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AUTHORS: H B TEFEMPA, P NGASSAM, P M MAPONGMETSEM, B ANKONGMENECK, H

GUBBUK

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BEHAVIOUR OF MAMMALS AROUND ARTIFICIAL WATERHOLES in THE WAZA NATIONAL PARK (CAMEROON)

Honore Bride TEFEMPA^{1a} Pierre NGASSAM¹ Pierre Marie MAPONGMETSEM³

Bernard Aloys NKONGMENECK² Hamide GUBBUK⁴

¹ Department of Biology and Animal Physiology, Faculty of Sciences, University of Yaoundé I, P.O. Box 812, Cameroon

² Department of Plant Biology, Faculty of Sciences, University of Yaoundé I, P.O. Box 812, Cameroon

³ Department of Biological Sciences, Faculty of Sciences, University of Ngaoundere, P.O. Box 454, Cameroon

⁴ Department of Horticulture, Faculty of Agriculture, 07059, Antalya - Turkey.

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Abstract

A study was undertaken in the Waza National Park (WNP) from March to June, to monitor the behaviour of 9 mammals around the artificial waterholes named Anane and Louloumbava. Observations were made all through the day. The frequency of observation visits to the waterholes was one per day and four times a month. The results showed three categories of animals in terms of food regime. The first group is represented by herbivorous, frugivorous such as Loxodonta africana Africana, Phacocheorus aethiopicus and Erythrocebus patas, the second group by represented by herbivorous like Giraffa camelopardalis, Hippotragus equines, Damaliscus korrigum and Gazella rufifirons and the third by group representing carnivorous like, Canis aureus and Herpestes hichneumon. Among these species, Loxodonta africana africana is the main consumer whereas Giraffa camelopardalis is the second in the Park. High temperatures reduce the activities of the animals during the dry season as well as the number of waterholes run off. Lack of water forces some animals to migrate to other localities and those which do not die in the course of time. February is the hottest month in the WNP where temperatures reach up to 48.8 °C. The mean number of the animal visits varies with the species and from one waterhole to another. Loxodonta africana africana was the most frequently seen species around the waterholes (47.72%) followed by Hippotragus equinus (16.57%) and Damaliscus korrigum (14.77%). Balanites aegyptiaca Ziziphus spp and Tamarindus indica are the main species eaten by the animals. However, these plant species are equally consumed by the local population as fruits. Therefore, it is necessary to domesticate them with a view to maintain the biodiversity of the area.

Key words: WNP, Mammals, Waterholes, Meteorology, Behaviour, Biodiversity

Waza (Camerun) Ulusal Parkında Yapay Su Göletleri Çevresinde Memelilerin Davranışları

Özet

Bu çalışmada, mart ayından haziran ayına kadar gecen surede Wasa Ulusal Parkın'da (WNP) Anane ve Louloumbaya olarak adlandırılan yapay göletlerin çerçevesinde 9 memelinin davranışları incelenmiştir. Gözlemler gün boyunca yapılmıştır. Yapay göletlerde gözlem sıklığı günde bir ve ayda 4 defa yapılmıştır. Araştırma sonuçları, yiyecek rejimleri bakımından hayvanların 3 kategoriye sahip olduğunu göstermiştir. Birinci grup, Loxodonta africana Africana, Phacocheorus aethiopicus ve Erythrocebus pata olmak üzere ot obur ve meyve ile beslenenler olarak gruplandırılmış, ikinci grup Giraffa camelopardalis, Hippotragus equines, Damaliscus korrigum ve Gazella rufifirons gibi ot obur ve üçüncü grup ise Canis aureus ve Herpestes hichneumon gibi et obur olarak adlandırılmıştır. Parkta bu türler arasında, Loxodonta africana Africana ana ve Giraffa camelopardalis ise ikinci tuketici olarak saptanmıştır. Yüksek sıcaklık, kurak sezonda hayvanların aktivitesini azaltmış ve ayrıca yapay göletlerin kurumasına neden olmuştur. Suyun azlığı bazı hayvanların göç etmesine neden olmuş ve bu sure zarfında hayvanlar ölmemiştir, Subat ayı WNP'de en sıcak ay olarak saptanmış ve bu ayda sıcaklık 48,8 °C'nin üzerinde saptanmıştır. Hayvanların ortalama olarak bir yapay göletten diğerine seyahatleri türlere göre değişiklik göstermiştir. Loxodonta africana africana yapay göletler etrafinda en yüksek oranda (%47.72) görülen tur olarak saptanmış ve bunu Hippotragus equinus (%16.57) ve Damaliscus korrigum (%14.77) izlemiştir. Balanites aegyptiaca Ziziphus spp ve Tamarindus indica hayvanlar tarafından yenen başlıca türler olarak saptanmıştır. Fakat bu bitki türleri, orada yasayan yerli halk tarafından da esit şekilde tüketilen meyve türleri olarak saptanmıştır. Bu nedenle, bu alanlarda genetik çeşitliliği artırmak acısından, bu türlerin kültüre alınmasına ihtiyaç duyulmaktadır.

Anahtar Kelimeler: WNP, Memeliler, Yapay Gölet, Meteoroloji, Davranış ve Genetik Çeşitlilik

^a Corresponding author: H. B. Tefempa, e-mail: tefempa@yahoo.fr

1. Introduction

Nowadays. mammal populations in Cameroon are observed to be decreasing. Numerous species which were abundant before have either disappeared today or are under severe treat (Banque Mondial, 1990). According to the World Bank it is partly due to the destruction of their habitat usually by grassing (65 %) and / or due to agriculture. Various other constraints continue to fragilise remaining their habitat (the increasing pressures of human population, the critical national economic situation of the developing countries and so on). In addition, 75 % of the developing countries population mainly in the sub-Saharan Africa depend on wild fauna as the source of food (Asibey, 1974; Ngandji, 1997). Hunting is at the origin of the extinction or of the scarcity of the wild fauna (UICN, 1990). The Waza National Park (WNP) hosts a highly diversified mammalian fauna among which exist an extremely abundant population of ungulates, artiodactyls, carnivorous and primates (Tefempa et al., 2006a). During the dry season when the temperature is very high between 13 and 16 hours, they remain under Acacia spp., Balanites aegyptiaca and Tamarindus indica trees for shade (Tefempa et al., 2006b). Water is a determinant in these animal species for their biological needs. In the Central African forests, the availability of fruits has an influence on the mobility and distribution of elephants during the dry season (Blacke, 2000). Mostly where food and water become scare, they could be concentrated in great number around the same source of water (Tsague, 2004). Seasonal migrations and habitat selection by the elephant populations are done with availability respect to the of the aforementioned factors (Tchamba, 1993). Spatio - temporal distribution of the waterholes is fundamental for their daily and seasonal migration (Fryxell and Sinclair, 1988; Senzota and Mtaliko, 1990). The quantity of water available in the medium varies according to the time and the meteorological conditions, the pedagogical factors as well as the intensity of their utilization by the animals (Lemoine and Katrin, 2003). The use of the artificial water sources becomes very important during the driest periods in the year when natural water sources by rain dry up. The water supply from the artificial waterhole has become very important for the management of the wildlife in most of the African National Parks. The WNP is one of the most important parks in Africa in general and in Central Africa in particular. From year to year the dryness in the region is becoming preoccupant problem.

The present study has been undertaken in view to understand the daily behaviour of the mammals in the WNP under climate constraints. The specific objectives are to identify the frequent mammals remaining in the area; to determine the daily period during which their activity is intensive; to evaluate the evolution of environmental factors such as hygrometry, wind, light, intensity and temperature.

We aim that this information will serve as a baseline to develop appropriate management strategies in order to keep animal diversity in the WNP and also to identify mammals which can be domesticated and used in existing farming systems of the area to alleviate some of the constraints of farmers.

2. Materials and methods

2.1. Study site

The National Park of Waza is located in the far northern province of Cameroon. The climate is soudano-sahelian type. It is characterized by a much extended dry season and a short rainy season. The mean annual pluviosity is 800 mm with great interannual variation. The mean annual temperature is 27.7°C (Letouzey, 1968). The rain is randomly distributed along the year. Nevertheless 50 to 60% of the precipitation is recorded during August and September (Beauvillain, 1968). The vegetation of the WNP is made up of savannah and steppe. These plant formations are characterized by large area of herbs mainly, Gramineae wooding layer showing protected by variable density. Wooding layer is

composed by various *Acacia* spp., *Balanites aegyptiaca*, *Ziziphus* spp.; among which species like *Anogeissus leocarpus*, *Bauhinia reticulata* and various *Ficus* sp. are also equally present. The altitude of the landscape varies from 300 to 310 m of altitude from the east to the west with little denivellation in flooding area locally known as ''yaeres'' in fufulde (UICN, 1997).

2.2. Methodology

Investigations were carried out from March to June around two artificial waterholes of Anane (324 m of altitude, 11.3297N latitude and 14.61869E longitude) and Louloumbaya (329m of altitude, 11,3290N latitude and 14,5616E longitude). These two waterholes have been targeted on the basis of frequency of the animals passing through. They were sampled and geo referenced. Parallel to the above-mentioned location characteristics of the waterholes, daily physical parameters (temperature, relative humidity, light and wind) were registered respectively by thermohygrometer, luxmeter and anemometer.

Animals were observed daily for 5 days, twice per month from 6 to 18.30 hours. During the day, the arrival and departure hours of the animals were noted with respect to one waterhole per day. The structure of the animal troop was evaluated as well as the sex distinction (males and females). The number of individuals per flock was counted and the herd profile determined. Data was analysed using Statgraphic Plus package.

3. Results and discussion

3.1. Biodiversity and distribution around artificial waterholes

3.1.1. Major animals

A total of 1448 animals distributed into nine species, were monitored in the WNP from March to June 2004. A total of 1448 visits of 9 animals species has been registered around the artificial waterholes in respect to 952 at Anane (65.71%) and 496 at Louloumbaya (34.29%). The nine species are regrouped into three orders (Ongules, Artiodactyles, Carnivores and Primates). The frequency of visit varies from 0.27% to 47.72% (Table 1).

The most frequent species found around the mare were mostly *Loxodonta africana africana* (47.72%), *Hippotragus equinus* (16.57%) and *Damaliscus korrigum* (14.77%). This result suggests that water is a determinant factor for the aforementioned species. They frequent these waterholes several times during the day. The main periods of visits are as follows: 8-9h, 12-13h and 16-18hours. After drinking water, animals rest under trees. The drinking duration of these animals is affected by the noises of vehicles of tourists.

3.1.2. Plants and animal interactions

In general, the animals forage the vegetation around the waterholes, and the foraging behaviour varies among the species found. The *Giraffa* are extremely selective

Species	Number of Individuals		
	Anane	Louloumbaya	Total Number
Loxodonta africana Africana	437 (30.17)	254 (17.54)	691(47.72)
Giraffa camelopardalis	30 (2.07)	57 (3.93)	87 (6.00)
Hippotragus equines	180 (12.43)	60 (4.14)	240 (16.57)
Damaliscus korrigum	136 (9.39)	78 (5.38)	214 (14.77)
Gazella rufifirons	20 (1.38)	0	20 (1.38)
Phacocheorus aethiopicus	15 (1.03)	24 (1.65)	39 (2.68)
Canis aureus	31 (2.14)	0	31(2.14)
Herpestes hichneumon	4 (0.27)	0	4 (0.27)
Erythrocebus patas	99 (6.83)	23 (1.58)	122 (8.47)
Total	952 (65.71)	496 (34.29)	1448 (100)

Table 1 Distribution of Animals Around Two Waterholes

regarding their food pattern. They eat selectively *Balanites aegyptiaca* and *Acacias (Acacia seyal and A. ataxacantha)*. The following examples illustrate strategies and choices of each animal.

Loxodonta africana africana prefers Balanites Acacia spp., aegyptiaca, Tamarindus indica, Ziziphus mauritiana, Terminalia macroptera, Piliostigma reticulatum, and gramineaes (Tefempa et al., 2007). However, Erythrocebus patas various fruits survives on whereas: Phacocheorus aethiopicus eats tree roots, bulbs, rhizomes and Poaceaes. Hippotragus equinus, Damaliscus korrigum and Gazella rufifirons forage on young buds of shrubs and gramineaes. Herpestes hichneumon eats small reptiles and insects whereas Canis aureus birds, small rodents and rest of meats left by Panthera leo (lions) and Hyena spp. (hyenas).

3.2. Visits scheduling during the day around the waterholes

Waterholes are visited by various animals usually from 0600hrs a.m to 1800h pm while the Giraffa camelopardalis, visit the waterholes between 8-12h am and 14-18h pm. These animals are able to spend more than 3 to 4 days without drinking. A Giraffa can consume in average 90 to 100 litres per up take. Similar results are reported in the Benue National Park (BNP) (Asibey, 1974; Tsagué, 2004). In case of insecurity, it may spend a month without drinking (Tsagué, 2004; Kingdon, 1997). Hippotragus equinus visits the waterholes from 7 to 12hours and 14 to 18hours. In the BNP of Cameroon, Tsagué (2004) reported that *Hippotragus* visits waterholes in the morning and in the evening. Our findings in the WNP concerning the abovementioned (Giraffa camelopardalis, animals Hippotragus equinus) in terms of daily visits are in agreement with those registered in BNP (Tsague, 2004). The author registered 50 and 250 visits for Giraffa camelopardalis and Hippotragus equinus respectively. These figures can increase as soon as food resources (food and water) became scares. If these conditions prevail, animals regroup themselve in search of new

water points and grazing area (Tsagué, 2004; Tefempa et al., 2006a; Ngandjui, 1997). For Damaliscus korrigum, the drinking time is between 7-9hours and 15 -18hours, whereas, in Gazella rufifirons, it is between 6 and 13hours. The Phacocheorus aethiopicus drinks between 6-11 hours in the morning and 14-18hours in the evening. Canis aureus drinks later in the morning around 9-11 hours and from 14 to 17 hours As far as Herpestes hichneumon is concerned, the drinking time is scheduled only in the morning and very early between 6 and 8 hours. Erythrocebus patas like the other animals drink two times during the day: 9-13 hours and 16-18 hours.

Generally, animals do not visit the waterholes between 12 and 13 hours. During this period, temperatures are very high and animals are seen to rest under shades of *Acacia* spp., *Balanites aegyptiaca* and *Tamarindus indica* trees (Tefempa *et al.*, 2006b; Tefempa *et al.*, 2007). The great number of animals registered in WNP suggests that the mammalian fauna is very diversified and rich.

3.3. Daily variation of environmental parameters around the artificial waterholes

The behaviour of the animals around the waterholes is significantly influenced by meteorological conditions of the site.

During the dry season, the temperature varies from 27.17 to 47°C (Anane) and 29.5 to 48.8°C (Louloumbaya). While the variation in relative humidity, raises from 0.3 to 5.4% (Anane) and 4 to 8.3% (Louloumbaya). With respect to light, the quantity varies at Anane from 430 lux to 1903.6 lux whereas: it ranges from 1236 to 1995 lux in Louloumbaya. The speed of the wind varies significantly (P < 0.05) from Anane (2.7 to 7.2 m/s at Louloumbaya 2.9 to 9.2 m/s).

Generally, the climatic parameters are significantly different in the sites. The high point for each parameter varies from site to site and is also different with respect to time. In Anane, the maximum temperature is at 18h30min whereas, at Louloumbaya, it varies between from 12h30 and 16h30min. However, in case the of relative humidity, the reverse is observed. In Louloumbaya two maximum time period such as 6h30 and 15h30min and in Anane 14h30min are observed. The evolution of light is similar in both the sites. The highest point is located between 9h30 and 15h30min.While the high point of the velocity of the wind is 16h30min in Anane and 17h30min Louloumbaya (Figure 1). Climatic affects does has an affect on the behaviour of the animals while also the availability of the water in the mare.

Water is a determinant resource in the life of the animals during the dry season in the National Park of Waza. Waterholes are found where animals drink water in the



Figure 1 Daily distribution of environmental parameters around Anane (A) and Louloumbaya (L) waterholes in Waza National Park during the dried season with respect to temperature (a), relative humidity (b), light intensity (c) and wind rate (d).

Park. The waterhole capacity is a function of the size of the animal troops visiting the waterholes. From March to June, the capacity of water in the Anane artificial waterhole varied significantly (P < 0.05) from 1632.4m³ to 307.69 m³ whereas in Louloumbaya, it decreased from 1453.45 m³ to 287.48 m³. These variations can be attributed to abiotic (effect of the meteorological conditions that we described) and biotic factors (effect of the various animals visiting the area).

In the abiotic conditions, metereological conditions play a determinant role via temperature and light. The high temperature and light leads to water evaporation and dryness. We notice that when the climatic conditions of the park become drastic, animals spend most of their time around the waterhole to drink water several times. This behaviour permits animals to replace the water transpired or passed by urine. Our investigations reveal that temperature existing around the waterholes varies from 27 to 47 °C while the total light quantity rises from 540.25 to 1995 lux. These values when compared with those registered in the Maroua airport meteorological station are very high. They suggest that a particular microclimate exists in the WNP. This harsh microclimate affects significantly the evapotranspiration of the area. In addition to climatic conditions, the physical properties can allow water infiltration. In South East parts of Australia, Trent et al. (2006) reported that Helieioporus australiacus is active from December to June. During this period, the mean temperature is 8°C whereas the relative humidity is 50 %. When the temperature increases to 16 °C and the relative humidity to 60%, the species are in a state of stress. Similar constraints prevail in the WNP from February to March 2007 where many waterholes gets dried up among Goumbouemaram, Bodelaram, Mougourma and Dourou Batassa. The dryness of these waterholes forces some animals to leave the WNP to other areas in search of suitable conditions. Those which could not migrate die for lack of water which is mostly common in the case of Canis aureus and Herpestes hichneumon. Distance between the two waterholes is about 5 to 6 km. These results suggest that high temperatures reduce animals' activities.

4. Conclusion

A total of 1448 visits of 9 animal species have been recorded around Anane and Louloumbaya artificial waterhole in WNP. The main groups of species are of Ongules, Artiodactyles, comprised Primates. The Carnivores and visit frequency varies from less than 0.27% to more than 47.72%. The most frequenting species are Loxodonta africana africana (47.72%), *Hippotragus equines* (16.57%), korrigum (14.77%) and Damaliscus Erythrocebus patas (8.47%). These animals visit the artificial waterhole all the day long 18.30 from 06 hours to hours. Meteorological conditions affect animals' activities as well as the availability of water. Water is a key resource in the life of the animals during the dry season in WNP. The quantity of water in the artificial waterhole varies according to the size of the animal troops visiting it.

In view to manage National Parks in a sustainable manner, it is necessary to track some animals by using Radio-VHF team collar and satellite transmitter; increase the number of waterholes and supply them with water during dry season; increase the number of invigilators; mobilise sufficient resource and equipment to invigilators to enable them to deter bandits. These precautions will maintain animals in place limit their migration toward and neighbouring parks.

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