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Species composition, relative abundance and habitat association of rodents in Yekoche Forest, East Gojjam, Ethiopia

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A study on species composition, relative abundance and habitat association of rodents in Yekoche Forest was carried out from September, 2014 to April, 2015 during both wet and dry seasons. Data were collected using live trap and snap trap. A total of 841 individual of rodents were trapped using both live trap and snap trap. Rodent species such as yellow spotted brush-furred rate (*Lophuromys flavopunctatus)* (24.5%), African grass rat (*Arvicanthis niloticus)*, (23.5%), Broad beaked dolphins (*Pelomys harringtoni*) (19.1%), Ethiopian narrow headed rat (*Stenocephalemys albicaudata)* (20.7%) and house mouse (*Mus musculus)* (12.1%) were recorded. Most of the rodent species prefer Acacia grassland habitats and agricultural farmland. Bushland and riverine vegetation provided less number of rodent individuals. Highest numbers of rodents were recorded during the wet season (56.8%) than the dry season (43.2%). All age groups were represented in the population of the captured species. Abundance of rodents was significantly differed between dry and wet seasons. The study area was highly affected by human activity, as a result rodents species were reduced. Therefore, community based conservation need to be implemented in the study area.

Key words: Habitat association, relative abundance, rodents, species diversity, Yekoche Forest.

INTRODUCTION

Rodents are the most successful mammals. They show great diversity in their ecology, morphology, physiology, behavior and life history strategies. The order Rodentia comprises the largest in mammalian species (Kingdon, 1997). Of the total rodent species of the country, 21% are endemic. Muridae family covers 57 species (84%) of the overall species (Afework and ZCorti, 1997). Rodents are adapted to wide range of environments (Nowak, 1999). They are highly successful mammals in different environments all over the world. Their success is probably due to their smaller size, having short breeding cycle and wide variety of food items. The way rodents select their habitats mainly depend on the vegetation type and life history strategies (Fitzherbert et al., 2007).

The distribution and abundance of rodents are influenced by environmental factors such as nature and

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density of vegetation, climatic conditions, disease, predication and habitat utilization by humans (Johnson and Horn, 2008). Absence of sufficient food and ground cover largely determine the number of individual rodents in a certain area. The loss of ground vegetation leads to decreasing rodents diversity but increasing predation risk (Hoffmann and Zeller, 2005).

Rodents live in different micro habitats. Some rodents spend their entire life in the underground tunnel systems. Others such as the ground squirrels dig extensive burrow systems used for resting and caring for their young, whereas few are arboreal. Some are gliders and others are adapted for semi-aquatic life (Nowak, 1999; Wright et al., 2002).

Rodents often respond rapidly to changes in habitat structures such as plant composition and ground cover (Leis et al., 2008). Their diversity tends to be lower in open habitats; this is due to reduction of habitats and food resources (Silva et al., 2005).

Habitats with increased structural heterogeneity have a positive influence on rodents abundance and richness (Ecke et al., 2002). Even though, habitat disturbance is associated with decreased rodent species richness (Avenant and Cavallini, 2007). Habitat selection provide that a useful way to determine how different species respond to environmental heterogeneity (Nowak, 1999). Habitat selection of rodents has an adaptive basis, this is due to individuals choosing high quality habitat have a reproductive advantage over in low quality habitats. This eventually would lead to particular species being more abundant in some habitats than others (Cramer and Willig, 2002).

Therefore, the present study aimed to assess species composition, relative abundance and habitat association of rodents in Yekoche Forest east Gojjam, Ethiopia.

MATERIALS AND METHODS

Description of the study area

Yekoche Forest is found in East Gojjam Zone, Amhara National Regional State and located at about 304 km northwest of Addis Ababa and 5 km northwest of Debre Markos town. It is located in between 10°21'52'' N latitude and 37°42'23'' E longitudes, minimum altitude of the area is 2355 m. a. s. l. and maximum altitude 2482 m.a.s.l (Figure 1). The study area represents one of the most beautiful natural areas in Gozamen woreda. Originally, the area of Yekoche Forest was large but recently it is reduced from 160 to 100 ha, this is due to agricultural encroachment (GWAO, 2010). Currently, the wildlife found in this area decreasing from time to time due to poaching and loss of habitat by human activities (EGZAO, 2010) (Figure 1).

Trapping

A permanent 4900 m^2 live trapping grid was established in each selected habitat types for three consecutive days and nights. The selection of different habitats was based on vegetation composition of the study area. The selected habitats were agricultural farmland, riverine vegetation, bush land and Acacia grassland. In each trapping site, standard square (seven rows by seven columns) trapping grids were established during wet and dry seasons (Linzey and Kesner, 1997). A total of 49 live traps were set per grid at every 10 m interval between points during both dry and wet seasons. Peanut butter was used as bait. To prevent the trap from cold weather and damage by other wild animals, the traps were covered with leaves and grasses. The traps were checked twice per a day early morning (between 06: 00 and 07:00 h) and late afternoon (between 17:00 and 18:00 h). Rodents caught from 06:00 to 18:00 h were recorded as a day trappings and those caught from 18:00 to 06:00 h as night trappings. Each trapped rodent was, identified, marked by toe clipping and released back to the site from where it was trapped (Linzey and Kenser, 1997).

Snap traps were also set during both wet and dry seasons, the skin and skull voucher of representative snap-trapped rodents were prepared and brought to the Zoological National History Museum of Addis Ababa University for identification purpose. Snap traps were shifted randomly during each trapping sessions in order to assess rodent species that might exist in the habitats. Trapped rodents were dissected and the number of embryos in the left and right uterine horns of pregnant females was counted. Grids in the study area contained 25 snap traps in a 5×5 alignment. Each snap trap was spaced at about 10 m interval along five transect lines in all habitat types. Snap traps were also baited with peanut butter and checked twice a day. The traps were labeled with consecutive numbers. Trapping was done for three consecutive days and nights during both wet and dry seasons.

Data analysis

The collected data were analyzed using SPSS statistical software version 20 and Microsoft Excel. Chi-square test was used to test the variation between sex of individuals. One-way ANOVA was used to test the significant variation among rodents caught across different season and habitats. Species richness and diversity were computed by using Shannon-Weaver Diversity Index (Shannon and Weaver, 1949). The species diversity is important to know which species is highly distributed and can be calculated by using the formula $H' = \Sigma (Pi) \ln (pi)$.

RESULTS

Species composition

A total of 841 individuals rodents were trapped during in both wet and dry seasons. They belong to five different species. The species were Ethiopian narrow headed rat (*Stenocephalemys albicaudata),* broad beaked dolphins *(Pelomys harringtoni),* African grass rat *(Arvicanthis niloticus),* yellow- spotted bush-furred rat *(Lophuromys flavopunctatus)* and house mouse (*Mus musculus). L. flavopunctatus* had (24.5%) the highest relative abundance whereas *M. musculus* had the least (12.1%) (Table 1).

Habitat association

Most species were trapped from Acacia grassland (47.5%) habitat, whereas the least number of species were recorded from riverine vegetation (5.1%). There

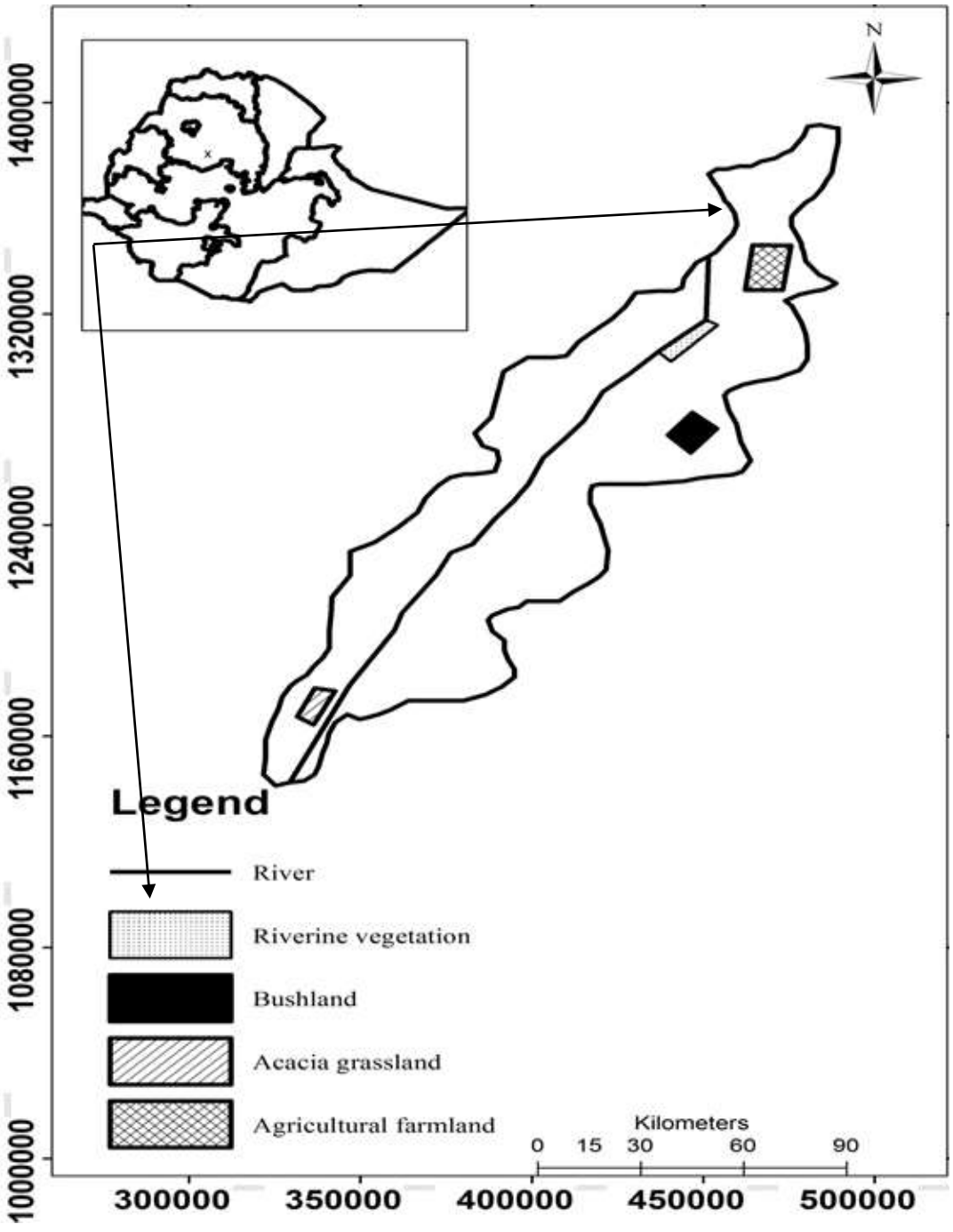

Figure 1. Map of the study area.

were was significant difference of rodents species in difference habitat (F= 7017.7 ,P < 0.05) (Figure 2).

Seasonal variation

In wet season L. flavopunctatus (14.2%) was highly recorded where as M. musculus had the least proportion (7.3%). In dry season A. niloticus (12.2%) was highly recorded whereas M. musculus was the least recorded (4.8%). There was significant difference among species across different seasons (F= 0.124, P < 0.05) (Figure 3). At day time the number of rodents species were varied, *L. flavopunctatus* (15.8%) was highly recorded whereas *Mus musculus* was the least (7.6%). During the night time the numbers of captured rodents were varied. The

Table 1. Rodent species and their relative abundance in the study area.

Species	Total number of individual	Relative abundance (%)
Lophuromys flavopunctatus	206	24.5
Arvicanthis niloticus	198	23.5
Pelomys harringtoni	161	19.2
Stenocephalemys albicaudata	174	20.7
Mus musculus	102	12.1

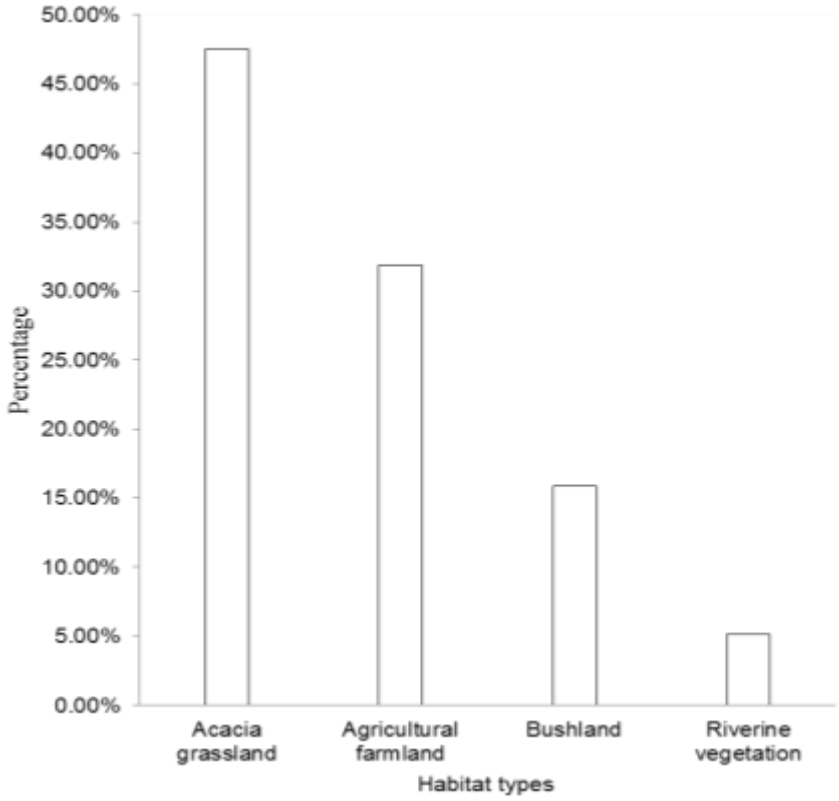

Figure 2. Percentage of species trapped in difference habitats.

numbers of L. *flavopunctatus (*15.8%) were higher than others, whereas *M. musculus* (4.5%) were the least abundant species. There was significant difference of rodents species across difference time (F= 1605.5, P < 0.05) (Figure 4).

Sex ratio and age structure

The numbers of captured female rodents were 54.5% and the remaining 45.5% were males. In both seasons the sex ratio of females was higher than males. There was variation; the variation was statistically significant among different sex (χ^2= 41.3, df = 1, P< 0.05). In both wet and dry seasons sub adult had 46.7% highly captured where as juveniles had the least value (17.5%). The majority of them were captured during the wet session (56.8%) and the remaining (43.2%) were captured during the dry season. There was significant difference among difference age groups (χ 2 = 88.1, df = 2, P < 0.05) (Figure 5).

DISCUSSION

Relative abundance of rodents

A total of 5 species of rodents were recorded during this

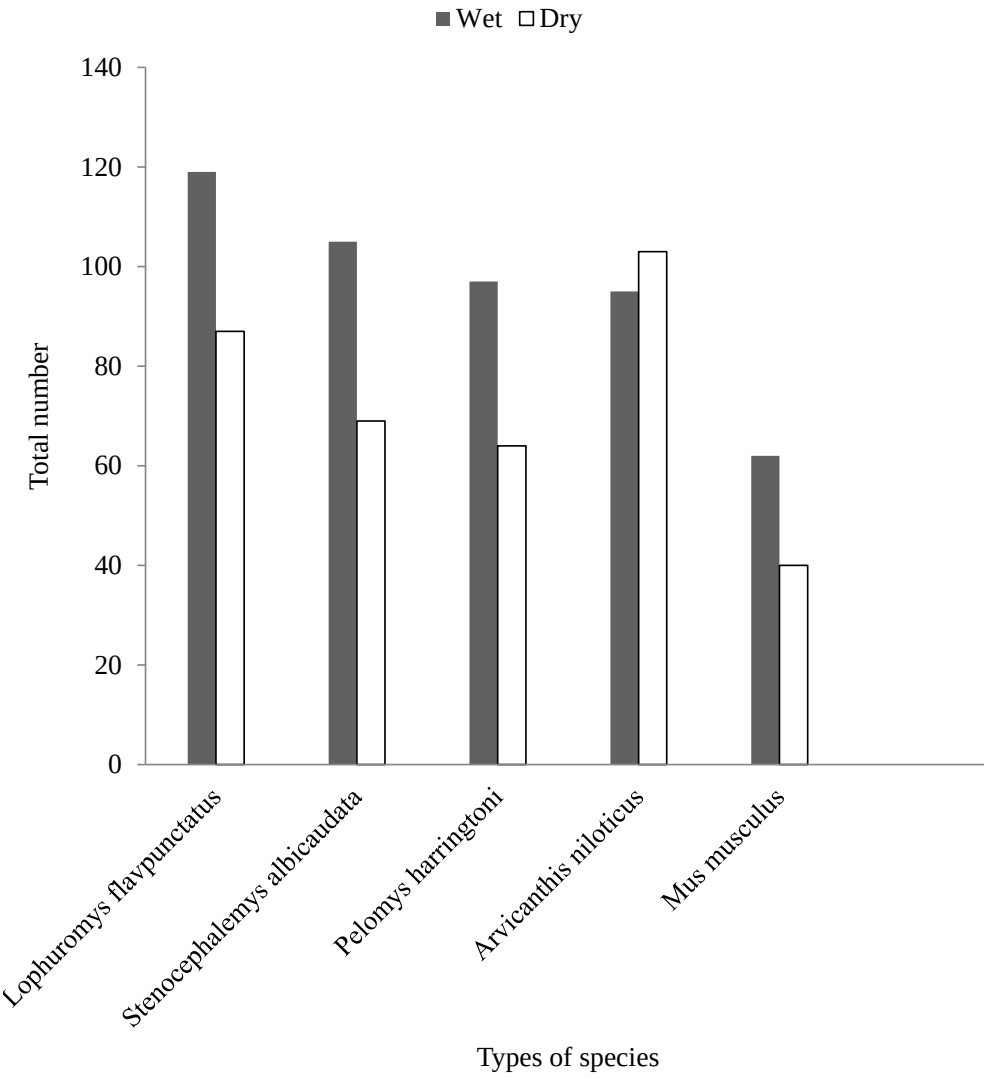

Figure 3. Total number of rodents species caught during wet and dry seasons across all habitats.

investigation. The number of *M. musculus (*12.1%) from the present investigation was the least interims of number and diversity. But the result was unexpected, as it is the most widespread rodent species in Ethiopia (Yalden, 1988). Demeke et al. (2007) described that the species was more abundant in agricultural farmland than bush habitats. Similarly, this species was abundant in the Acacia grassland than bush land habitat in the present study. The reduction of *M. musculus* might be food and other factors such as the nature and density of vegetation, climatic conditions, disease, predication and habitat utilization by humans, those factors were not comfortable for them.

During the present study *L. flavopunctatus* 24.5% was the first most abundant and widely occurring species of the total captured rodents. This agrees with the findings of Yalden (1988) in the Harena Forest, Bale Mountains National Park and in the Wondo Genet, Ethiopia, by Dawit and Afework (2008). *L. flavopunctatus* is the most widespread and numerous rodents in the moist area of East Africa. The species lives in different habitat types having dense vegetation (Clausnitzer et al., 2003). Yalden and Largen (1992) reported that the species was widely distributed in Ethiopia inhabiting both scrub and forest habitats. In the present study, the species has generalized distribution encountering in all habitats. The findings of earlier studies have shown similar pattern of generalization throughout different habitats, especially in the moist massive forest (Delany, 1971; Juch, 2000). This might be attributed to the diverse feeding habit of the species (Hanney, 1964).

*Arvicanthis niloticus (*23.5%) was the second most abundant rodent species in the study area. Similarly a study conducted in Gambela and lower Omo Valley

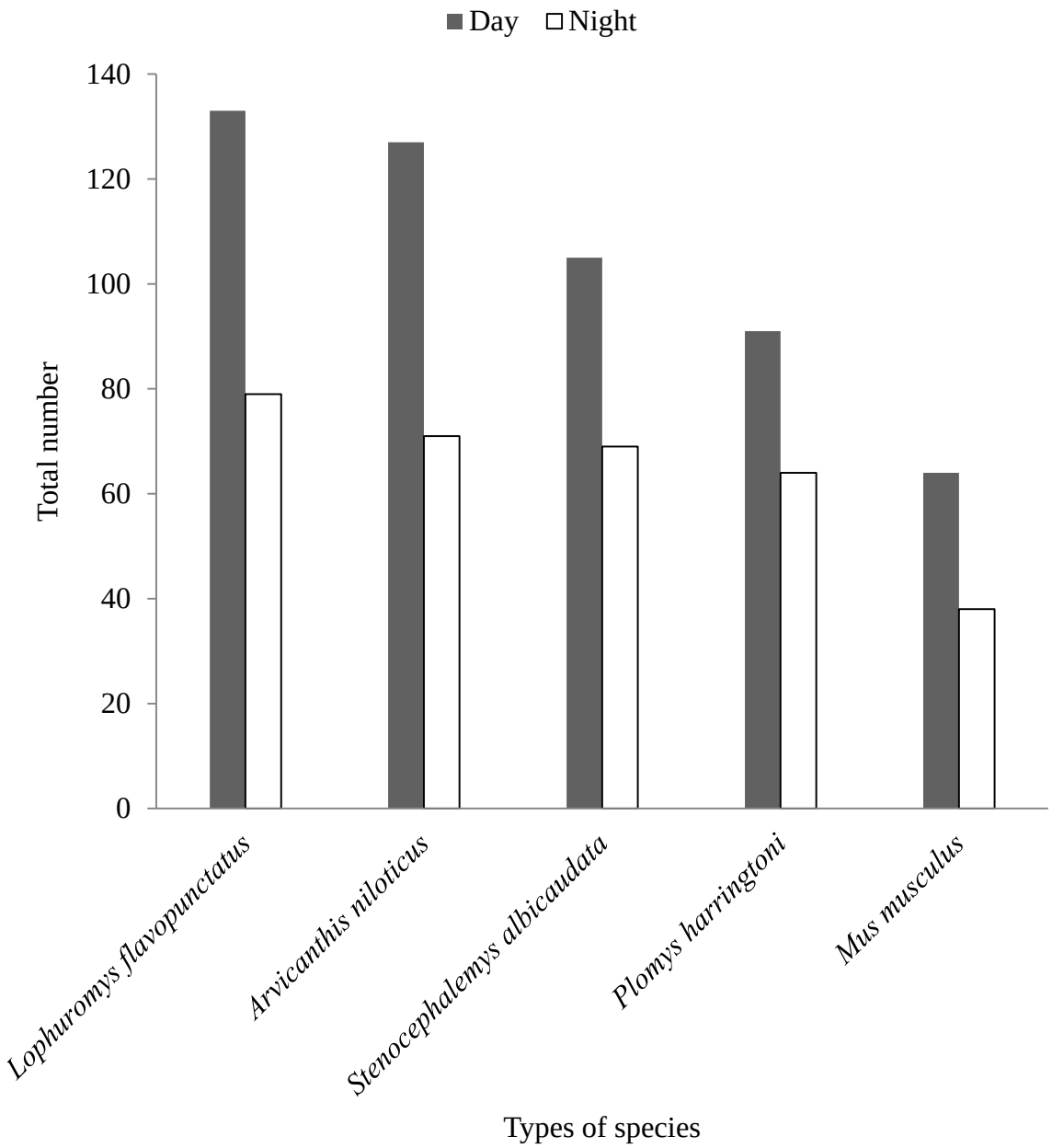

Figure 4. Number of rodents species caught during day and night time.

indicated that *A. niloticus* is a common species (Bulatova et al., 2002). In the present study, the species was recorded from all habitat types. They were also captured by both live and snap traps.

*Stenocephalemys albicaudata (*20.7%) was the third abundant species in the study area. Yalden and Largen (1992) described the species as one of the most common and abundant endemic rodent species in Ethiopia. In the present study this species was the most abundant in the Acacia grassland. The absence or reduction of *S. albicaudata* can serve as an indicator for reduction of Acacia grassland.

*Pelomys harringtoni (*19.2%) was the fourth abundant species in the present study area. This species practices arboreal and frequented forest habitats (Yalden and Largen, 1992). In the present study, the species was captured from all habitats. Like *S. albicaudata* the species was abundant in Acacia grassland. This might be due to the presence of enough food found in Acacia grassland. However, the number of *P. harringtoni* in the riverine vegetation was highly reduced; this might be due to the presence of enough food was not found in this study sites. The presence of *P. harringtoni* was reported by Afework (1996) from Menagesha State Forest, Ejigu

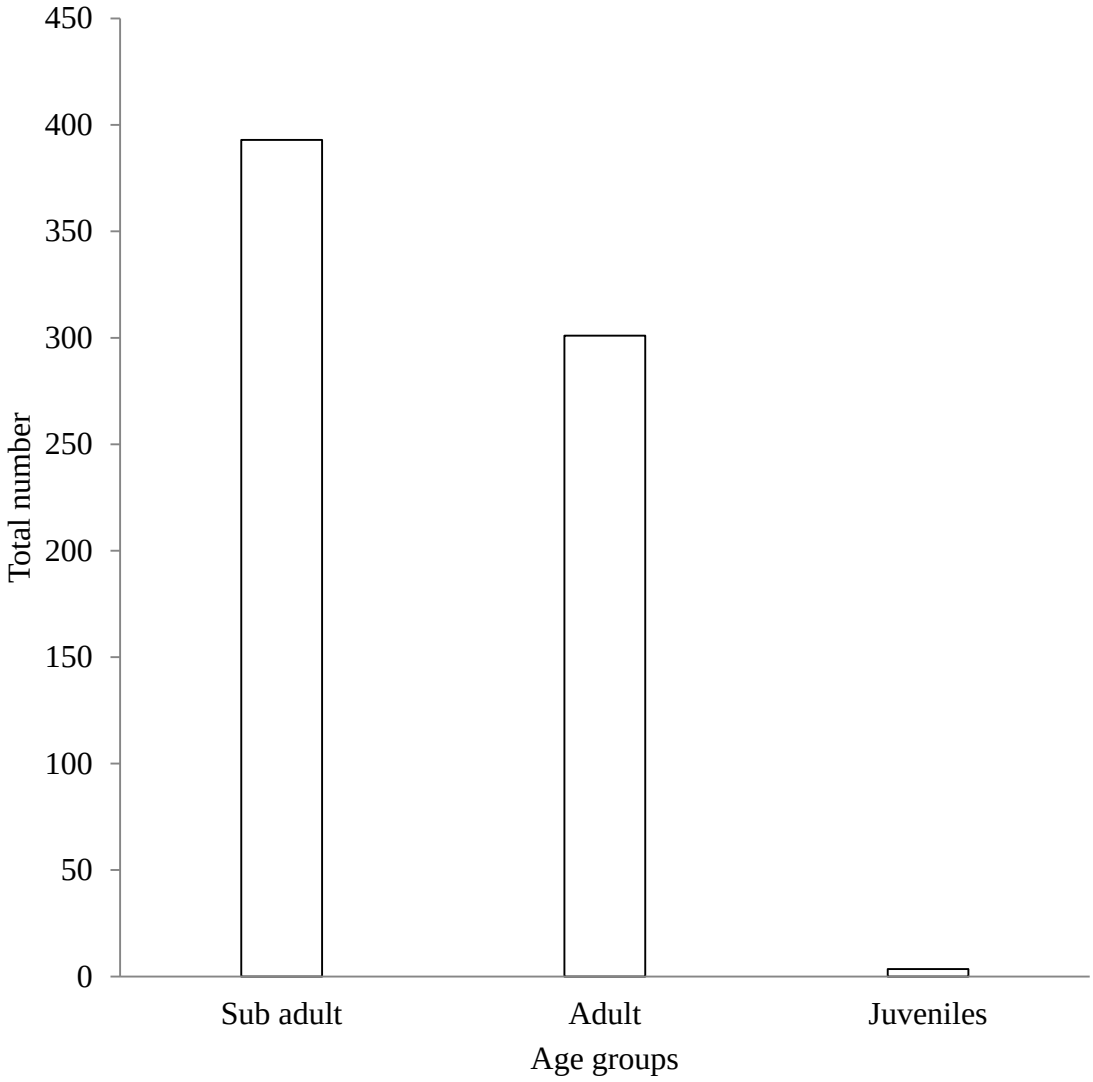

Figure 5. Age distribution of trapped rodents in all habitats.

(2008) from Birsheleko and nearby natural habitats and Eshetu (2008) from Donkoro Forest.

Seasonal variation

In both live and snap trap the numbers of rodents during wet season were higher than dry season. At the beginning of the wet season, newly regenerated grasses after harvest attracted rodent species because fresh grasses might be nutritionally high and easily edible. As noted by Mahlaba and Perrin (2003) rodents are known to respond to habitat quality such as food, vegetation cover and rainfall. Rainfall had a significant role for the occurrence of high population of rodents during the wet season. As noted by Mahlaba and Perrin (2003) rodents are known to respond to habitat quality such as food, vegetation cover and rainfall. Therefore, rainfall had a significant role for the occurrence of high population of rodents during the wet season.

Age structure and sex ratio

In both methods the numbers of sub adults were higher than juveniles and adults respectively. This might be due to factors that affect the distribution of rodents do not affect sub adults. Out of the 841 trapped rodents by both live and snap trap during all trapping sessions, males and females comprised 383 and 458 respectively. From this the numbers of females were higher than males. This might be the factors that affect rodents distribution like food, predication, climate and others comfortable for females than males. Most of the rodent species respond differently to different habitats during the wet and dry seasons. Habitat favorite and distribution of rodents in the

study area determined by the degree of ground cover, habitat structure and availability of food, plant species composition and other physical and biological variables. Yekoche Forest is one of the remnant forest priority areas in Gozamen woreda that is affected by humans due to agricultural expansion and fire wood production. Therefore, it is better to take responsibility of Gozamen worda agricultural office and Wonka Kebele people to practices restoration of the Forest through aforestation. Wonka Kebele administration and local people should take responsibility to reduce livestock grazing especially during the dry season.

Conflict of Interests

The authors have not declared any conflict of interests.

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