
# JIMMA UNIVERSITY

## COLLEGE OF NATURAL SCIENCE

## DEPARTMENT OF BIOLOGY

**The Diversity,Habitat association and Relative abundance of large and medium sized mammals of Gibe Sheleko National Park, Gurage Zone, South Nations and Nationalities Peoples Regional State, South Ethiopia**

**By: YosefBekeleBalcha**

**Advisor:TsegayeGadisa (PhD)**

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**GPS** - Global Positioning System

**PP** - Page

**SPSS** - Statistical Package for Social Science

**FAO** - Food and Agriculture Organization of united nation

## *Abstract*

*The present research was carried out to assess the diversity, abundance and habitat association of medium and large-sized mammals in Gibe Sheleko National Park, Gurage Zone South Nations Nationalities Regional State, South West Ethiopia. Data was collected from January to July 2017. There are two habitat types in the study area;the riverine woodland and the woodland.Three blocks namely: Gibe seriti,Cheha and Borer were established to represent the study area.The Gibe seritirepresent the riverine woodland type,the Borer and the Cheharepresent the woodland habitat type with slight difference in their altitude.The transect lines were randomly establishedon each habitat andused to survey mammals in the study area.Indirect methods including foot prints, calls and faces were also used to record the presence and absence of mammals.A total of 954individuals of mammals (wet=521) and (dry=433) were recorded which belong to five mammalian orders; primates,lagomorpha,carnivore, arcdactila androdentia. There areeight families under the given orders. Like family canidae, bovidae, suidae,cercopitheci,leporidae, hyaenidae, viverridae and tachyglossidae. Among the three representative habitat types Gibeseriti (riverine woodland)had the highest diversity index (H`=1.4) during wet season. The most diversity was recorded inBorer (woodland)with (H`=1.66) during dry season. The least diversity was recorded inBorer (woodland)in combined seasons (H`=0.88). The Most abundant medium sized and large sized mammals in the study area were olive baboon(papioanubis) (50%), Thevervetmonkey (Certopithicusaetopis) (20.3%), Hippopotamus (Hippotamus amphibious) (12.35%) Warthog (Phacochoerus afr4icanus)(7.8%) and common jackal(Canisaureus) (2.5%)., The highest species similarity was obtained between borer and cheha habitats SI=0.475 and the least similarity was between Borer and Gibe Seriti habitats (SI=0.33) during wet season. During dry seasons the highest similarity of mammalian species wasbetween Cheha and Borer (SI=0,50).Mammals of the study area were classified in to common 53.84%, un common 23.07% and 23.07% are rare based on the way of they sighted in the study area.Despite the study area is home for different species of mammals, livestock grazing and human encroachments are evident in the area, putting strain on the flora and fauna. Hence, conservation measures should be taken to ensure long term conservation of the area.*

***Key words:*** *Abundance,Diversity, Gibe Sheleko National Park, Habitat association and Mammalian species,Species similarity.*

# 1. Introduction

## 1.1 Background

More than 5000 mammalian species have been recorded worldwide. Among these about 40% are small mammals. The remaining are medium and large sized mammals. Over 320 species of mammals are recorded from Ethiopiaof which 36 species are endemic (BekeleandYalden, 2014). Mammals show great variation in size. Traditionally, body weight has been used to classify mammals in to medium and large size or small size. Therefore small mammals' weigh below 2kg while medium-sized mammals are those weighing between 2to7kg such as small carnivores, small primates, large rodents,hyraxesand pangolins and mammalian species with more than 7kgare considered to be large sized mammals. These include; most diurnal primates, most carnivores larger than a fox or acat, all perisoductilesandartiodactilas (Emmons and Feer, 1997).Mammals are usually found in and around the arid part of Ethiopia for many years.

Now days, the natural ecosystem of Ethiopia has been changed as a result of human activities and natural factors. Because of these the wild resource of the country are largely restricted to a few protected and none protected areas. In addition, the recent demand on agriculture need or requires the use of fertile lands. This isaffecting the wild life.To make protection it is important to improve the wildlife management program. It could be by establishing national parks, sanctuaries and controlled hunting areas.As a result Ethiopia has established 21 national parks, 11wildlife reserves, 3 sanctuaries, 21 controlled hunting areas and 69 important bird areas (Young, 2010). But, there are challenges facing all Ethiopian protected areas. These are related with hunting, deforestation for agriculture purposes and competition for resources by domestic animals.The Gibe Sheleko National Park is a newly established National Park(SNNRS, cultural and tourism office, 2010).It is under influence of the above mentioned problems facing the other protected areas. Large and medium sized mammals are exposed for the problems. So they are underfearof unstable habitats. It needs serious wildlife management interventions.

Vaughan et al. (2000) indicated that the distribution of mammals occurs in two different levels; The first one is the geographic distribution of species and the other is the local distribution of individuals home ranges,territories and micro habitats are indicators of the distribution of individualswithin area of convenient habitats(Smith,1992). These are governed by access to important resourcessuch asfood, living space and availability of mates.Information on diversity

and abundance of mammals is central to understanding ecological processes including population dynamics,demography and the community structure of mammals. Such information has significance in conservation that it can point the areas of high diversity of mammals and fragmentation (O'Connell, 1989).

GibeSheleko National Park is with limited biological information. The diversity of large and medium-sized mammals in the area is not yet documented. Other important information like abundance and habitat association of mammals in the park are not known. Hence,this study tried to obtain information on diversity, abundance and habitatassociation of large and medium-sized mammals of the Park.

## 1.2Statement of the problem

Among 21national parks found in Ethiopia, five (were Nechsar, Omo, Chebera-Churchura, Mago and the Gibe Sheleko National parks) are found in south Nations Nationalities Regional State. Gibe Sheleko National Park located in Gurage Zone,South Nations Nationalities Regional State .which is recentlyestablished since 2003 E.C. (Young,2010).

The park is expected to have great diversity of animals and plants.But theactual diversity, abundanceand habitat preference of mammals is lacking. Itneeds great research effort todiscover their relative abundance. In protected area like (National park) NP appropriate management actions are essential to achieve the desired goal. Designing effective management strategies require basic ecological information including the diversity, relative abundance and habitat association of species under consideration. The research is expected to report the abundance, distribution and relation of habitats in the research area.

## 1.3. Objectives of the study

### 1.3.1. General objectives

The general objective of this study was to assess the diversity,abundance and habitatpreference of medium and large sized mammals in Gibe Sheleko National Park, South Nations and Nationalities People regional state,Gurage zone, South Ethiopia.

### 1.3.2. Specific objectives

- Identifying the diversity medium and large sized mammals in the study area.
- Assess habitat association of medium and large sized mammals in study area.
- Determine the abundance of medium and large sized mammal's species in varioushabitat of the study area.
- To record the actual threats and potential threats in the park for better conservation of faunas.

## 1.4Significance

The removal of vegetation and environmental degradation have become issues of national and global concern in recent years .This is because of decrease in vegetation cover and depletion of natural resources are closely associated with drought and food shortages have become major threat affecting thesarvival of wild life .Therefore the study was designed to document the diversity,abundance habitat association of medium and large sized mammals of GibeSheleko National park. This is important for the future development and sound managementplan of national parks. As mentioned above no information was collected in terms of abundance,diversity and habitat association of medium large sized mammals from the area.So the information collected during this study will serve as abase line for other researchers who are interested to carry out additional studies in national park. Therefore the aim of the research is to have the overall knowledge of mammalian resources in the park. The knowledge of abundance, distribution and habitatassociation are used for special care and better conservation of the species.

## 1.5Delimitation

This research focus only on diversity distribution and relative abundance of medium and large sized mammals in GibeSheleko National Park physical boundary,which is located inGurage zone,south nations nationalities regional state ,south Ethiopia.

# 2. Literature review

## 2.1. Biodiversity

Biodiversity describes all of the wealth of life on the earth.Various types of life ranging from microscopic to huge organisms are included. Their genetic composition, and the communities, ecosystem and habitats can be included under biodiversity (Burley,2002).Ecological process is the sum of structural and functional relationships (Koromod, 1996). Energy flow and mineral cycle is assembled into ecological communities.None of these ecological process occur in isolation for each population o fa species in particular environment (Grime,1997).

Biodiversity benefits human beings in several ways. These include economic, ecological, aesthetic, educational and scientific values. It used to have pure and sanitized air and water, fertile soil, normal mineral nutrient cycle and waste disposing mechanisms by microorganism and symbiotic and mutual relations of organisms which benefits human being (Tillman *et al.,*1999).

Biodiversity has a fundamental importance in functioning all of the nature and human engineered ecosystem by providing the ecosystem service which is provided by nature without any charge to human society (Takacs, 1996).Economic importance of biodiversity include its use individually, in satisfying human needs, tourism, fishing, bee hiving (honey production) and use of wild life for smoke less industries(Cox andBalic,1994).

Biodiversity can be affected by different conditions. Naturally occurring phenomena such as fire,volcanic eruption and floods can adversely affect community and there by diversity. The major is humanitarian activities like habitat destruction, hunting, fishing, introducing invasive species, fuel wood gathering and agriculture can be mentioned(FAO,2001).

Over 1,150 species of mammals are recorded from Africa, belonging to 13 Orders and 50 Families. Ethiopia is well known in having diverse fauna and flora. There are more endemic organisms in the country. So it is recognized on the world wide by its being of one of the global biodiversity hot spot (NSC, 1994)

## 2.2 Mammalian diversity

Mammals are one of the most important components of biodiversity in the world (Ogeda*etal*, 2000). .Mammalian diversity increases where there is sufficient food and water source (Yime, 2008).Mammals range in size from African pigmy mice(*Musminutoides*) to whales (Mugatha,2002). The African tropics is rich in the diversity of mammalian fauna There are 1,150 species under 13 orders and 50 familiesThe fauna consists of different species such as elephant, tiny pigmy mice,scaly pangolins,amphibious hippopotamuses, flying squirrels, necked burrowing rodents, and termite eating aardvarks(Dlanay and Happold, 1979).

Many species are arboreal; they spent most of their time in the forest. Some are adapted to live in dwelled lands (underground).Partial are aquatic living near lakes, streams or the coast lines of oceans. They have different styles of locomotion and social behavior. Most are group oriented, some are solitary. They may be nocturnal &diurnal (Reicholf, 1990). Mammals show several properties in common.

Mammals have different life styles. They can exploit a large variety of ecological niches and have numerous adaptations to take advantage of different life styles (Flynn et al., 2005).About 0.1% of all mammals are egg lying and 99%are placental (Yirga, 2008).Mammalian community is highly significant in ecosystem function. For example, large carnivores regularly shape the quality, distribution and behavior of prey animals (Berger *et al.*,2000). In addition herbivores play role in engineering the structure and species composition of the surrounding vegetation(Dinerstein,2003).

## 2.3. Classification of mammals

The mammalian class over 5000 species under 26 orders (Wilson and Reader, 2005.Their size vary from small to large. The smallest mammal believed to be Thailand's Kitts-hog nosed bat which has approximately 3cm length and weight 1.5gm-2.2gm(Renfee, 1980). The largest mammal is the blue whale, which can be up to 27m long and has 150tons weight. On land the largest is the African elephant, which is 3.2m tall and has 5.5tones of weight (Flynn and Hill,1947).

## 2.4. Threats of medium large mammals

The abundance of mammals can be affected by different a biotic and biotic factors. These factors can affect mammals in different ways. This is because each species may get favorable site from the combination of environmental variables that most closely corresponds to its requirements (Brown, 1984). Some of the threats affecting mammals are deforestation, forest fire, over use of the land for cultivation, loss of genetic diversity, endangerment and extinction. It was mainly affected by human activities such as forest burning, hunting, poisoning, wood gathering and other type of killing mammals (Miller et al, 2000).The others are disruption of the physical environment including migration,alteration and introduction of invasive species. These activities can affect the survival tendencies of the mammals .The increased level of human population can result with habitat destruction and hunting can cause the decline of mammalian species. So these may result with extinction of organisms (Cardillo et al., 2004).

## 2.5. Habitat and distribution of mammals

The distribution of species is explained as the sum of many local populations and the distribution of a particular species or group of populations. The habitat associations of large mammals are determined in terms of their basic requirements such as food, water and other conditions or factors (Oubert, 1976).According to Balakrishinan and Easa (1986),habitats in terms of mammalsare related to the vegetation composition, floristic and structure of the area. Therefore, animals occur possibly where the basic necessities are fulfilled. Complex habitats may provide more niches and diverse ways of exploiting environmental resources and thus increase species diversity (Bazzaz, 1975).

Each mammalian species has an environmental agreement for diverse environmental conditions. They may some mammals occur over large areas, unless barriers intervene, and thus they may be said to have generalized in habit or to be adaptable. If their limits of tolerance are restricted, their distribution is usually confined to relatively small local areas and they may be said to be specialized or not adaptable (UNESCO, 2008

## 2.6. Measures and methods to understand medium and large sized mammals

### 2.6.1. Taxon sampling curves

Although species richness is a natural measure of biodiversity,it is an elusive quantity to measure properly(May,1988).The problem is that for diverse taxa as more individuals are sampled, more species will be recorded (Bunge & Fitz patric1993).The same ,of course ,is true for higher taxa, such as genera or families .This sampling curve rises relatively rapid at first ,then much more slowly in later samples as increasingly rare taxa are added. In principle for a survey of some well-defined spatial scope, an asymptote will eventually be reached and no further taxa will be added.In this case there will be kinds of taxon sample curves, based on two dichotomies. Although it is expected to present curves in terms of species richness. The first dichotomy concerns the sampling protocol used to assess species richness .Suppose one wishes to compare the number of free species in two contrasting 10-ha forest plots one approach is to examine .some number of individual organisms at random within each plot,recording sequentially the species identity one organism after the other. Alternatively,one could establish and identify a series of quadrants ineach plot, record the number and identify all of mammals within each, and additional quadrants are censured (Chazdon*et al*, 1998; Vandermeer*etal*., 2000).

### 2.6.2 Species richness vs. species density

One ofthe most ecological comparison is of biodiversity are actually comparison of species density; the number of species per unit area (Simpson, 1964).Species density depends on species richness and on the mean density of individuals (disregarding species).

### 2.6.3. Line transect

If a species is relatively large and conspicuous, one of the best methods for estimating abundance is the transect line (Buck land*et al*.2001). The essential feature of line transect is that one walks along a straight path and records the individual seen and their perpendicular distance from transect line. Some individuals to the side of the path being walked escape detection by the observer,and the critical assumption is that all animals on the path are seen. The data gathered on perpendicular distances are used to construct a detection function for distances of thetransect lines. It assumed that the detection function has some smooth shape and varietyof shapes is possible (Krebs, 1999)

Roads and tracks are often used as the path of the line transect. Line transect can be used to estimate the abundances of indices of mammals activities, such as dung piles and burrows. It can be converted to rectangular sampling quadrants of fixed sized if the observer can be certain of sighting all individuals within the fixed strip. This approach is not recommended for most mammals because detecting is not usually 100% and, in contrasting sighting to a fixed strip width, data are lost for sightings more distant from the path of the line transect.

### 2.6.4 Counting calls

Lionsand different animals can be recorded by a detector.Example lions can be heard roaringeven a dense fog.Whale and seal calls can be recorded under water with a hydrophone .Its main idea is to count calls for a standard unit of time, and to use these counts as an index of population size .In these cases it is not possible to recognize individuals from their calls, but species can be distinguished (Stirling*et al*.1983).

### 2.6.5 Counting dung

It is easy to count dung than to try to capture the animal itself. Dung can be used simply as an index of the presence or absence of species, but attempts to use the amounts of dung as an index of population abundance have also has been made.Dung can be counted with quadrants (circular) rectangular,square or by line transect method. Some species deposit dung in piles and a clear operational definition of a sampling unit of dung must be made before counts can be under taken. If quadrants are to be used in sampling, effort can be minimized by determining the optimal quadrant sizeand shape for the particular specie (Krebs, 1999).

There are problems with counting dungs. These are determining the age of dung. The appearance of dung will change depending on temperature and moisture conditions .So it requires recounting and clearing all of the dung each timethey are counted.The counting interval must depend on the rate of decay of dung. Attempts to estimate absolute abundance from dung rely on known rates of production of fecal pellets(Krebs *et al.,* 2001).

Living things produce dung when they are alive.And consequently the presence of a species in an area can be identified by dung counts in habitats where dung persists.This method can be used very effectively to index population with a minimum of efforts. Astechniques for identification of individuals from DNAin dung are developed, fresh dung can also potentially become a way of

estimating population size by mark recapture of dung from specific individuals (Eggert*et al* 2003).

### 2.6.6. **Counting foot prints and run ways**

Track of species in soft ground or snow are an excellent way of determining presence and abundance. For instance in Finlandused snow tracking to index stoat and weasel abundance 1-2 days after fresh snows. O'Donoghue*et al.* (1997)used snow–track transects to index population changes in coyotes in Northern Canada. Sand tracking stations have been used to index Dingo populations in Australia (Allen *et al*., 1990)

Foot prints can be assessed actively or passively. Active assessments typically use scents or baits to bring animals in to the tracking plot.Whereasthe passive assessments uses tracks made by animals in their daily travels. The advantage of track counts is that they are a cheap way ofdetermining the relative abundance of wide-ranging carnivores that live at low density (Wilson, 2001)

# 3. THE STUDY AREA AND THE METHOD

## 3.1 THESTUDY AREA

Gibe Sheleko National Park is located in Gurage Zone, 178 km to the south west of Addis Ababa and 20 km to the south of Welkite, capital of the Zone. The park is located between 07º 56‟137‟‟ to 08º 00‟315‟‟ N latitudes and 037º 40‟969‟‟to 037º 41‟133‟‟ E longitude and covers an area of 360km$^2$ (Fig.1). The altitude in the park ranges is from 1050 to 1835m above sea level, and was recognized as park since 2003e.c. (SNNPRs culture and tourism bureau)

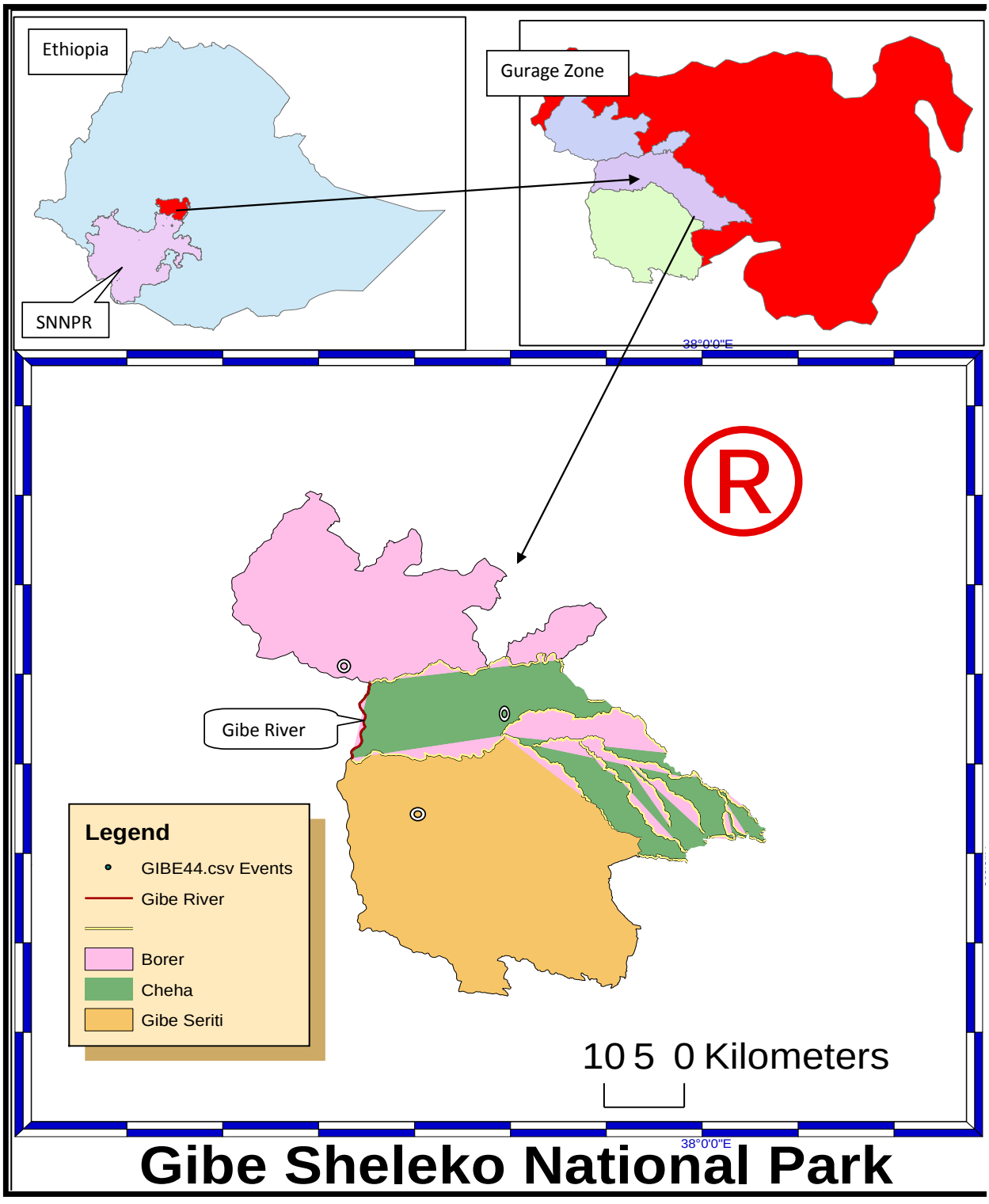


**Fig 1** The map of the Gibe Sheleko National park

## *3.*2Climate

The information was collected from the Gurage zone agriculture office near the study area (20 km.)

### 3.2.1. Temperature

According to the information obtained from the Gurage zone agriculture office, the mean maximum temperature of the area ranges between $24^0$c to $30^0$C and minimum temperature of the area ranged between $11^0$cto $17^0$C·The meanannual minimum and maximum temperaturewere recorded in the months of March and December respectively (Figure2).

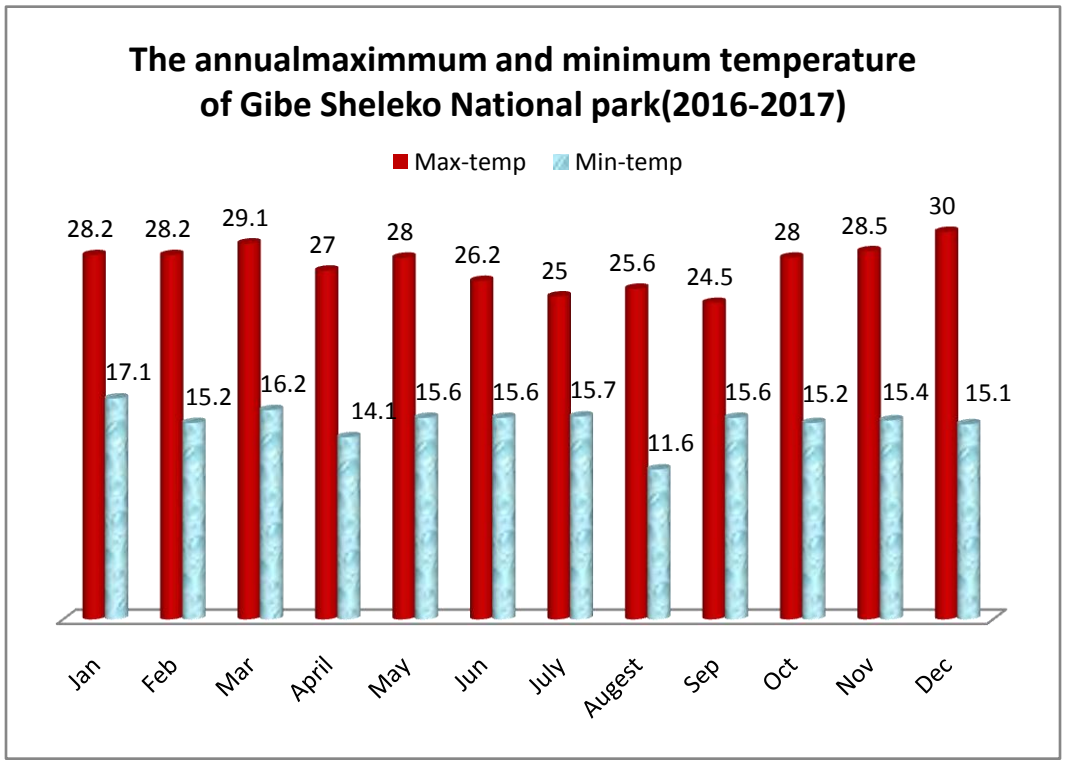


**Figure 2** The mean maximum and minimum temperature of the study area(Source: Gurage zone agriculture office,2017)

### 3.2.2. Rainfall

The average annual rainfall in the study area is 1063.It varies between 800mm to 1400 mm.

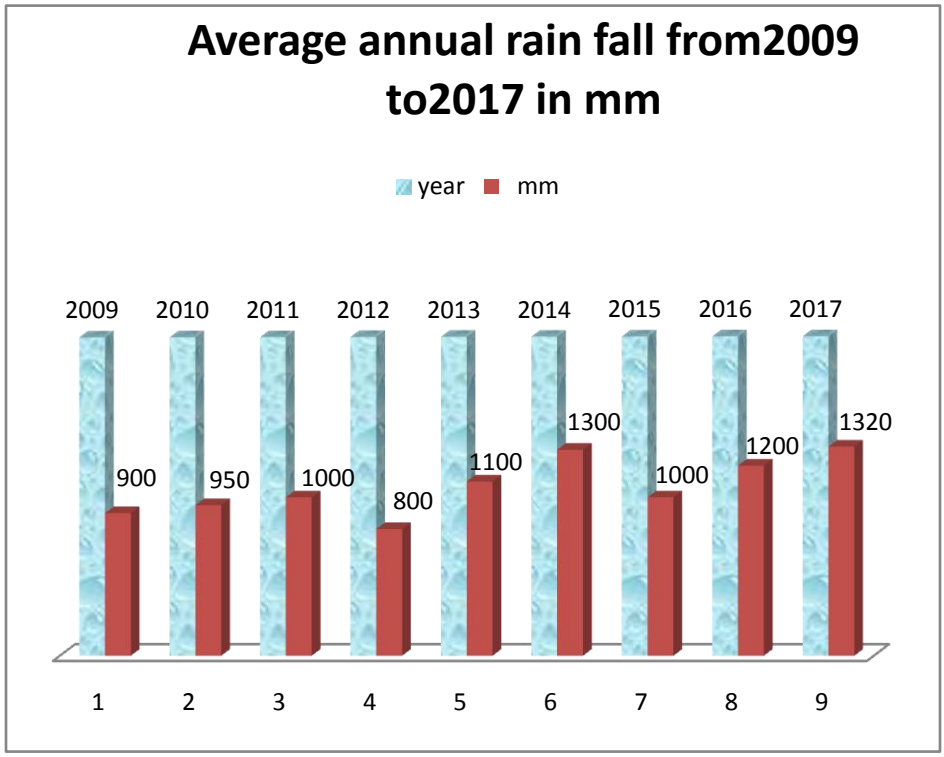


Fig. 3 the annual rain fall in Gibe Sheleko National park (Source:GurageZone Agriculture Office, 2017).

The area recieves high rainfall in wet seasons (July)and the lowest in Dry seasons (November and December).

## 3.3 Materials

To conduct research on the diversity, relativeabundance and habitat association of medium and large sized mammals in Gibe Sheleko national park, material such as GPS, to know the accurate position of the area to be researched,data sheets and field guides,digital cameras,note books, ruler,pencil,meter, bags and binocular microscope where used.

## 3.4Methods

### 3.4.1 Preliminary survey

Preliminary survey was conductedto gather essential information about the study area including the determination of habitat type and topography of the study site. The habitat Gibe

shelekonational park is categorized in two habitat types. Those were acacia dominated wood land (80%) and the riverine woodland (20%). The classification was done on the basis of topography and habitat type.The woodland can be defined as the area covered by different plants like acacia, eucalyptus species and other small shrubs and characterized by having the higher altitude (Teshome*et al*, 2011

**Fig 4 Partial view of Borer (wood land) in Gibe shelekonatonal park (Photograph by YosefBekele, 2017)**

The riverine woodland can be expressed as the area having vegetations with the presence of river. (Teshome*et al, 2011)*

**Fig 5** Partial view of Gibeseriti, Gibe sheleko national park (riverine woodland) (Photograph by YosefBekele, 2017)

## 3.4.2. Sampling design

In the study area the acacia dominating woodland was estimated to cover 80% which is 288sq.km and the riverine woodland is about 20% which is 72sq.km.So the study area was divided into blocks by choosing the location of habitats.Among the established habitats representative blocks were selected for actual study (Sutherland, 1996). Random selection of study blocks was made .To cover at least 20_25%of the area (Bibby*etal*.1992) 90 square kilo meters were estimated to make transect line to be studied.Totally three places two for woodland, one for riverine woodlandwereselected for sampling. These wereCheha which is desert hill(1390m-1785m)above sea level, Borer which is relatively high land (1540m-1835m) above sea level and Gibe Seriti which is low land and gorgy.Out of the whole area of the park which is 360km$^2$,25% was planned to be covered in this study.Accordingly, 90km$^2$ and 45transect lines fromthe three habitat types, 9 transect lines on riverine woodland,36 transect lines of the

woodland blocks were established.Therefore there were 9 transect lines from Gibe Seriti,20 transect lines from Borer and 16transect lines from Cheha. Transects were separated by a distance of 350mtoavoided the double counting of individuals during the time of survey.Each transect covered a total area of 0.5km$^2$. The selection was depending on vegetation type and difference in location. Each transect lines were surveyed twice a month for three months in each seasons.From January to March, 2017and fromMay to July, 2017for wet seasons. Some of the transect lines surveyed twice a day randomly at the same time. There weretwo individuals per each transect lines to be surveyed. Conducive time for the survey was06:00 to 08:00 AM in morning and between 16:00 to 18:00Pm in the afternoon.It was done with collaboration of 3 scout members of the national park. Mammals was visually detected (medium sized or large sized mammals).The transect line which had a length and width of 5km.X100m respectively covering an area of 0.5sq.km. When individual mammals were spotted, It was identified depending on the knowledge of the researcher.

Some unknown species were met the counters. The researcher and the field assistants tried to find its local names and the scientific names had determined later with the help of the field guide book (Alden*etal,* 1995).The presence of the mammalian species were also detected using sign marks like foot prints,facesand vocalizations.

### 3.4.3 Data collection

The method of line transect counting was used for recording of the medium and large-sized mammalian species of the study area. Therecording the species in the study site was done by using necked eyes as well as binocular microscope (Erb.2005).As mentioned above there were 45 transect lines with 0.5km$^2$ area used in observation.

The presence or absence of mammalian species was gathered indirectly through identification of pellets (dung), foot prints, and calls of animals (Wemmer*et al*., 1996).When an individual animal was sighted, movement wasceased and begun to record species, habitat type, geographic location, number of individual species in group.This was done by collaborative work with the scout members and local guiders.

## 3.5. Data analysis

Speciesdiversity can be calculated using different equations.Here the Shannon _wiener index(H)is selected.

$$H = -\sum \left(\frac{ni}{N}\right) XIn \left(\frac{ni}{N}\right)$$

Where

ni=numbers of individuals of each species (the $i^{th}$ species) and

N=total number of individuals for the site, In = the natural log of the number

The evenness of species was calculated as

J=H/H max

Where Hmax=In(s) and S is the number of species

Chi square($X^{2)}$used to calculate habitat association of the mammalian species in the study area.

Abundance was estimated as Total number of individuals of species/sample block (Nigussie, 2009).

SPSS computer softwareused for chi-square analysis test the association of mammal species and their habitats (Flower and Cohen, 1990).

Simpsons similarity index (SI) was also computed to assessthe similarity between the habitats.

Where SI=nc/1+II+III

SI=Simpsons similarity index

C=the no of common species to all habitats

I=number of species in habitat one

II=number of species in habitat two

III=number of species in habitat three

## 4. Result

### 4.1 .Species composition

A total of 954 (433 dry and 521 wet seasons) individuals of mammals comprisedof 13species in five orders and eight families recorded for Gibe Sheleko National Park during the time of data collection. Among the identified species, two species ( Vervet monkey and Starks hare) were medium-sized mammals while the remaining were large-sized mammals. The largest number of species were recorded from order Artiodactla which contained five species and the followed by order primate and carnivore with three species (Table 1).

**Table 1:**Mammalian species recorded in Gibe sheleko national park

| **Local name** | **Common name** | **Scientific name** | **Order** | **Family** |
|---|---|---|---|---|
| Kebero | Common jackal | *Canisaureus* | Carnivora | Canidae |
| Midakwa | Grey duiker | *Sylvicapragrimmia* | Artiodactyla | Bovidae |
| Kerkero | Warthog | *Phacochoerusafricanus* | Artiodactyla | Suidae |
| Zinjero | Olive baboon | *PapioAnubis* | Primate | Cercopitheci |
| Gureza | Colobus monkey | *Colobusguereza* | Primate | Cercopitheci |
| Tinchel | Stark`s hare | *Lepusstarcki* | Lagomorpha | Leporidae |
| Jib | Striped-hyena | *Hyaenahyaena* | Carnivora | Hyaenidae |
| Dafarsa | Water buck | *Kobusellipsirynnus* | Artiodactyla | Bovidae |
| Asama | Pig | *Susscrofa* | Artiodactyla | Suidae |
| Gumare | Hippopotamus | *Hippopotamus amphibious* | Artiodactyla | Suidae |

| | | | | |
|---|---|---|---|---|
| Gumare | Hippopotamus | *Hippopotamus amphibious* | Artiodactyla | Suidae |
| Tota | Vervet Monkey | *Certopithicusaetopis* | Primate | Cercopitheci |
| Tirign | African civet | *Civettictiscivetta* | Carnivora | Viverridae |
| Jart | Crested porcupine | *Hystrixcristata* | Rodentia | Hystricidae |

## 4.2. Diversity indices of medium and large sized mammals

From the three blocks the highest mammalian diversity was recorded from Borer (H`=1.66) and with high evenness (J=0.67), the second was for Cheha, (H`=1.515 and J=0.61).The least diversity index was recordedfor Gibe Seriti (H`= 1.41) during dry seasons. During the wet seasons, the Gibe seriti had the highest mammalian diversity with the Shannon wiener diversity index (H`=1.4) and evenness (0.67). The least was Borer (H`=0.199 and J=0.85) (**Table 2**).

**Table 2:**Diversity (H`), evenness (J) and the abundance for the medium and large mammalian species in the three different blocks in the study area during dry and wet seasons

| | **No of species** | | **Abundance** | | **Diversity** | | **Evenness** | |
|---|---|---|---|---|---|---|---|---|
| **Habitat type** | Wet | Dry | Wet | Dry | wet | Dry | Wet | Dry |
| Borer | 10 | 12 | 153 | 139 | 0.199 | 1.66 | 0.85 | 0.67 |
| Gibe seriti | 8 | 10 | 228 | 191 | 1.4 | 1.41 | 0.67 | 0.61 |
| Cheha | 9 | 12 | 140 | 103 | 1.35 | 1.515 | 0.62 | 0.61 |

For the combined seasons, Cheha has the highest diversity index with the Shannon-weiner index (H`=1.43) and evenness (J=0.615). The second was Gibe Seriti (H`=1.4 and J=0.64). The least diversity was recorded in Borer with H`=0.88 and J=0.0.76 for combined seasons.(Table-3)

**Table 3:**Diversity indices (H`), evenness (J) and the abundance for medium and large sized mammalian species in the three different blocks in the study areas during both seasons

| Habitat type | Number of species | Abundance | Diversity | Evenness |
|---|---|---|---|---|
| Borer | 12 | 292 | 0.88 | 0.76 |
| Gibe seriti | 13 | 319 | 1.4 | 0.64 |
| Cheha | 12 | 243 | 1.43 | 0.615 |

## 4.3. Distribution of mammals observed in the different blocks of the study area

Of the observed mammals in the study area 10 species were identified by directobservation. Theother 3 were recorded by indirect method (sound and faces) (Table 6). All the 12 species were recorded in all the study blocks (Table 4)

**Table 4:** Distribution of medium and large sized mammals along the study blocks observed in the study area

| **Species** | **Identification ways** | **Habitat type** | | |
|---|---|---|---|---|
| | | Borer | Cheha | Gibe seriti |
| Common jackal | Visual | √ | √ | √ |

| | | | | |
|---|---|---|---|---|
| Grey duiker | Visual | √ | √ | √ |
| Warthog | Visual | √ | √ | √ |
| Olive baboon | Visual | √ | √ | √ |
| Colobus monkey | Visual | √ | √ | √ |
| Stark`s hare | Visual | √ | √ | √ |
| Striped hyena | Sound | √ | √ | √ |
| Water buck | Visual | √ | √ | √ |
| Pig | Visual/ faces | √ | √ | √ |
| Hippopotamus | Visual | - | - | √ |
| Monkey | Visual | √ | √ | √ |
| African civet | Faces | √ | √ | √ |
| Crested porcupine | Dugs/faces | √ | √ | √ |

√ stands for the presencceof the Animal._ stands for the absence

## 4.4. Commonness of mammals

Based on occurrence degree of observation in the study area, the medium large sized mammals were grouped into common, un common and rare (Table 5),Out of the 13-mammalian species recorded in the study area, 23.07 % was un common,53.84 % were common and 23.07%were rare**.(**Table 5).

**Table 5:**The occurrence of medium and large sized mammalian the study area

| **Common** | **Uncommon** | **Rare** |
|---|---|---|
| *Canisaureus* | *Sylvicapragrammia* | *Colobus monkey* |
| *Phacochoerusafricanus* | | *Hyenahyaena* |
| *PapioAnubis* | | *Kobusellipsirynnus* |
| *Certopithicusaetopis* | | |
| *Sussacrofa* | | |
| Crested porcupine | | |

## 4.5 Species richness

During the dry season, the highest number of mammalian species was recorded in Borer and cheha blocks followed by Gibe Seriti which contained 10 species. The least number of mammalian species was recorded in Gibe Seriti. For combined seasons, Gibe contained 13 species Cheha 12 species and the least number of species was observed in Borer(Table 8).

During the wet season, the highest number of mammalian species was recorded in Borer, followed by Cheha which contained nine species. The least number of mammalian spp. was recorded in Gibe seriti which contain eight species. For combined seasons, Borer contain 12 species, Gibe seriti 13species. The least number of species was observed in both borer and Cheha blocks **(**Table 6).

**Table 6:** Number of mammalian species in different habitat type in both seasons

| Number | Habitats | Species distribution | | Species composition |
|---|---|---|---|---|
| | | Dry | Wet | For combined seasons |
| 1 | Borer | 12 | 10 | 12 |
| 2 | Cheha | 12 | 9 | 12 |
| 3 | Gibe | 10 | 8 | 13 |

## 4.6. Abundance

Among the individuals of medium and large sized mammals recorded in the wet seasons, the most abundant species and was Olive baboon (41.27 %) followed by Pig (20.45%) and vervet monkey (14.44%) during wet seasons.(Table 7)

**Figure 6**The olive baboon in the study area (Photo by YosefBekele, 2017)

From 481 individuals recorded in the dry seasons the most abundant species was olive baboon (41.49%) followed by Monkey spp. (22.4%) and Hippopotamus (15.14%)was the third most

abundant in the study area. During combined seasons olive baboon 41.38 %, Vervet Monkey (18.42%),Hippopotamus (12.35%) were the most abundant and the hyena0.58%,the water buck 0.67% are the least abundant species in the study area (Table 7 ).

**Table 7:**Total number of medium and large-sized mammalian species recorded in the study area and their relative abundance during wet and dry seasons**.**However the indirectly observed mammals were not mentioned on the table.

| **Species** | **Total record** | | **Relative abundance (%)** | |
|---|---|---|---|---|
| **Total record** | | | | |
| | Wet | Dry | Wet | Dry |
| **Common jackal** | 0 | 13 | 0 | 2.5 |
| **Grey duiker** | 11 | 5 | 2 | 1.15 |
| **Warthog** | 43 | 34 | 8 | 7.8 |
| **Olive baboon** | 220 | 200 | 50 | 46.51 |
| **Colobus Monkey** | 3 | 4 | 0.6 | 0.9 |
| **Stripped hyena** | 3 | 7 | 0.6 | 1.6 |
| **Water buck** | 4 | 2 | 0.8 | 0.46 |
| **Pig** | 109 | 7 | 20.9 | 1.6 |
| **Hippopotamus** | 51 | 73 | 9 | 16.85 |
| **Vervet monkey** | 77 | 88 | 14 | 20.32 |
| **Total(10)** | 521 | 433 | 100 | 100 |

The highest number of individuals of medium sized & large sized mammalian were recorded from Gibe seriti (228 individuals), followed by Borer (153 individuals) during the wet season. During the dry season, more numbers of individuals were recorded from Gibe Seriti (191individuals)during dry seasons followed by borer (139individuals) and Cheha contain 103 individuals (Table8).

**Table 8:**Numbers of medium and large sized mammalian species in each habitat type during Wet and Dry seasons.

| **Species** | **Study blocks** | | | | | |
|---|---|---|---|---|---|---|
| | Borer | | Gibe seriti | | Cheha | |
| | Wet | Dry | Wet | Dry | Wet | Dry |
| **Common jackal** | 0 | 7 | 0 | 2 | 0 | 4 |
| **Grey duiker** | 3 | 2 | 5 | 1 | 3 | 2 |
| **Warthog** | 19 | 15 | 13 | 10 | 11 | 9 |
| **Olive baboon** | 74 | 67 | 69 | 62 | 77 | 71 |
| **Colobus baboon** | 0 | 1 | 2 | 1 | 1 | 2 |
| **Stripped hyena** | 1 | 2 | 1 | 0 | 1 | 5 |
| **water buck** | 1 | 1 | 0 | 0 | 3 | 1 |
| **(Pig)** | 11 | 5 | 87 | 0 | 11 | 2 |
| **Hippopotamus** | 0 | 0 | 51 | 73 | 0 | 0 |
| **Vevet monkey** | 44 | 39 | 0 | 42 | 33 | 7 |
| **Total(10)** | 153 | 139 | 228 | 191 | 140 | 103 |

## 4.7Distribution of mammals in the study blocks

During the wet season, mammalian species were very similar between Borer and Cheha blocks (SI= 0.475), followed by Gibe Seriti and Cheha blocks (SI= 0.470), whereas the SI between Borer and Gibe Seriti block was 0.33. However, the SI between Borer and Cheha during dry season was 0.50. The least similarity between Cheha and Gibe is (SI=0.41)(wet=521 and dry=433) ($x^2$=0.00438, df=1, P <0.05), woodland (wet=293, dry=242) ($x^2$ =0.0274, df=1, P<0.05) and the riverine woodland (wet=228, dry=191) ($x^2$=0.0706, df=1, P>0.05). The seasonal variation in Gibe Seriti was not significant. But the variation seen in woodland habitats was significant (Table 9).

**Table 9:**Similarity of medium and large-sized mammalian species between habitats during wet and dry seasons

| | **Study blocks** | | | | | |
|---|---|---|---|---|---|---|
| | Borer | | Gibe seriti | | Cheha | |
| | Wet | Dry | Wet | Dry | Wet | Dry |
| **Borer** | - | - | 0.33 | 0.41 | 0.475 | 0.50 |
| **Gibe seriti** | - | - | - | - | 0.470 | 0.40 |
| **Cheha** | - | - | - | - | - | - |

During combined seasons, the highest similarity of medium and large sized mammalian species was seen between Borer and Cheha (0.485).This followed by Gibe Seriti and Cheha. The least was in between Gibe seriti and Borer. Total dry *is 481 and total wet is 541* (**Table 10**).

**Table 10:**Similarity of medium and large sized mammals during combined seasons

| | **Study blocks** | | |
|---|---|---|---|
| | Borer | Gibe seriti | Cheha |
| **Borer** | - | 0.365 | 0.485 |
| **Gibe seriti** | - | - | 0.435 |

## 5. Discussion

The present study identified and recorded 13 species of medium and large- sized mammals from a total of 954 wet 521 and dry 433 individuals of mammals observed during the study period. The number of species recorded from Gibe Sheleko national park is less compared to the number of mammalian species recorded with a similar study in other newly established protected areas of Ethiopia. For example, from a survey conducted in Datiwolel national park (Gonfa*et al*, 2015) recorded 28 species of mammals. Similarly, Negeri*et al*. (2015), identified 24 species of medium and large-sized mammalian species from Baroye controlled hunting area, Ilubabor Zone, south west Ethiopia. But, the number of species identified with this preliminary study does not represent the exhaustive list of mammals that may occur in the area; detailed investigations definitely add more species from this National Park.

Among the three representative blocks of the study area, the highest diversity index (H`=1.43) and evenness (J=0.615) of medium and large-sized mammals were recorded in Cheha followed by Gibe seriti (H`=1.4, J=0.64) for combined seasons.This might due to the presence of sufficient water and food in these blocks when compared with theother blocks. The presence of different plant species in Cheha might account for high species diversity index.

The availability of mixed plant species directly influences the species diversity among mammals.Studies have also showed that homogenous conditions yield lower diversity while heterogeneous conditions yield higher diversity(Alatolo, 1981, Conroy, Mekonin*et al., 2011* and Nichols 1996). Chane (2010) has reported high diversity index and evenness of medium and large-sized mammals from Woodland and Riverine forest in Borena-Sayint National Park, south Wollo, Ethiopia.

The most abundant species in the study area was Olive baboon (50%) and large numbers were recorded in the Cheha and the second was vervet monkey (20.3%). The high abundance of primates (olive baboon and VervetMonkey) in the study block might be associated with vegetation cover, especially the riverine wood and availability of food and water. Vervet monkeys and Olive baboons are abundant in areas with sufficient food and water (Enstam, and Isbell, 2007; McDougal *et al.,* 2010).

The least abundant medium and large sized mammal species from the recorded area were water buck, hyena and Colobus Monkey. This is because of their territorial behavior. They are highly sensitive to ecological disturbance (Neivergelt, 1998). The low abundance of the hyena is due to its nocturnal behavior and killing by the local peoples due to its attacking domestic animals. Some mammals need dense forest to live (Girma,2006). Agriculture ,resource extraction and extensive usage of natural resources may affect the settlement of some organisms (Foley et al,2005).The other is the grazing effect of domestic animals can have strong impact on native wild life's (Aagesen,2000). The availability of mixed plant species is one of the major factors that determine the diversity of mammalian in an area (Mathew and Rahamatthulla, 1993). Heterogeneous plant species available in the study area might be the main reason for high diversity index of these two habitats. The highest number in the Gibe seriti was because of the presence of satisfactory resources and less impact of domestic animals and human activities for agriculture, hunting and other affecting external and intrinsic impacts (Hassan *et al*,2008*).*

Mammalian species like common jackal, grey duiker, warthog, olive baboon, Stark's hare, hyena, water buck and pigs were observed and recorded in all habitat types. The distribution of these mammals in all habitats is because of their adaptation to variety of habitat type. However Hippopotamuses were common in Gibe Seriti. This is because of its behavior that it prefers the

site where water is present (Smith, 1992).The distribution of mammals in the study area explains that the mammalian fauna is not uniform across the three habitat types in the study area.

The highest similarity for combined seasons of medium and large-sized mammals was obtained from Borer and Cheha(0.485).This is because of the reduced impacts of disturbing factors of two habitats by human being and live stocks. The least spp. similarity was obtained from Borer and Gibe Seriti (0.365). This might be due to difference in the availability of food and other resources to join the mammalian requirement. Finally the mammals in the Gibe Sheleko national park are under different challenges. The challenges were the human activities like hunting, forest fire, overgrazing by domestic animals and cutting forest for different uses illegally. Therefore the mammals live under unstable habitat. Some mammalian species which are sensitive for unstable habitats can migrate to other areas .For example cheetah cannot found in the area recently. The reason was the over hunting of the mammal for cultural use made it to disappear from the area. The next is the expansion of farmers in the park and building of shelters in park resulted with habitat loss. The forest fire had great contribution on the reduction of number of mammals in the park.

# 6. Conclusion and recommendation

## 6.1 Conclusion

The study identified and recorded 13 species of medium and large sized mammals in Gibe sheleko national park, Gurage zone, and south nation's nationality regional state. The investigation provided current information about their presence. No observation was conducted in the past. So this is the pioneer investigation for the research area. The current investigation belongs to 13 species of medium and large sized mammalian under 5 orders. There were difference in diversity, abundance and distribution. This is because of differences in vegetation, availability of food and living and nonliving factors. Small variation in species diversity was observed among the three major habitat types in the study area during the present study.

## 6.2 Recommendation

- One of the recently established national parks in Ethiopia is the Gibe National park. It is very important national park in terms of its medium sized and large sized mammalian species .The following recommendations are suggested for better attention and conservation of mammalian species in the study area.
- From mammalian recorded in the study area, Starks `hare was the endemic in Ethiopia. So it requires great deal by the society and all of the concerned body.
- This study focused on abundance, diversity and distribution and habitat association of the medium and large sized mammals. So it cannot give complete information about the number and abundance of the medium sized and large sized mammals of the study area. Therefore further findings should be conducted.
- There are scout members in the study area. Increasing and updating the knowledge of these members about how to handle, protect and count these mammalian spp.Will provide great support to the mammalian diversity in the study area.
- The contribution of the society, the government and the concerned people (being) should be increased to protect the national park from different damaging activities. So generally it requires exhaustive job to study more about the mammalian diversity in the study area.

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## Appendix-**1:** DATA COLLECTION FORMAT

NAME OF THE PARK_____

INFORMANT BLOCK_____

NAME OF THE RESEARCHER_____

NAME OF SCOUT (CO WORKER)_____

VEGATATION TYPE_____

RESEARCH SEASON _____

SITE_____

| AFTERNOON | LOCAL NAMEOF ORGANISM | SIENTIFIC NAME | MAMMAL TYPE | | | |
|---|---|---|---|---|---|---|
| | | | MALE | FEMALE | SMALL | LARGE |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Appendix-2:** Row data of mammalian species recorded throughout the study period from different study site

| Species | Habitat | | |
|---|---|---|---|
| | Riverinne | Woodland | |
| | Gibeseriti | Borer | *Cheha* |
| Common jackal | 1 | 3 | *2* |
| | 1 | 3 | *1* |
| | - | 1 | *1* |
| Greyduiker | 5 | 1 | 2 |
| | 0 | 2 | 1 |
| | 0 | 1 | 1 |
| | 1 | 1 | 1 |
| Warthog | 5 | 8 | 4 |
| | 5 | 7 | 5 |
| | 6 | 9 | 5 |
| | 7 | 10 | 6 |
| Olive baboon | 32 | 32 | 36 |
| | 30 | 35 | 35 |
| | 34 | 34 | 36 |
| | 35 | 40 | 41 |
| Coloubusbaboon | 1 | 1 | 1 |
| | 0 | 0 | 1 |

| | | | |
|---|---|---|---|
| | 1 | 0 | 1 |
| | 1 | 0 | 0 |
| Starks hare | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| Non spotted hyena | 0 | 0 | 0 |
| Non spotted hyena | 1 | 1 | 1 |
| | 0 | 1 | 3 |
| | 0 | 1 | 2 |
| Water buck | 0 | 0 | 1 |
| | 2 | 1 | 2 |
| | 0 | 1 | 1 |
| Pig | 0 | 0 | 0 |
| | 0 | 5 | 2 |
| | 42 | 6 | 5 |
| | 45 | 5 | 6 |
| Hippo | 31 | - | - |
| | 20 | - | - |
| | 33 | - | - |
| | 40 | - | - |
| Vervet monkey | 18 | 19 | 3 |
| | 24 | 20 | 4 |

| | | | |
|---|---|---|---|
| | 0 | 24 | 11 |
| | 0 | 20 | 22 |
| African civet | | | |
| | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| Jart | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| | | | |

## **Appendix 3:** DATA COLLECTION FORMAT

NAME OF THE PARK_____

INFORMANT BLOCK_____

NAME OF THE RESEARCHER_____

NAME OF SCOUT(CO WORKER)_____

VEGATATION TYPE_____

RESEARCH SEASON _____

SITE_____

| AFTERNOON | LOCAL NAMEOF ORGANISM | SIENTIFIC NAME | MAMMAL TYPE | | | |
|---|---|---|---|---|---|---|
| | | | MALE | FEMALE | SMALL | LARGE |
| | | | | | | |
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## Appendix-4

**Row data of mammalian species recorded throughout the study period from different study site**

| Species | Habitat | | |
|---|---|---|---|
| | Riverinne | Woodland | |
| | Gibeseriti | Borer | Cheha |
| Common jackal | 1 | 3 | 2 |
| | 1 | 3 | 1 |
| | - | 1 | 1 |
| Greyduiker | 5 | 8 | 5 |
| | 5 | 7 | 4 |
| | 6 | 9 | 6 |
| | 6 | 10 | 5 |
| Warthog | 5 | 8 | 4 |
| | 5 | 7 | 5 |
| | 6 | 9 | 5 |
| | 7 | 10 | 6 |
| Olive baboon | 32 | 32 | 36 |
| | 30 | 35 | 35 |
| | 34 | 34 | 36 |
| | 35 | 40 | 41 |
| Coloubusbaboon | 1 | 1 | 1 |
| | 0 | 0 | 1 |
| | 1 | 0 | 1 |
| | 1 | 0 | 0 |
| Starks hare | 1 | 1 | 1 |
| | 0 | 1 | 1 |
| | 1 | 2 | 2 |
| | 1 | 1 | 1 |
| stripped hyena | 0 | 0 | 0 |

| | | | |
|---|---|---|---|
| Stripped hyena | 1 | 1 | 1 |
| | 0 | 1 | 3 |
| | 0 | 1 | 2 |
| Water buck | 0 | 0 | 1 |
| | 2 | 1 | 2 |
| | 0 | 1 | 1 |
| Pig | 0 | 0 | 0 |
| | 0 | 5 | 2 |
| | 42 | 6 | 5 |
| | 45 | 5 | 6 |
| Hippo | 31 | - | - |
| | 20 | - | - |
| | 33 | - | - |
| | 40 | - | - |
| Vervet monkey | 18 | 19 | 3 |
| | 24 | 20 | 4 |
| | 0 | 24 | 11 |
| | 0 | 20 | 22 |
| African civet | | | |
| | 0 | | |
| | 0 | | - |
| | 0 | | - |
| Jart | | | |
| | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| | 0 | 0 | 0 |
| | | | |

## Appendix-5

**Large and medium sized mammals in the study area (Gibe sheleko national park)(photo by YosefBekele)**

Warthogs in the borer (woodland), photograph by yosefBekele(2017)

***The olive baboon in Gibe seriti(Photo by Yosef Bekele,2017)***

*Hippopotamuse in Gibe sheleko*

*Vervet monkey in Gibe shelekonational park particularly in cheha,Photo by Yosef 2017.*

*colobus monkey in Gibe sheleko national park 2017. Photo by YosefBekele*

Pig in gibe seriti site 2017, photo by YosefBekele

Grey duiker in Gibe sheleko national park particularly in Gibe seriti. 2017 photo by Yosef B

*The common jackal in Borer study site,2017 photograph by Yosef Bekele*

*The stripped Hyna in Cheha study site,2017 photo by Yosef Bekele*

The water buck in Gibe Seriti study site photo by YosefBekele (2017).