	
				Lower Bound	Upper Bound
Dry	93	19	5.8	80	107
Wet	136	11	3.6	128	144
Total	115	27	5.9	102	127

NB: SD=Standard deviation, SE= Standard error & n= numbers of sample transects.

3.2 Distribution

A. Lesser Kudu showed significant difference in their distribution between the forest and wooded grassland habitats (P<0.05) (Table 2). The estimated numbers of Lesser Kudus in the forest habitat (125±4.97SE) was larger than that of wooded grassland habitat (105±4.83SE) (Table 2).

B. The variation may be due to better quality of habitat requirements in the forest (presence of preferred food its ability to feed variety of plant species that provide browse and get protection) than wooded grassland. Forest may not be only as source of food, but also used for cover from strong sun light and predation for Lesser Kudu. Menit

tribes and other communities perhaps disturb the habitat when they hang the traditional beehive on the tree in open wooded grassland. Many carcasses of animals were found in open habitat during study period. Therefore, poaching in open wooded grassland habitat might be relatively higher than forest habitat, because targeted animal to kill is visible in open habitat. Due the above reasons and the vigilant/shy behaviors of Lesser Kudu, it is preferred in the forest habitat type.

Those of [7], [23], [3] also support the finding of the current study, which stated that due to its shy behavior of Lesser Kudus are rarely found in open habitat, and prefer flat and densely thicketed forest areas. In addition, [17] stated that Lesser Kudu is a forest dwelling antelope because, it is a pure browser; feed on foliage from bushes and trees, shoots twigs, fruits, seedpod and herbs. According to [27], many animals prefer feeding and performing other activities in shed or forest covered area that helps them to avoid the heat and other danger and minimize water loss, therefore, the distribution in such area is higher.

TABLE 2: POPULATION DISTRIBUTION IN FOREST AND WOODED GRASSLAND HABITATS.

Habitat types	Mean No of individuals (n=10)	SD	SE	95% Confidence Interval for Mean		F-value	P-value
				Lower Bound	Upper Bound		
Forest	125	16	4.9	113	136	8.08**	0.011
Wooded-grassland	105	15	4.8	94	116		
Total	115	18	4.1	106	123		

NB: SE= Standard error, **= $p<0.05$ and n=the sampled transect.

This finding is different from [12] result; Lesser Kudu is frequently occurred in the open woodland of Nech-Sar National park (70.9%). They rarely occurred in the wooded grasslands (26.6%) and the least observed in shrub lands and open grasslands (2.5%). However, not observed in dense forest, Reverine forests and water logged areas, because, Lesser Kudu is a habitat specific species. This showed as Tululujia Wildlife Reserve comparatively poor wildlife management, presence of illegal killing and of habitat disturbance in as compared to Nech Sar National Park.

The distribution of Lesser Kudu in forest habitat type was significantly different between dry and wet seasons ($p<0.05$). Their existence in forest habitat type during wet season was larger than dry season (i.e. their number was 54±3.82SE and 71±2.28SE during dry and wet seasons respectively) (Table 3). The population distribution in wooded grassland habitat type was significant difference between dry and wet seasons ($p<0.05$). The population distribution of Lesser Kudu in wooded grassland habitat type during the wet season (65±2.98SE) was higher than that of dry season (40±3.81SE) (Table 3). This outcome might be due to the presence of better habitat quality (i.e. the presence of quality forge, cover, water and safe space to rest, rearing of young and reproduce) in wet season

than dry season in both forest and wooded grassland habitat. Relatively lower human disturbance and fire occurrence in both forest and wooded grassland habitat during wet season than dry season.

There was also significant variation of Lesser Kudu distribution between wooded grassland and forest during dry season ($p<0.05$) (Table 3). There were higher numbers of Lesser Kudus in forest habitat type (54±3.82SE) than wooded grassland habitat type (40±3.81SE) during dry season (Table 3). This could be due to fire sweeps through long grasslands during dry season and may not have sufficient cover for concealment against predators in wooded grassland habitat during dry season. This result is related with [1], stated that the distributions of most mammals including Lesser Kudu are based on the availability of cover to hide them from hunting, and predator, food and distance from anthropogenic factors.

However, the Lesser Kudu was evenly distributed in forest and wooded grassland during wet season, because the population distribution between the two habitat types during wet season was no significant variation ($p>0.05$) (Table 3). The individual numbers of Lesser Kudus were 71±2.28SE in the forest and 65±2.98SE in wooded grassland habitat type during wet season (Table 3). The uniform distribution during wet season across two habitat types may be due to near similar habitat quality for Lesser Kudu population during wet season in both forest and wooded grassland habitats during wet season. The growth of leaves of the trees and shrubs, and no fire burn of grass during wet season may be important reason for even distribution of Lesser Kudu in the two habitat types.

This study is different from [12] declaration that the population distribution of Lesser Kudu is limited to particular sites (i.e. not evenly distribute across the habitat) which can be due to their habitat specificity.

However, according to [17] Lesser Kudu occur in grassland area to feed flowers and small proportions of grasses, usually in the wet season at the time they also inhabit in forest. While [19], described that Lesser Kudu, seasonally different distribution across the habitat due to environment influences.
This finding reveals that Lesser Kudu was existed at altitudes ranges from 1,203 m a.s.l to 1,450 m a.s.l around Tululujia hilly area of the study area. Whereas [3], stated that Lesser Kudu is commonly, exist from 1,200 to 1,740m a.s.l altitudinal range.

TABLE 3: THE POPULATION ABUNDANCE IN RELATION TO DISTRIBUTION OF LESSER KUDU IN FOREST AND WOODED GRASSLAND HABITAT TYPES DURING WET AND DRY SEASONS.

Transect Number	**Population distribution during dry season**		**Population distribution during wet season**	
	Forest	Wooded grassland	Forest	Wooded grassland
1	37	45	64	78
2	54	30	67	79
3	55	20	68	66

4	73	38	79	57
5	44	54	82	62
6	40	27	59	52
7	59	46	72	76
8	46	36	78	66
9	63	40	71	59
10	68	59	67	59
Mean ±SD	54 ± 12	40 ± 12	71 ± 7	65 ± 9
P-value	0.016**		0.175 ns	

NB: SD=Standard deviation, **= $p<0.05$ & ns=not significant ($p>0.05$).

3.3 Density

The estimated density was 0.99±0.05SE Lesser Kudu per square km in the study area. There was significant variation the number of Lesser Kudu per square km between wet and dry season ($p<0.05$) (Table 4). The density of Lesser Kudu during wet season was higher than dry season (there was 1.18±0.03SE and 0.81±0.05SE during wet and dry season respectively) (Table 4). There was also significant difference between the density of Lesser Kudu in the forest and in wooded grassland habitat types ($p<0.05$) (Table 4). Lesser Kudu was densely populated per square km in the forest than wooded grassland (i.e. 2.5±0.1SE and 1.6±0.1SE in the forest and wooded grassland respectively) in the study area.

The possible reason of variation of density between two habitat types were due to availability of basic component of habitat (space, food, water and cover) has a relation to the density of Lesser Kudu. There was better habitat quality in forest than wooded grassland and during wet season than dry season as well. The 43% of the study area covered by natural forest **[2]** is a suitable habitat for Lesser Kudu.

According to [3], the heavily forested area is preferable habitat for Lesser Kudu since it desires dense cover to protect any dangers and wariness behavior. According to [11], the population density is 0.05-1.0 per square km within its habitat. Whereas [28], [3], stated that population density is rarely exceeds one Lesser Kudu per square km and commonly much lower.

TABLE 4: THE DENSITY OF LESSER KUDU IN TWO HABITAT TYPES AND DURING WET AND DRY SEASONS.

Seasons	**Mean Density**	**SD**	**SE**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**	**F-Value**	**P-Value**
				Lower Bound	Upper Bound				
Dry	0.81	0.2	0.05	0.69	0.92	0.58	1.10	38.67***	0.000
Wet	1.18	0.1	0.03	1.11	1.25	0.96	1.28		

Total	0.99	0.23	0.05	0.89	1.1	0.58	1.28		
Habitat									
Forest	2.5	0.31	0.1	2.26	2.71	1.98	3.03	51.72***	0.000
Wooded-grassland	1.6	0.23	0.1	1.43	1.77	1.2	1.88		
Total	2	0.53	0.1	1.79	2.29	1.2	3.03		

NB: SD= Standard deviation, SE= Standard error and ***= p<0.01.

3.4 Population Structures of Lesser Kudu

3.4.1 Age Groups

The estimated numbers of Sub-adult females were 30.68% (35) of the total estimated population of Lesser Kudu, which was the highest percentage whereas adult males' comprised 9.63%(11), was the lowest in the study site. There were 24.79 %(28), 20.48% (24) and 14.42% (17) of adult females, sub-adult males and juveniles of the total estimated population respectively (Fig. 2). Sub-adult females' populations were recorded the highest number both during wet and dry seasons (there was 43 and 27 individual numbers during wet and dry seasons respectively). Adult males were recorded the lowest population numbers both during wet and dry seasons (there was 11 individuals' numbers both during wet and dry seasons). This might be due to the illegal hunters mostly killed adult males Lesser Kudu in the study area. The solitary behavior of adult male and move in-group of sub adult female and male might have an impact on their existence.

According to [19], [23], adult male Lesser Kudu has beautiful shaped horns, use as musical instruments, honey containers and symbolic ritual objects in many places. In some cultures, the horns thought as the dwelling places of powerful spirits, and symbols for male potency/strength. Consequently, adult male Lesser Kudu are best spot of most trophy hunters' cause for lower in numbers as compared other age categories in many place.

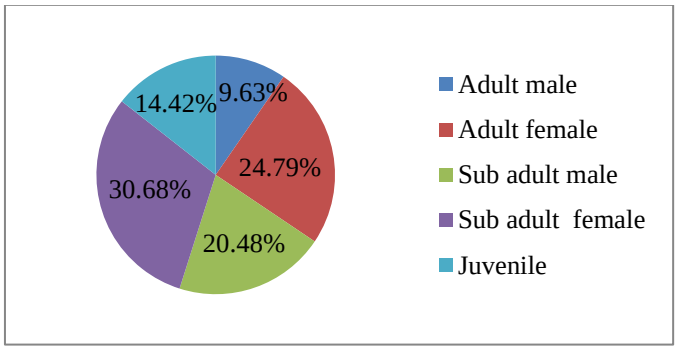

Fig. 2: The proportion of Lesser Kudu age groups in the study area.

3.4.2 Sex Composition

There were 55.47% (64) of females, 30.11% (35) of males and 14.42% (17) of unknown sexes that accounted from the total population of Lesser Kudu in the study area (Fig. 3). There was significant difference between the numbers of males and females, males and unknown sexes and females and unknown sexes (p<0.05). The numbers of females

(64±4.01SE) was higher than males (35±1.74SE) (Table 5). The variation of males, females and unknown sexes individuals' numbers of Lesser Kudus were statistically significant between wet and dry seasons (p<0.05) (Table 6). There were more numbers of males, females and unknown sexes during wet season than dry season (i.e. 38±82.5SE, 78±3.2SE and 20±0.8SE numbers of males, females and unknown sexes during wet season respectively and 31±1.9SE, 50±3.6SE and 13±1.1SE numbers of males, females and unknown sexes during dry season respectively) (Table 6).

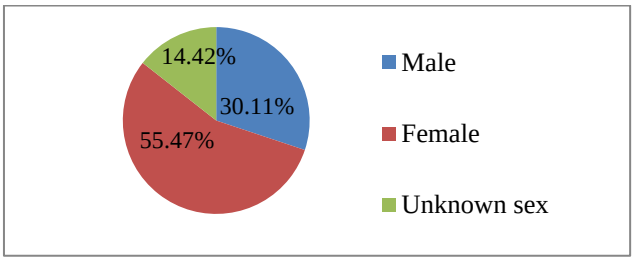

Fig. 3: The proportion of males, females & unknown sexes of Lesser Kudu.

TABLE 5: COMPARISON OF SEX CLASS.

Sex	**Mean (df=19)**	**SD**	**SE**	**T-value**	**P-value**
Unknown Sex	17	5	1.05	15.72***	0.000
Female	64	18	4.01	15.88	
Male	35	8	1.743	19.84***	0.000
Unknown Sex	17	5	1.053	15.72	
Male	35	8	1.742	19.84***	0.000
Female	64	18	4.01	15.88	

TABLE 6: SEX COMPARISON IN DIFFERENT SEASONS.

Sex	**Dry season**	**Wet season**	**Total mean**	**F-value**	**P-value**
Male	31±1.9 SE[a]	38±82.5SE[b]	35±1.7 SE	5.036**	0.038
Female	50±3.6 SE[a]	78±3.2 SE[b]	64±4 SE	34.26***	0.000
Unknown Sex	13±1.1 SE[a]	20±0.8 SE[b]	17±1.1 SE	31.04***	0.000

NB: SD=Standard devotion, Standard error, df= degree of freedom, ***= p<0.01, ** p<0.05, a & b= significant difference along columns.

The difference in individual numbers of unknown sexes between dry and wet season may be due to give birth of calves by large numbers of females during wet season. While the reason of more numbers of males and females during wet season than dry season, might be due to immigration of Lesser Kudu, relatively low poaching and human disturbance during wet season than dry season in the study area.

According to [7], [19] descriptions, most of the time individuals' numbers of young are higher during wet season due to giving birth of calf during rainy season. Lesser Kudu population mainly consist of females and their calves, while male Lesser Kudus lower in number and tend to solitary, only come together when it is time of mate [24]. According to [14], [7] Lesser Kudu appears together when available food and water supply exist (usually during wet season). If food is scarce or seasonally limited, home ranges must be larger or shifted seasonally (mostly during dry season), leading to movements and migrations due to this the numbers of male, female and young Lesser Kudus become lower in dry season.

The large number of breeding females' ungulate indicates that, if better conservation measure is taken by the conservation area management, the population can increase in the future [26]. This study also reveals that more number of female Lesser Kudu in the study area. Therefore, if take better conservation measures, the population of Lesser Kudus will have a chance of increase the number in the future.

3.4.3 Sex Ratio

The male to female sex ratio (M: F) was 1.0:1.84 which means 1.84 female for each male of Lesser Kudu in the study area (Table 7). The sex ratio of male to female was larger in wet season than dry season.1.16 females for each male Lesser Kudu (1.0:1.16) during dry season and 2 females for each individual male (1.0:2.0) during wet season (Table 7). There was almost similar sex ratio male to female in forest and wooded grassland (male to female sex ratio was 1.0:1.8 and 1.0:1.9 in forest and wooded grassland habitat respectively). Adult male to adult female sex ratio was equal in forest and wooded grassland (1.0:2.6) (Table 7).

TABLE 7: SEX RATIO OF LESSER KUDU IN TULULUJIA WILDLIFE RESERVE.

Sex ratio	**Seasons**		**Habitat type**	
	Dry	Wet	Forest	Wooded-grassland
M:F	1.0:1.6	1.0:2.0	1.0:1.8	1.0:1.9
SAM:SAF	1.0:1.35	1.0:1.61	1.0:1.42	1.0:1.59
AM:AF	1.0:2.07	1.0:3.05	1.0:2.6	1.0:2.6
Total M:F	1.0:1.84			

NB: AM=adult male, AF=adult female, SAM=sub adult male, SAF=sub adult female, M=male &F=female.

A female-biased sex ratio has been reported in many antelope's populations. Potential bias in sex ratio is related with the management of the species. Unequal sex ratio of antelopes perhaps an increased predation pressure on males, due to greater boldness or the emigration of subordinate males to other habitats [26].

4. CONCLUSION

The estimated total population size of Lesser Kudu was 573 individuals in Tululujia Wildlife Reserve. This finding was showed as wet season of the study area is peak breading season of Lesser Kudu. Even thought, the population of Lesser Kudu distributed nearly similar way in the two habitat types during wet season, not uniform distribution across the habitat types in general. Dense forest cover of the study site is preferred habitat of Lesser Kudu. There was one Lesser Kudu per square km in the study area. Additionally, this study revealed that there were more females Lesser Kudu than males, which indicated that the Lesser Kudu has viable population in the study site.

5. ACKNOWLEDGMENT

First, I would like convey my deepest gratitude to my major advisor Dr. Girma Mengesha and Co-Advisor Dr. Abdella Gure for their continual guidance and **support** for all my research work without hesitation. **I also thank to Guraferda district Administration office and police Station for order of** security personnel **to help me during the study period. I would like to express the heart full thanks to Guraferda district culture and tourism office, scouts, wildlife and forest experts for their support during field survey. My** thanks also go to the Ministry of Agriculture for the financial support provided. Finally, I would like to thank all my friends, who provided **me ideas and technical supports** and my beloved brothers Wondmagegn, Hailye, and Zenebe Tilahun for their encouragement.

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