Journal of Coastal Life Medicine

journal homepage: www.jclmm.com

Original article doi: 10.12980/jclm.4.2016J6-95

Assessment of naked mole-rat distribution and threats in Eastern Ethiopia

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ARTICLE INFO

Article history:
Received 24 May 2016
Received in revised form 9 Jun 2016
Accepted 22 Jul 2016
Available online 3 Aug 2016

Keywords:
Naked mole-rat
Eastern Hararghe Zone
Somali National Regional State
Dire Dawa Administrative

ABSTRACT

Objective: To identify the distribution, threats and community attitudes towards naked mole-rat in Eastern Ethiopia.
Methods: Data were collected through direct observation and interview and *Chi*-square at 95% confidence interval was used for significance test.
Results: Naked mole-rat was identified in Fafan, City/Shinele, Eastern Hararghe Zone and Dire Dawa Administrative. The main threats of naked mole-rat identified were agricultural expansion, human killing and lack of awareness. From a total of 100 respondents, 92% of them considered naked mole-rat as pest as a result that 46% of them participated in direct killing. Literacy rate significantly affects the willingness to participate in the conservation of naked mole-rat ($\chi^2 = 7.478$, $df = 1$, $P < 0.05$). From a total of 26% respondents who did not show the willingness to participate in the conservation, 80.8% of them were illiterate.
Conclusions: Naked mole-rat is fairly common in many of the study sites. However, rapid shift from nomadic life style to cultivation of crops and lacks of awareness were the main threats of naked mole-rat. Therefore, since there is no conservation action currently, further comprehensive study is required to design conservation plan for this species.

1. Introduction

There are 84 species of rodents recorded from Ethiopia[1,2]. Diverse types of interactions with other organisms, adaptability to diverse habitats and variation in the food habits have been responsible for their success in wide geographic distribution.

Naked mole-rats (*Heterocephalus glaber*) are small rodents which belong to the order Rodentia (rodents), the family Bathyergidae, the genus *Heterocephalus*. It was first described in Ethiopia by German naturalist Eduard Rüppell (1842) in his studies documenting the African mammals[3]. The naked mole-rat is mammal because of body structure and lifecycle but it is unlike other mammals. It has very little body hair and is unable to maintain a constant body temperature when the environmental temperature changes more than a few degrees. It is essentially poikilothermic across ambient temperatures[4]. Furthermore, the naked mole-rat is unique among mammals because of its eusocial lifestyle like honey bee and ants[5,6].

Historically naked mole-rat has been found in Uganda and Tanzania. However, the current range of this species is in East Africa, namely, Ethiopia, Kenya and Somali[6,7]. It is native to Ethiopia found more in Eastern Oromia and Somali National Regional State with an altitudinal range of 400–1 500 m above sea level. The habitat of naked mole-rat is subterranean animal in grassland and savanna of East Africa. Naked mole-rat lives in arid habitats, characterized by high temperatures and low and irregular rainfall, which generally averages 200–400 mm/year[7]. Naked mole-rat is found most frequently in hard, consolidated and lateritic loams, although it can live in fine sand and pure gypsum[7,8]. Naked mole-rat feeds on geophytes plants such as root bulbs and tubers which are accessible underground and acquires all of its water need from the food it consumes[9]. Naked mole-rat is fascinating subterranean rodent that offers great promise in biomedical research such as cardiovascular disease, neurodegenerative illness (Alzheimer or Parkinson), immunology and cancer research[3,10]. It is the longest living rodent known (maximum lifespan potential > 28

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Foundation Project: Supported by Ethiopia Biodiversity Institute (Grant No. EBI-MOFED/08).
The journal implements double-blind peer review practiced by specially invited international editorial board members.

years) and is a unique model of successful aging showing attenuated declines in most physiological function[11]. In general, the naked mole-rat is promising mammal in biomedical research to save human life in the near future due to the following major characteristics. It lives ten times longer (30 years) than a mouse with similar body size which corresponds to 600 years for human and maintains its vascular system in perfect condition which doesn't develop cancer, and it has immune system that doesn't deteriorate and an extremely resistant brain to anoxic environment[10,11].

Therefore, conservation of this fascinating mammal is essential for future healthy life of human beings. However, expansion of agricultural activities and poor management of biodiversity along with lack of awareness about the importance of biodiversity by local community have been threatening the fauna of Ethiopia. This is also a case for native areas of naked mole-rat in Ethiopia such as Eastern Hararghe Zone, Dire Dawa Administrative and Somali National Regional State. According to Sherman and Jarvis[12], naked mole-rat lives in areas with little agriculture and minimal development so that it does not pose a significant agricultural pest. However, it does eat crops such as cassava and sweet potatoes, which are both important agricultural products, and expansion of agricultural activities into the range of this species could lead to the species being regarded as a pest. According to Dr. Frederic Saldmann, farmers developed techniques to kill naked mole-rat because of their crops damage complain and probably due to lack of awareness about the importance of this mammal. They killed the entire colony by pouring hot water onto their tunnels. Continued population monitoring of this eusocial species is necessary to propose conservation measure[13]. However, there has no research done on population status and threats of naked mole-rat in Ethiopia[7] despite its biology and distribution studied elsewhere. Therefore, it is necessary to assess the specific sites, the status, threats and community attitudes of naked mole-rat in Ethiopia.

2. Materials and methods

2.1. Study areas

The Somali National Regional State is the easternmost of the nine ethnic division of Ethiopia (Figure 1). It is geographically located in south-eastern part of Ethiopia, between 4° and 11° N latitude and 40° and 48° E longitude. The altitude of the region ranges between 400 and 1 600 m above sea level, with most areas lying below 900 m above sea level. It is bounded by Kenya, Somali, the Republic of Djibouti and Oromia National Regional State. The region covers a total area of 350 000 km^2 consisting of 9 administrative zones, 68 districts (Woredas). The zones include Jigjiga/Fafan, Shinele/City, Liban, Afder, Godey, Korahay, Warder, Dagahbrur/Jarar and Fik.

The region is remote with nomadic population inhabited and inadequate infrastructure. Based on the 2015 census conducted by the Central Statistical Agency of Ethiopia, it has 5 307 000 rural inhabitants accounting for 85.6% of the total population. Climatically, it is mostly desert with high average temperatures and low bimodal rainfall.

Eastern Hararghe is one of the zones of Oromia National Regional State (Figure 1). It is located in eastern part of the country at latitude 8°30′ N and longitude 40°40′ E with a land area of about 17 935.40 km^2. The population size of the area is estimated to be 2 723 850. The zone has three agroclimatic zones (Kola, Weyna dega and Dega). The main socioeconomic activities are mixed farming (crop production and animal husbandry). Moreover, the main crops grown in the area include maize, sorghum, groundnut, khat, coffee, haricot bean, sweet potatoes and pepper[14].

Dire Dawa is one of the two chartered and the second largest city in Ethiopia (Figure 1). It is divided administratively into two Woredas, the city and the non-urban Woreda of Gurgura. It is located at 9°36′ N, 41°52′ E and 9°36′ N, 41°52′ E. It is characterized by an arid and semiarid climate with low and erratic rainfall. The administration enjoys a bimodal type of rainfall with April as a peak for the small rains and July for the big rains. The rainfall pattern is characterized by small rains in spring and big rains in summer[15].

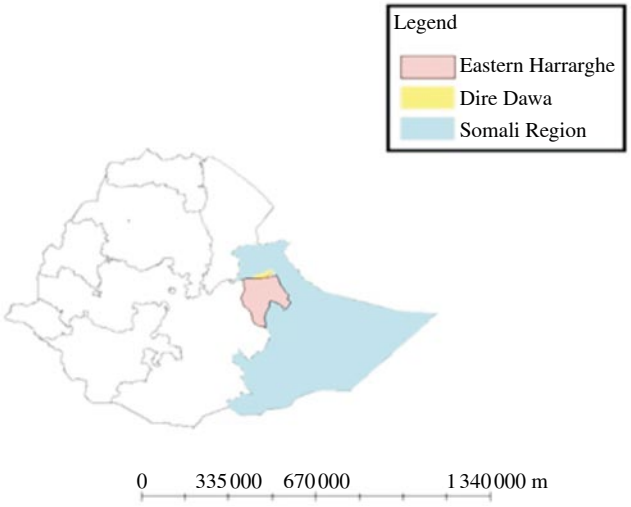

Figure 1. Map of the study areas.

2.2. Methods

Assessment of naked mole-rat was carried out in selected sites of the Eastern Hararghe, Dire Dawa and Somali National Regional State using roads as line transect. Residents were interviewed using semi-structured questionnaire to assess main threats, distribution, possible crop damage, importance and their willingness to be involved in future conservation of naked mole-rat in the study areas after the importance has been explained. The presence of naked mole-rat was identified by direct observation of the animal or/and by their molehills in the study areas with guide of the local community. Field guide was also used for identification. GPS data were taken and recorded in data sheet in sites where the naked mole-rat is identified either directly or indirectly.

2.3. Data analysis

Data were analysed using SPSS version 16.0. Descriptive statistics was used to quantify the threats, crop damage and willingness

to conserve naked mole-rat. *Chi*-square test was used to see the association between variables.

3. Results

A total of 100 respondents from Fafan (27%), City/Shinele (39%) and Eastern Hararghe Zone (26%), and Dire Dawa Administrative town (8%) were used to assess main threats, distribution, possible crop damage, importance of naked mole-rat and willingness of local community to participate in conservation of naked mole-rat.

The distribution of naked mole-rat was assessed in road accessible areas using roads as line transect and identified in the Fafan, Shinele/ City, Eastern Hararghe Zone and Dire Dawa Administrative town (Figure 2). In these study sites, the presence of naked mole-rat was checked with direct observation of the animal or/and molehills (Figure 3) and the local people were interviewed. Naked mole-rat specimens were collected and preserved in Ethiopian Biodiversity Institute.

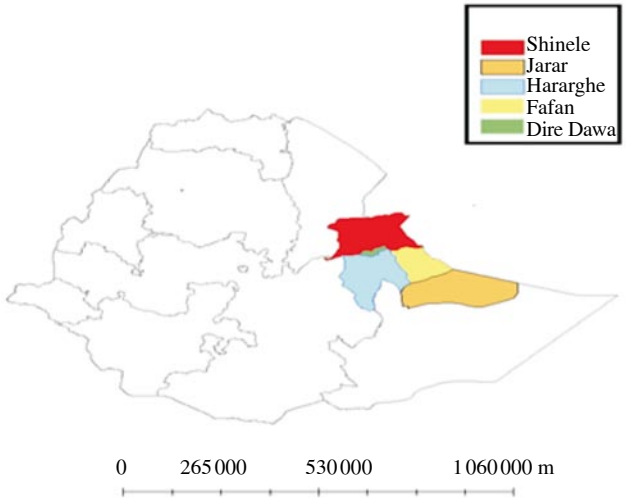

Figure 2. Distribution of naked mole-rat identified in the study areas.

Figure 3. Molehill (left) and naked mole-rat (right) identified in the study areas.

The main threats of naked mole-rat in study area includes human killing by either chemicals or mechanical means (46%), habitat destruction due to expansion of farm land (43%) and predation by snakes (8%) while others threats were negligible. Naked mole-rat was significantly affected by threatening factors, (χ^2 = 41.107, *df* = 12, $P < 0.005$) in City/Shinele followed by Eastern Hararghe Zone (Figure 4).

Local communities were also interviewed to determine their attitudes towards naked mole-rat. Almost all of the respondents (98%) did not have awareness about the importance of naked mole-rat to human or any else.

Regarding to conservation, about 74% of the respondents showed willingness to participate in the conservation of naked mole-rat at least that they would not kill it. The study also identified that educational background of the local community strongly affects the conservation of naked mole-rat. From a total of 26% respondents who did not show willingness to participate in the conservation, 80.8% of them were illiterate and the result was significant (χ^2 = 7.478, *df* = 1, $P < 0.005$).

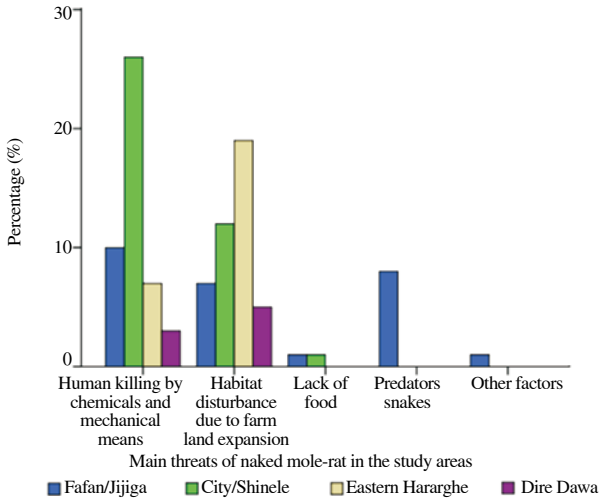

Figure 4. Main threats of naked mole-rat identified in the study areas.

4. Discussion

Naked mole-rat is naturally found in subterranean burrows in the arid and semiarid regions of East Africa, namely, Ethiopia, Kenya and Somali[3,6,7]. In line with this, the present study identified the distribution of naked mole-rat in three zones (Fafan, Shinele/ City and Eastern Hararghe Zone) and Dire Dawa Administrative rural kebele which are among the arid and semiarid areas in Ethiopia.

The major threats of naked mole-rat identified in the study area were found conflict with human, followed by predation by predators like snakes and others were negligible. Petrie[16] reported that human could be the greatest enemy for naked mole-rat in the future. In line with this, the present study identified that naked mole-rat was treated as unimportant animal by the local communities or farmers. The reason for this is that about 92% of the local community believed that naked mole-rat destroys their crop and other plant roots particularly in areas where cultivation of crop is practiced.

Naturally naked mole-rat and human territories did not overlap but this has been changed as human population expands. In this case, the entire crop field can be lost to naked mole-rat, as a result that farmers considered naked mole-rats as pests that destroy them[6,16]. In this study, conflict of human and naked mole-rat was more pronounced in City/Shinele and Eastern Hararghe zones where cultivation of crops like sorghum, nuts and others were extensively practiced. But in other areas where crop cultivation was low, naked mole-rat was not considered as pests.

The killing of naked mole-rat either by chemical or/and mechanical

means was more extensively practised in illiterate communities and people have no information about the importance of naked mole-rat. Lack of awareness strongly affects conservation of species. In this study, the number of local communities who showed willingness to participate in conservation of naked mole-rat, at least that they would not to kill it, were higher (74%) than it was before after the importance of the animal was awarded. The reason for this was that most farmers or local communities in the study areas did not have the information about the importance of naked mole-rat in particular wild animals in general. As a result, they enjoyed killing naked mole-rat in any incidence they encountered.

Another threats of naked mole-rat identified in this study was illiteracy rate of the local community. From a total of respondents who did not show willingness to participate in conservation of naked mole rat, 80.8% of them were illiterate. The reason for this is that illiterate people can't easily understand the indirect benefits of wild animals especially naked mole-rat.

In conclusion, naked mole-rat is fairly common in many of the study sites despite variation in abundance of their molehill and absence of few areas of study sites in particular Birkot, Lefesa, Degahabur and Fedis of the Jarar and Eastern Hararghe zones respectively. However, rapid shift from nomadic life style to cultivation of crops resulted in the conflict of human and naked mole-rat which becomes the main threats of the animal. This aggravated the lack of awareness about the importance of naked mole-rat in the local community. Based on the finding of the survey, the following recommendations are forwarded: 1) There is not any conservation attempts of naked mole-rat carried out in the Ethiopia by government or concerned bodies and generally it is neglected mammal. Hence conservation plan has to be incorporated in wildlife conservation plan; 2) Awareness creation program has to be conducted; 3) There is not any studies conducted about threats, distribution and conservation status of naked mole-rat in Ethiopia, even the current study was conducted in short time and covered only small parts of area. Therefore, further extensive study is needed; 4) People who live around the naked mole-rat habitat are now shifting from nomadic life style to settlement and agriculture is expanded. As a result, conflict between human and mole-rat becomes more and more intense. Therefore, conservation area of naked mole-rat has to be established.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

The authors wish to acknowledge the Woreda and Zone Natural Resource Conservation Bureau and all the local communities of study sites who participated in the interview in particular and in the study in general. Finally, but not the least the acknowledgment goes to the Ethiopian Biodiversity Institute (Grant No. EBI-MOFED/08) for financial support.

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