

Human Pressure Threaten Swayne's Hartebeest to Point of Local Extinction from the Savannah Plains of Nech Sar National Park, South Rift Valley, Ethiopia

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Abstract

We investigated the population size of the endemic and endangered Swayne's Hartebeest (*Alcelaphus buselaphus swaynei*) in Nech Sar National Park from 2012 to 2014 and document the major threats why the species is on the verge of local extinction. The park was once known for its abundant density of Swayne's Hartebeest. We used direct total count methods for the census. We administered semi-structured interviews and open-ended questionnaires with senior scouts who are a member of the local communities. Historical records were obtained to evaluate the population trends of the animals since 1974. The density of the animal decreased from 65 in 1974 to 1 individual per 100 km² in 2014 with a decline of 98.5% in the past 40 years. The respondents agreed that the conservation status of the park was in its worst condition ever now with only 2 Swayne's Hartebeest left, with a rapid decline from 4 individuals in 2012 and 12 individuals in 2009. Mainly hunting and habitat loss, but also unsuitable season of reproduction and shortage of forage as minor factors were identified as threats for the local extinction of the Swayne's Hartebeests. On the other hand, predation, fire, disease and ticks were not considered a cause for the declining trend. Hunting happens mostly out of some kind of revenge since the local community thought that they were pushed out from the land because of the presence of Swayne's Hartebeest in the area. Respondents agreed that the revenge action of the local communities was in response to their unwillingness to be displaced from the park in 1982/3. This conflict situation is resulting from the exclusionary wildlife management policy of the country. We conclude that the human interventions in general and illegal hunting, in particular, pushed the Swayne's Hartebeest to a point of local extinction. Therefore, we recommend an inclusive wildlife management approach for the continuing existence of the park together with its natural resources so that sustainable use of the resources is in place.

Keywords: Hunting • Habitat destruction • Local extinction • Nech Sar National Park • Swayne's Hartebeest

Introduction

Protected Areas (PAs) are designed to protect biodiversity from threats [1]. However, many PAs are only 'paper parks' which are not only highly degraded but also a target of continuing exploitation [2]. Conflicts occurring between the ethnic groups bordering or living within the parks [3,4] and the exclusionary PAs policy are among the major causes of the problem [4]. Ethiopia designated 15% of its land to be PAs [5] whereas the global average is 12% [6]. However, PAs in Ethiopia do not receive adequate protection against human-induced pressures. As a result, serious degradation is threatening much of the home range of wild animals. The distribution and population of many mammals are declining [7-12] in response to anthropocentrically skewed pressures. The endemic and endangered Swayne's hartebeest (*Alcelaphus buselaphus swaynei*) is one of them.

At the beginning of the 20th century, Swayne's hartebeest was known to be human-induced in Somalia and Ethiopia [13] but now they are restricted to the Ethiopian Rift Valley [7] only in Senkele Swayne's Hartebeest Sanctuary, Maze and Nech Sar National Parks [8,12,14-16]. In Awash NP and Yabelo sanctuary, they are extinct [12,17] and the species is rated as endangered [18]. A few years ago, their numbers were still reported to be 700 [18,19];

less than 800 [12] or 840 [8] but the recent decline especially in Nech Sar National Park (NSNP) has been very serious, being only 12 in 2009 [8]. In 1974 Ethiopian Wildlife Conservation Organization translocated Swayne's hartebeest from Senkel sanctuary to Awash NP (90) and NSNP (110) [20]. However, Tischler reported that the translocated Swayne's Hartebeest had not joined the original population in NSNP and it is not even clear whether the currently surviving population is the original one or the reintroduced one [21].

The NSNP Swayne's population, since it displays lower genetic variation and has remained relatively low in the past decades, is vulnerable to inbreeding depression [16]. It was once suggested that while every effort to establish a reserve in-situ should be made, a captive breeding group should be established in a Zoo in developed nations since the threat of extinction is so great [19].

Swayne's hartebeest is an indicator and it was the target species for the establishment of NSNP [5,22,23]. Although there are studies conducted on its population and conservation status few years ago [8,10-12,24] due to high level of human-induced pressures and the quick response of the population size of the animal to the pressure, updating the conservation status and understanding the people's knowledge on why this animal is on the verge of local extinction is deemed necessary. Therefore we conducted this research

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to investigate the current population size of Swayne's Hartebeest and to identify the major threats contributing to its local extinction from the savannah plains of NSNP and to recommend better management options for continuing existence of the park and its natural resources for sustainable use.

Methods

Study area

We conducted this study in semi-arid savannah plains of NSNP. Established in 1974 and located at 500 km south of Addis Ababa (5° 5' and 6° 10'N and 37° 32' and 37° 48'E), it is one of the oldest parks in Ethiopia. Its altitude ranges from 1180 to 1350masl. The mean annual maximum and minimum temperatures are 30.10°C and 17.0°C, respectively and the mean annual temperature is 23.50°C. The mean monthly maximum and minimum temperatures are 33.40°C and 13.60°C in the months of March and June, respectively. A long rain season is from March to May and a short one is from September to November. The mean annual rainfall is 1041.2 mm.

The peak means monthly rainfall is in April (180.7 mm) and the minimum in January (35.1 mm) (Arba Minch University Meteorology Station: 1987-2014). The plains of the park are dominated by soils with high clay content and vertic properties. Vertisols are the most dominant followed by Leptosols and Cambisols. The hills and steep slopes are occupied by Leptosols whereas Vertisols dominated on the gentle slopes. The lowest part of the plains is occupied by Cambisols [24]. The plains of the park are the dominant feature of the park and the main source of food for grazing animals. It is the only suitable habitat for Swayne's hartebeest with an area of about 200 km² [25].

The park is home for 84 species of wild mammals [22] and is also inhabited by agro-pastoral and agrarian communities. Its vegetation lies within one of the major floristic regions in Africa, the Somali-Masai Regional center of endemism [26] and within one of the IUCN's global biodiversity hotspots: 'Horn of Africa', which is regarded as one of the most degraded hotspots in the world, with only about 5% of its original habitat remaining [27]. There are scattered trees and bushes on the plains of the park and various grass species (Chrysopogon, Bothriochloa, Chloris, Cenchrus, Lintonia, Ischaemum and Themeda) are co-dominating the plains. Data collection

We used direct total count to know the population size of Swayne's hartebeest from February 2012 to September 2014 on the plains of NSNP.

We counted the animals along a road loop of 26 km (for a total drive of 520 km) from a vehicle for 20 times in the morning and evening hours. Three skilled observers each with binoculars participated in the census.

The small size of the area together with a narrow home range and rich experience of scouts made the count possible with a reasonable degree of confidence. Besides, secondary data on the population census were obtained from records and published pieces of literature [10,22,23,27-29].

Semi-Structured interviews and open-ended questionnaires were administered with senior scouts (n=14, 42.4%) in order to understand their perception about the conservation status and main threats of Swayne's Hartebeest in the park.

The scouts were selected purposefully based on their experience and ethnic composition. They are all members of the local communities living in and around the park. Individual-based oral interviews were followed by group discussions at various times within the study period.

We used a five-point ranking scale to ask our respondents to rate each of the possible threats where a score of one refers to the least significant threat and a score of five refers to the most important threat. We also asked respondents to give a score from one to 10 for animal preference for hunting where one indicates most preferred and 10 least preferred animals. The respondents were also asked to rate reasons why people hunt the animals

using one to three scales where one indicates strong reason and three indicates the weak reason.

Data analysis

For data analysis, we used simple descriptive statistics in an excel spreadsheet. We considered the population size of the animal as the number of individuals counted. Then we divided the population size of the animals by total area of the savannah plains to get the absolute density of the animals.

We used mean score values of the scale given by the respondents to identify the most serious threat. Similarly, we took mean values (rounded to the whole number) of the rates of the respondents to identify the most preferred species for illegal hunting. We reported a standard deviation together with the averaged values. Identification of the reasons why people hunt the animals was also accomplished calculating the mean values of the respondents' rate.

Results

The population size of Swayne's Hartebeest

The maximum and the minimum number of Swayne's Hartebeest we counted was 4 in 2012 and 2 in 2014, respectively. Its population size has declined from 130 individuals in 1974 to 2 individuals in 2014, (Figure 1) or a density that has decreased from being 0.65 km⁻² in 1974 to 0.01 km⁻² in 2014.

Threat analysis: Why the population of Swayne's Hartebeest is declining to the extent of local extinction?

We identified four threats, i.e. two major and two minor, to the decline of the population size of the Swayne's Hartebeest.

Hunting: Hunting was identified by all the respondents as the main threat of the Swayne's Hartebeest in NSNP. It rated level 5 by 92.8% and level 4 by 7.2% of the respondents. It ranked first with a mean score of 4.93 ± 0.267 . All the interviewees responded that the animal was hunted for two reasons: to revenge its presence in the park and for its meat. In addition, 78.5% of the respondents added a third reason, i.e. Swayne's hartebeest also being hunted for its skin. According to the respondents' people see the animal as the reason for which they were unwillingly displaced from their settlement. All respondents agreed that both the agro-pastoral and agrarian communities were hunting the Swayne's Hartebeest.

Habitat destruction: With a mean score of 4.79 ± 0.425 , habitat destruction was the second most important threat to the declining population size of the Swayne's Hartebeest. 78.6% of the respondents rated it level 5 while 21.4% rated it level 4.

Unsuitable reproductive period: With a mean score of 3.79 ± 0.699 , the unsuitability of the Swayne's Hartebeest reproduction period was the third threat for the declining population. About 50% of the respondents rated it to level 4, 35.7% level 3 and 14.3% level 5.

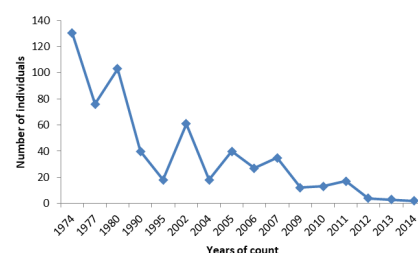


Figure 1. A trend of population size of Swayne's Hartebeest in NSNP between 1974 and 2014 (Sources: [8,12,21,22,27,28,30]).

Shortage of forage: With a mean score of 3.71 ± 0.611 , a shortage of forage ranked the fourth position. All animals except Zebra were hunted for their meat whereas except Warthog all mammals were hunted for their skin.

No animal was hunted for horns and teeth in the park. Swayne's hartebeest was the only animal hunted for three reasons (Tables 1 and 2).

Table 1. List of preferred mammals identified by the respondents for hunting with their rank of preference.

Common names	Scientific names	Rank of preference	Reason for hunting
Swayne's Hartebeest	<i>Alcelaphus buselaphus swaynei</i>	1	Revenge, Meat, Skin
Grant's gazelle	<i>Gazella granti</i>	2	Meat, Skin
Greater Kudu	<i>Tragelaphus strepsiceros</i>	3	Meat, Skin
Common warthog	<i>Phacochoerus africanus</i>	4	Meat, Medicinal value
Lesser Kudu	<i>Tragelaphus imberbis</i>	5	Meat, Skin
Bushbuck	<i>Tragelaphus scriptus</i>	5	Meat, Skin
Hippopotamus	<i>Hippopotamus amphibious</i>	7	Meat
Waterbuck	<i>Kobus ellipsiprymnus</i>	8	Meat, Skin
Guenther's dikdik	<i>Madoqua guentheri</i>	8	Meat, Skin
Plains Zebra	<i>Equus quagga</i>	10	Skin, Not mentioned

Table 2. Percentage of respondents for identifying the reasons why animals are illegally hunted in the Park (Legend: SHB: Swayne's Hartebeest; GG: Grant's gazelle; DK: Dik Dik; ZB: Zebra; HP: Hippopotamus; WB: Waterbuck; BB: Bushbuck; GK: Greater Kudus; WG: Warthog).

Reasons	SHB	GG	GK	WG	HP	LK	WB	BB	DK	ZB
Revenge	100	0	0	0	0	0	0	0	0	0
Meat	100	100	100	100	100	100	100	100	100	0
Medicinal Value	0	0	0	85.7	0	0	0	0	0	0
Skin	78.6	100	100	0	0	100	100	100	57.1	14.3
Horn	0	0	0	0	0	0	0	0	0	0
Teeth	0	0	0	0	0	0	0	0	0	0
No reason mentioned	0	0	0	0	0	0	0	0	0	85.7

Predation and other factors: Predation was not identified as an important threat with a mean score of 1.36 ± 0.497 . Fire (mean score of 1.14 ± 0.363), disease (1.00 ± 0.0), drought (1.00 ± 0.0) and tick (1.29 ± 0.468) were considered to be not important causes for the declining population of the Swayne's hartebeest in the savannah plains of the NSNP.

Scouts' perception of the NSNP: We presented here the general perception of the respondents from individual-based oral interviews concerning the continuing existence of the park. About 92.9% of the respondents believe that the park is vulnerable for looting having any opportunity to do so and they are highly skeptical of its continued existence. The respondents indicated that this was due to the exclusionary wildlife management regulation and the forceful translocation that happened in 1982/3.

Discussion

Population size of Swayne's Hartebeest

A declining trend of the population of Swayne's Hartebeest has been reported for Senkele sanctuary [15,17], Maze National Park [31] and NSNP [8,10,12]. Although our results, in general, revealed the same trend, it was very serious and was at a point of local extinction being 0.01 km^{-2} currently.

This was very low compared to the density of other Hartebeest species recorded in various areas [32-34]. Though its population size declined by 83.3% between 2014 and 2011; there were a number of falls and rises during the same period.

This oscillation seemed to be correlated with some conservation measures and management effectiveness i.e. if the law enforcement is loose,

the population size tends to decline and if strong law enforcement is in place, the population size tends to increase.

The translocation of the animal from Senkele sanctuary; the forceful eviction of the local communities from the park, and the African Parks Foundation (APF) management efforts helped the population size to improve at least for the short term. Because of the translocation, its population increased to 130 in 1974. But due to the dropping of the number to 76 mainly by illegal hunters, the government forcefully evicted the communities from the park. In response to this, the population size increased again and maintained until it has dramatically dropped again due to illegal hunting during the downfall of the government. Its population size was raised to 35 in 2007 from 18 in 2004 during the APF regime due to effective patrolling, continuous awareness and creating job opportunities for the local communities. But it was not possible to maintain its abundance after the resignation of the APF. As the current population size and its trend for the past years showed all efforts had revealed a short-term advantage only. In other words, the translocation operation; the forceful eviction of the local communities and the termination of the management contract agreement with APF were not appropriate measures taken to improve the conservation problem of the Swayne's Hartebeest. If the situations remain unchecked its local extinction will be soon as reported for Awash NP and Yabelo sanctuary by Antonínová et al. [12] and Hillman [35]. Without enforcement of environmental regulations and a goal-oriented strategy, it is unlikely that PAs will serve their purpose worldwide [1]. But in the case of NSNP these alone without paying attention to sound inclusive management approach does not serve the purpose although a strong measure could bring short term relief as seen very recently.

In general, inverse relationships exist between the densities of wildlife and human interference in PAs. Wildlife numbers begin to decline when human populations incline to 8-10 people km⁻² and about 90% of the wildlife disappears when there is more than 75 people km⁻² [29]. NSNP with a number of inhabitants and cultivated land is no exception to this truth. Cultivation is the most intensive and least compatible human land use with wildlife [29] usually causing a significant impact on wildlife due to habitat loss as the case was also true for NSNP where human-induced pressures have extremely affected the population size of the Swayne's Hartebeest. Although maintaining Swayne's Hartebeest population in NSNP is a target for its existence as PA, it persisted at extremely low abundance in a very hostile environment with a likely chance of extinction.

Why has the Swayne's Hartebeest population size declined to the point of local extinction in NSNP?

Four interdependent factors i.e. hunting and habitat loss as major factors and the unsuitability of the reproduction season and shortage of forage as minor factors were identified as the threats to Swayne's Hartebeest in NSNP [35].

Illegal hunting as the main cause of the decline or extinction of antelopes from their natural home has been reported [36]. It has also been reported for Senkele Sanctuary [15,17] and for Maze National Park [8,31]. Our results also were in agreement with these reports. In contrast to these results, hunting is categorized among the most wildlife compatible and least intensive human land use if the off-take is sustainable [29], which the case was not true in NSNP. In general three reasons (revenge, meat and skin) were identified for hunting Swayne's hartebeest in the park. The reason for revenge outweighs the reason for its meat and the reason for its meat outweighs the reason for its skin. The high motivation for revenge was rooted for they were forcefully evicted in 1982-1983 on one hand and for they thought that if they eliminate all the Hartebeest from the park, then the park will be abandoned to serve as a park and will be free to use on the other hand. Although the effectiveness of implementing strict wildlife management and conservation regulations in increasing the population size of the Swayne's Hartebeest for Maze National Park has been reported [31], the case seemed unlikely for NSNP from point of view of long term advantage.

Various authors [8,10,12,33,34] have reported habitat loss as the main threat to the declining population of Swayne's Hartebeest in different PAs. Kumssa and Bekele, Refera and Bekele, Yeshitela and Hilker [33-35] reported that agriculture, overgrazing and settlement are the main reasons for habitat loss in PAs in Ethiopia. However, all these activities were currently undertaking in NSNP and contribute to habitat loss, the main reasons were overgrazing and bush encroachment in the savannah plains of NSNP. Livestock grazing and human movement were evident in all parts of the savannah plains of the park. In agreement with our observation, [3] reported that the northeast of the NSNP is intensively used by local people and cannot be considered a functional part of the park anymore. The individuals of Swayne's hartebeest in NSNP were shy and wary and avoid grazing close to cattle and humans. Because of this, it was observed in a very narrow home range. This behavior, however, was not in agreement with what has been reported in Senkele sanctuary by Lewis and Wilson [17]. Besides, since they prefer open grassland and avoid more closed woodland [7], the encroachment forming many small patches [35] also narrowed their home range.

The Swayne's hartebeest reproduce in the dry period of the park when the grass was withered with little biomass for foraging. However, the ability of the Hartebeest to survive on relatively low intake [37] and their efficiency to extract leaf blades from dry swards [37] help them to be successful feeders even during the dry season. Since illegal hunters have free time to move in the park armed during the dry season the chance to be hunted for the calves will be high. Also as young born in the dry season, they are also more likely to be predated [36] for being exposed with no tall grasses to hide. Even though we did not observe calves killed by predators; generally extremely low density of the Hartebeest in the park clued us to suggest that the calves of the savannah plains of the park were not free of this constraint. Because of these factors, there was a challenge for the calves to grow to an adult and to contribute to the population size of the Swayne's Hartebeest positively.

The shortage of grass as a threat was interrelated to the narrow spatial distribution of Swayne's hartebeest in the park. Hartebeest has specific habitat preferences [7] and it utilizes less than a quarter of the territory of the savannah plains of the NSNP. Spatial use of the home range is known to vary in response to the availability of food and human interferences [11,15]. It is common to see hundreds of people crossing the park and many herders following their cattle in the plains. As a result, the individuals of Swayne's hartebeest fed in confined places for a long time and face a shortage of grasses. According to Swayne's [12] Hartebeest are specialist grazers and thus its vulnerability in NSNP stands especially on rangeland changes induced by cattle grazing. Besides, their feeding habits bring them into direct conflict with livestock and, their densities are inversely related. Its mortality has been reported due to starvation when food resources are exhausted [7]. But Murray and Brown [38] reported that Hartebeest is less affected by the shortage of grass because of their ability to extract high-quality food from senescent swards. According to this author, Hartebeest is thus particularly well adapted to survival in arid grasslands and in dry seasons [7]. These, coupled with low appetite and high digestive efficiency, could be key adaptations that give them an important advantage in the dry season even over cattle [7] although we did not get evidence in favor of this explanation in NSNP.

Predation and fire were not identified as important threats for Swayne's Hartebeest in the park. The low density of predators especially lion and hyena [3] in the savannah plains could be a reason why predation was not identified as a major threat to the declining population of Swayne's Hartebeest. Besides, Hartebeest are notably alert animals and can run for very long distances fast [7].

Neither disease nor tick was also identified as threats for Swayne's Hartebeest in the park. Consistent with our results, [7] reported that there are only a few records of Hartebeest showing any clinical symptoms. However, sometimes they were severely affected by rinderpest, as the case of Somali

in 1987 [39]. Hartebeest is remarkably free of ticks compared with such species as wildebeest [40].

Scouts' perception of the NSNP

Conservation of biodiversity can, in many cases, conflict with efforts to alleviate poverty [41]. NSNP is no exception to this truth. It is susceptible to raiding having any opportunity to do so. This is due to local communities' response to exclusionary wildlife management regulation. The park is considered by the local communities as a basis of their livelihood, and they believe that the land was once owned by their ancestors in the past. In view of most of the dwellers, the park is associated with the Swayne's Hartebeest, whose existence is a reason behind the ban to the park. They felt that the park management is only concerned about the Swayne's Hartebeest and not about people. As a result, they developed feelings of antagonism towards conservation of the park as is also reported by Datiko et al. [10]. Due to this, hatred towards the Swayne's Hartebeest developed among the communities. Datiko et al. [10] reported that about 91.6% of the local community have a positive attitude to Swayne's Hartebeest. However, the reality on the ground did not support this conclusion as it was illegally hunted more than any other animal in the park. Since for species local extinction there is no short-term recovery [1], it shall be obligatory to protect biodiversity from unsustainable use, even when such protection necessitates a sacrifice in order to conserve ecosystems for the future.

Conclusions and Recommendations

Different factors have been contributing to the elimination of the population of Swayne's Hartebeest (*Alcelaphus buselaphus swaynei*) from Nech Sar National Park, of which many are human-induced. Among them, hunting and habitat loss were the most significant threats. It can be expected that Swayne's Hartebeest will disappear soon since the probability to be hunted is high, but the likelihood of birth is very low. There is no possibility for other Swayne's Hartebeest to immigrate to the park since it is geographically closed for the animals to join either from Maze National Park or from Senkele sanctuary. We hence are unfortunate to conclude that we are pessimistic about the continuing existence of the remaining individuals of Swayne's Hartebeest in the savannah plains of the park since they are extremely low to support a viable population. We strongly presume that at any moment from now these two individuals could be shot to the final elimination. We feel that the current level of resource management is inadequate not only to protect the declining population of Swayne's Hartebeest but also to guarantee the continuing existence of the other components of the ecosystem of the park in general. If not addressed soon with all commitments, this situation will result in a substantial habitat loss and deterioration to the level where it is unable to carry even other wild ungulates and livestock. With this conclusion, we recommend:

A shift from the exclusionary wildlife management approach to an inclusive approach may alleviate the long-lasting disputes concerning the use of resources of the park. Consideration of local people's concerns should be a major part of the conservation program in NSNP

Once the first recommendation is in place, the reintroduction of Swayne's Hartebeest from Maze National Park may probably help to improve the population size of the animals in the park and may contribute to its conservation positively. While implementing this option, lessons from the previous failure should be part of the operation. We recommended Maze National Park from where populations of Swayne's hartebeest could be translocated for its geographic proximity and climatic relevance

Informative management decision to be in place to guarantee the other wildlife; especially Lesser Kudu and Greater Kudu will not follow the same path as Swayne's Hartebeest

Further research to investigate the impact of vegetation cover dynamics especially the expansion of encroaching woody species on the situation

of wildlife population and to predict a scenario analysis on the relationships of historical overgrazing, natural resource degradation and wildlife extinction

Although our study identified the proximate threats for the conservation of Swayne's Hartebeest in NSNP, the ultimate cause of the management problem of the park does not seem only ecological. It rather seems more of socio-political. Therefore the determination of the political system is crucial for the scientific inputs to bring solutions

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