



International Journal of Primatology Research

Research Article

Baseline conservation information on Drills (*Mandrillus leucophaeus*) and Olive Baboons (*Papio anubis*) in the Menchum Landscape Northwest Region, Cameroon -

MVO Denis Chuo^{1*}, Tsi Evaristus Angwafo^{2,3}, Fotang Chefor², Taku Awa II¹ and Akongte Peter Njukang¹

¹Department of Animal Biology, Faculty of Science, Dschang, University of Dschang, Cameroon

²Department of Forestry, Faculty of Agronomy and Agricultural Sciences (FASA), Dschang, University of Dschang, Cameroon

³Department of Fundamental Science Higher Technical Teacher Training College (H.T.T.T.C.) Bambili University of Bamenda, Cameroon

***Address for Correspondence:** MVO Denis Chuo, Department of Animal Biology, Faculty of Science, P. O. Box 222 Dschang, University of Dschang, Cameroon, Tel: +237-675398645; E-mail: mvo235@yahoo.com

Submitted: 26 January 2021; **Approved:** 10 February 2021; **Published:** 18 February 2021

Cite this article: Chuo MD, Tsi AE, Chefor F, Taku Awa II, Njukang AP. Baseline conservation information on Drills (*Mandrillus leucophaeus*) and Olive Baboons (*Papio anubis*) in the Menchum Landscape Northwest Region, Cameroon. *Int J Primatol Res.* 2021 Feb 18;4(1): 010-017.

Copyright: © 2021 CHUO MD, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Menchum landscape, has recently becomes a vital research ground for the conservation of a variety of wildlife and primate species, most especially the endangered Nigeria-Cameroon chimpanzees (*Pan troglodytes ellioti*). Despite conservation efforts, drills have been extinct in most of their natural habitats, with revealing presence of olive baboons due to overhunting and habitats loss. As such, this study was undertaken in the Menchum Landscape; Case study of the Kimbi-Fungom National Park (K-FNP) and Kom-Wum Forest Reserve (K-WFR), aimed to practically investigate the status of drills and baboons in order to contribute vital information for their conservation. Primary data were obtained through recce walk, whereby direct and indirect observations of bio-indicators and human signs were recorded and analyzed manually to obtain their encounter rate. From the results, 13 and 289 drills and olive baboons individuals were directly observed which gave a mean encountered rate of 0.10 signs/km and 2.21 signs/km respectively. Up to 38 voices of olive baboons were heard and 16 carcass observed which gave an encountered rate of 0.33 signs/km and 0.17 signs/km respectively. Distribution analysis of these primates shows that 100% of drills and 27% of olive baboons were concentrated in the Black Bush Areas of Window. Anthropogenic activity gave an average encountered rate of 0.32 signs/km mean while all signs associated with hunting, registered the highest encountered rate of 0.68 signs/km. Thus, upgrading data on the abundance and distribution of drills and baboons, identifying areas of intense anthropogenic activities through effective conservation methods will greatly help to identify hotspots and ensure better protection for these species. Also, it is vital to undertake regular educational conservation plans to promote all stakeholders on the necessity to conserve the remaining species, especially the few drills population.

Keywords: Anthropogenic activities; Conservation status; Drills; Menchum landscape; Olive Baboons

ABBREVIATIONS

K-FNP: Kimbi-Fungom National Park; K-WFR: Kom-Wum Forest Reserve; BBAW: Black Bush Areas of Window; NTFPs: Non Timber Forest Products

INTRODUCTION

Drills and Baboons are just like other primates all over the world battles for survival as a result of increasing human influence in their natural habitats [1,2]. Drills are one of the largest monkeys and one of the most endangered primate species. Compare to other primate, they are the least understood, studied and little-known primates in Africa [3]. Due to their very small geographic range, which covers only the rain forest zone north of the Sanaga River in Cameroon to the Cross River in southeast Nigeria, and Bioko Island of Equatorial Guinea [2-4]. They inhabit an area roughly the size of Switzerland, with possibly fewer than 3000 left in the wild. They prefer living in dense forest and will flee from humans [5]. They are not well-protected in any of their remaining habitat, and are hunted by the local community for bushmeat to supplement their protein level [6], to produce traditional medicine, rituals and festivals [7]. Most of their suitable forest home continues to be lost due to unsustainable logging and poor farming practices [3]. As a result of these threats, the IUCN Red Data List classified Drills among Africa's most endangered mammals, and among African primates with the highest priority for conservation action in recognition of its taxonomic distinctiveness, restricted distribution and degree of threat from hunting and habitat destruction [8]. Cameroon drill monkey just like the Nigerian-Cameroon chimpanzee, Cross River gorillas Preuss's monkey and the African golden cat, will go extinct if conservation action is not taken seriously [9]. Due to continuous decline of drill numbers in all known habitat areas for decades and in areas where their presence have not yet been discovered, especially in non-protected areas.

Notwithstanding the fact that, olive baboons are widespread throughout equatorial Africa and are found in 25 countries, understanding their status is important for its ecology, conservation, management, disease control, and sustainable use of its benefit [10]. Furthermore, it will increase awareness of both the conservationist and local community about their disappearance in some of their

previous habitats [11]. Although olive baboons are widely distributed, this primate species continues to reduce in abundance in most of their healthy habitats as they are heavily hunted, and hunting has instigated local extinctions [1].

The Menchum landscape which recently have become a vital research ground for the conservation of a variety of wildlife species including primates and most especially the endangered Nigeria-Cameroon chimpanzees (*Pan troglodytes ellioti*) discovered in some protected and fragmented forest areas, have been reported of Drills (*Mandrillus leucophaeus*) and Olive Baboons (*Papio anubis*) presence [12-14]. With the exception of drills monkey, olive baboon monkey were both reported in the two protected (K-FNP and K-WFR) and around some wildlife hotspot non-protected areas within the landscape [15,16]. Despite their presence, it is disturbing that conservation strategy around the landscape have never been considered a priority and population survey has been barely reported with little or no information on their ecology and status. Even though olive baboon's species appear to be relatively abundant, no quantitative data is accessible [17]. The landscape is made up of a wide range of habitats types and a reckoning population growth seriously engage at different levels of human activity that impact on these primates status [18]. Within the landscape, several important forest patches and water catchments that are hotspots for biodiversity are being degraded and fragmented as a result of illegal logging, unsustainable grazing and poor farming methods [19]. Based on this, some researchers hold that drills have been extinct from the landscape with olive baboons barely seen in most of their natural habitats due to decades of hunting and habitats destruction [20,21]. As such, conservation initiatives for the species are hindered by a poor understanding of their ecology and status as no studies of drills and olive baboons have taken place around the landscape. This means that no scientist has successfully carried out a long-term study to tell the conservation status of these species in the wild. Therefore, in the absence of such studies, understanding their social structure and habitat requirements pose a serious problem as very little information exists on behavioral patterns in the wild. Based on this, the study was carried out with the main objective to set up base line information for future study by practically investigating the presence of drills and olive baboons as well as their status that will contribute to improving their conservation in the Menchum Landscape.

MATERIAL AND METHODS

Description of case study areas

Case study area of kimbi fungom national park: The Kimbi-Fungom National Park (K-FNP), created on February 3, 2015 by a Prime Ministerial decree number 2015/0024/PM is located in the North West Region of Cameroon approximately at latitude 6.5-6.9° N and longitude 9.8-10.5° E with a total surface area of 953.8 km² [22]. The K-FNP cuts through 3 divisions: Boyo, Menchum, and Donga-Mantung, covering 4 Sub-divisions: Fonfuka, Fungom, Furu-Awa, and Misaje [14]. In the north, it is bordered by Tumbo and Tosso in Nigeria, Baji, Nser, Kpep, Furubana, Supong, Akum, Edjong and river Katsina Ala in Furu Awa sub-division. In the east by Labo, Batari, and the Dumbo cattle ranch in the Misaje sub-division. In the South by river Kimbi, Kimbi village and Su-Bum in the Fonfuka sub division. In the center by Zhoa-Nkang, Esu, Kundzong and Iwo in the Fungom sub-division, and in the West by Munkep and Gayama also in the Fungom sub-division. These two compartments are linked by a corridor that stretches between Nkang and Nkannye on the Fungom end to the north west of Kimbi and South West of Dumbo cattle ranch with river Kimbi being a natural boundary between the ranch and the National Park. The park has four main entry points: Kimbi to the south, Zhoa-Nkang in the center, Esu - Gayama to the west, and Furuawa to the North. [22]

Case study area of kom-wum forest reserve: The Kom-Wum Forest Reserve (K-WFR) is located between Latitude (6°16'12.53"N) and Longitude (10° 7'57.85"E) in Boyo and Menchum Divisions in the North West Region of Cameroon. The reserve covers a surface area of approximately 80 km² and is located 25 kilometres away from the main city of Bamenda. The sub-montane forest spreads on an undulating landscape with an altitude of 700-1500 meters above sea level [23]. The forest is bordered by the villages Mughom and Bueni in the south and extends northwards towards Bu, Mbengkas, Baiso Mbongkissu. The Menchum River flows through the western section of the reserve creating a riparian forest [23]. The area has a sub-equatorial climate with a rainy season that lasts from March until November and a dry season between December and February. The overall annual rainfall varies between 2512.5mm and 2829.6mm. The reserve falls within a biodiversity hotspot of global significance. These areas are home of two endangered bird species, Bannerman's turaco (*Tauraco bannermani*) and the banded wattle-eye (*Platysteira laticincta*) [24], which are restricted to montane forests in the Bamenda highlands (IUCN red list). These sites have been recognized as some of Africa's priority primate conservation sites [25], with the presence of the seven diurnal and six nocturnal primate species in the Kom-Wum Forest Reserve [6,21,24].

Data collection and analysis

Data collection: Data collection was based on obtaining pre-existing information from the delegation of forestry and wildlife, non-governmental organizations, and from the surrounding village's elites. Since no recent research have specifically reported the presence of drills and olive baboons at these study sites. Field data on drills and olive baboons core areas and encounter rate were determined within the field through recce (or reconnaissance) survey method [27]. A recce is a path of least resistance through an area following a compass bearing (e.g. north-south, southeast-northwest, and east-west). Recce walks, were carried out intentionally by walking through forest types with clear under-storey, along human/buffalo trails and up water-courses. The Recces were oriented to cut across the major

vegetation types of the area (primary forest, secondary forest, gallery forest and Savannah) and drainage features (rivers and streams) in order to sample a representative proportion of all vegetation types. The start and end point of each recce was determined using a global positioning system (GARMIN 62CSx) to obtain the distance covered. A total of 43 recces of 2km each were covered giving a total distance of 86km throughout the study areas.

Following White and Edwards's method (2000), the recce survey teams was composed of one team leader, one field assistants, one labourer and a local hunter. The leader was responsible for reading the bearing; look out for signs and observations and recording data with the help of a GPS. The assistance carrying a pair of binoculars and a digital camera, looked out for signs and observations and recorded information obtained. The hunter was responsible for identifying tracks and signs of these primate's species in cases where identification was difficult. The labourer was responsible for opening the bush ahead along the compass bearing with the help of a machete where movement is difficult. During recce walk all signs of drills, and olive baboons (sightings, vocalization, dung and carcasses), and human signs (farming, hunting, fishing, extraction of natural resources and logging activities) were recorded and a GPS coordinate taken. In the field, all data/samples collected were entered into a data sheet along with all associated information.

Data analysis: Field data sheets were decoded and information entered into Microsoft excels. The observations were grouped according to the different species sighting and signs (faeces, traces, and vocalizations) and type of anthropogenic activity (traps, farms, grazing sites and logging site). The Encounter rate (ER) or index of Kilometric Abundance (IKA) was obtained by dividing the total number of species signs/human signs observed by the length (L) of recce walk (in kilometer).

$$ER = N / L$$

Where: N = Species signs/Human signs observed

L = Length of recce (Km)

Finally, field data results were presented in the form of tables and graphs, frequencies, and percentages.

RESULTS

Encountered rate of drills and olive baboon's signs

Following recce walk, registering of drill's and olive baboon's signs to determine their encounter rate were obtained through direct sighting and indirect observations signs encountered in the study areas.

Direct sighting of drills and olive baboons

The direct sighting of these primates were undertaken along a recce path in 6 different locations of protected and non-protected areas. Table 1 shows the encountered rate of drill and olive baboon sighted in the study areas with respect to the total distance covered.

From table 1, the result shows that only one group of drills made up of 13 individuals were directly observed in the Black Bush Areas of Waindow which gave an encountered rate of 0.59 signs/km in this sampled area. And an overall encountered rate of 0.10 signs/km throughout the entire study areas. This means in every 1km within the study areas, the probability of encountering a drill is far less than 0.5, indicating a very low observation ($0.1 < ER < 0.5$). Up to 13 groups of olive baboons were observed throughout the study areas, which

Table 1: Encounter rate of Drills and Olive Baboons sighted in the study areas.

Species		Drills			Olive Baboons		
Study areas	DC/A (km)	NG	SP	ER signs /km	NG	SP	ER signs/km
Kimbi-Fungom National Park	44	/	/	/	3	65	1.5
Kom-Wum Forest Reserve	42	/	/	/	2	56	1.33
Black Bush Areas of Waindow	22	1	13	0.59	4	78	3.55
Zhongho-Fuh Forested Areas	8	/	/	/	1	24	3
Benakuma Forested Areas	8	/	/	/	1	27	3.38
Cha Bush Areas	7	/	/	/	2	39	5.57
TDC/ TSP/MER	131	1	13	0.10	13	289	2.21

Legend: Total Distance Covered (TDC); Distance Cover Per Area (DC/A); Number of Groups (NG); Species Population (SP); Mean Encountered Rate (MER); Encountered Rate (ER); Total Encountered Rate (MER); When $0.1 < ER < 0.5$ = low observation, $< ER > 0.5$ = High observation, and / = no observation.

Table 2: Encounter rate of drills and olive baboons indirect signs observed in the study areas.

Species		Olive Baboons						
Study areas	DC/A (km)	Indirect Signs/Encounter Rate						AER/ signs/ km
		V	ER	D	ER	C	EN	
Kimbi-Fungom National Park	44	12	0.27	1	0.02	4	0.09	0.13
Kom-Wum Forest Reserve	42	5	0.12	1	0.02	/	/	0.05
Black Bush Areas of Waindow	22	14	0.64	/	/	8	0.36	0.33
Zhongho-fuh forested areas (Kento)	8	2	0.25	/	/	/	/	0.08
Benakuma forested areas	8	3	0.38	/	/	2	0.25	0.21
Cha bush areas	7	2	0.29	/	/	2	0.29	0.19
TDC/TIS/AER	131	38	0.33	2	0.02	16	0.17	/

Legend: Total Distance Covered (TDC); Distance Covered Per Area (DC/A, Voices (V); Encountered Rate (ER); Dung (D); Carcass (C); Average Encountered Rate (AER) and / = no observation. When $0.1 < ER < 0.5$ = low observation, $< ER > 0.5$ = High observation.

Table 3: Encounter rate of anthropogenic activities observed in the study areas.

Study areas	DC/A (km)	ER of Anthropogenic Activities						AER/ signs/km
		F	H	G	NTFPs	Fs	L	
Kimbi-Fung National Park	44	0.55	0.73	0.64	0.45	0.27	0.18	0.47
Kom-Wum Forest Reserve	42	0.24	0.52	0.19	0.10	0.14	0.29	0.31
Black Bush Areas of Waindow	22	0.09	0.82	1.05	0.09	0.18	0.14	0.40
Zhongho-fuh forested areas	8	0.5	0.63	0.25	0.25	0.13	/	0.29
Benakuma forested areas	8	0.38	0.63	0.25	0.25	0.13	0.25	0.32
Cha bush areas	7	0.29	0.75	0.29	/	0.29	/	0.28
TDC, MER	131	0.34	0.68	0.40	0.19	0.19	0.14	0.35 0.32

Total Distance Covered (TDC); Distance Cover Per Area (DC/A); Farming (F); Hunting (H); Grazing (G); Non-Timber Forest Products (NTFPs), Fishing (Fs), Logging (L), Mean Encountered Rate (MER), Encountered Rate (ER), Average Encountered Rate (AER) and / = no observation. When $0.1 < ER < 0.5$ = low observation, $< ER > 0.5$ = High observation.

gave a mean encountered rate of 2.21 signs/km. This implies in every 1km walk in the study areas there is the possibility of encountering 2 olive baboons, signifying very high observations ($< ER > 0.5$) with respect to the total distance covered. The greatest number of baboons were directly sighted in the Black Bush Areas of Waindow with 78 individuals sighted giving an encountered rate of 3.55 signs per km.

Encounter rate of indirect signs of drill and olive baboon

Indirect indices of drill and olive baboon were also identified

during recce walks and recorded to further shows evidence of their presence. During the study periods, only three clearly biological indices were identified (dung, carcass, and voices). The table 2 shows the indices of abundance of drill and olive baboon observed in the study areas.

As shown by table 2, throughout the study areas and period, no indirect sign of drills was observed in the field. This show how this species have become very scarce and have disappeared in most of it previous suitable habitats. Most observable indirect biological indices

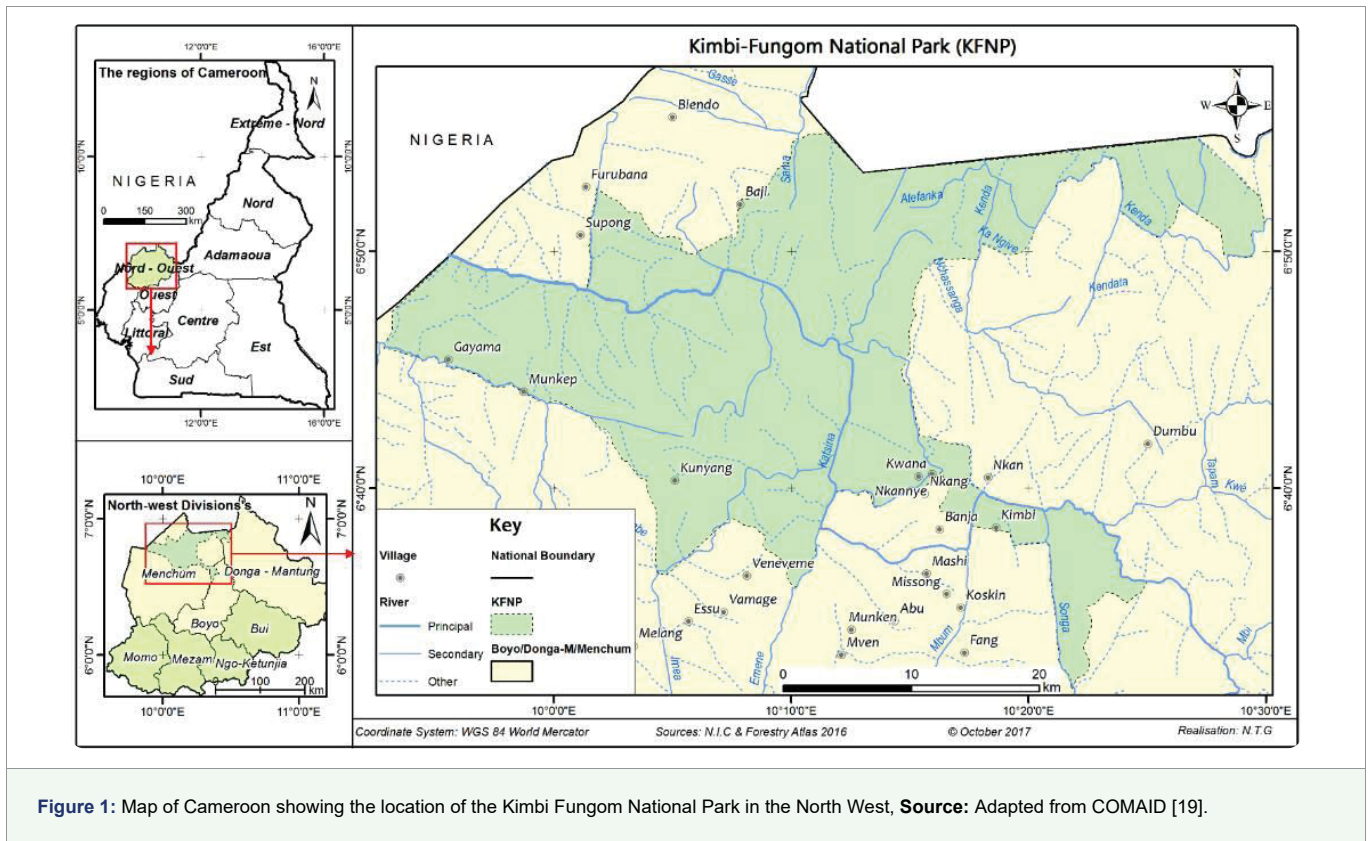


Figure 1: Map of Cameroon showing the location of the Kimbi-Fungom National Park in the North West, **Source:** Adapted from COMAID [19].

encountered in the study sites were the hearing of olive baboons voices (38 times) and carcasses (16), giving an average encountered rate of 0.33 signs/km and 0.17 signs/km, respectively in the entire study areas. This implies that there was a low observation ($0.1 < ER < 0.5$) of indices of indirect signs. That is in every one km walk, the possibility of seeing one indirect indices is very low. Equally, the highest indirect signs of olive baboons were observed in the Black Bush Areas of Waindow which gave an encountered rate of 0.33 signs/km equally, showing a low observation ($0.1 < ER < 0.5$) of indirect signs in this specific sampled area despite having the highest numbers of indirect signs [14] in his study of status of bushbuck and buffalo in the K-FNP, reported to have heard three times the voices of olive baboons and [13] in his study of the status of blue duiker and bushbuck in K-WFR reported to have heard twice the voices of baboons which in both cases are less than the numbers recorded in this study.

The distribution of drills and olive baboons in the study areas

Distribution analysis of these sighted primates shows that 100% of drills and 27% of olive baboons were concentrated in the Black Bush Areas of Waindow. For the rest of the study areas, 22.5%, 19.4%, 8.3%, 9.3% and 13.5% of olive baboons were concentrated in the Kimbi-Fungom National Park, Kom-Wum Forest Reserve, Zhongho-Fuh Forested Areas, Benakuma Forested Areas and Cha Bush Areas respectively. The high concentration of these primates in the Black Bush Areas of Waindow could be due to the fact that these species find safe and abundant food varieties as compare to high and constant disturb areas.

Encounter rate of anthropogenic activities in the study areas

The entering of humans into primate habitats either for

hunting or harvesting of natural resources, leaves signs which were recorded to assess the influence of their activities in these primate located sites within the study areas. As such, the relative abundance of anthropogenic activities were calculated to determine the hotspot. Figure 3 shows the encounter rate of the different signs of anthropogenic activities recorded in the study area.

From table 3, signs of anthropogenic activities were grouped into six main categories (farming, hunting, grazing, non-timber forest products, fishing and logging). All signs associated to hunting, registered the highest encountered rate in all the sample areas with the exception of grazing that gave the highest encountered rate of 1.05 signs per km in the Black Bush Areas of Waindow. The mean encountered rate of human activities associated to hunting gave 0.68 signs per km which entailed that there was a high observation ($< ER > 0.5$) of hunting indices as compared to logging activities with a mean encountered rate of 0.14 signs per km, which shown a low observation of signs throughout the study areas. With respect to each study area, the Kimbi-Fungom National Park gave an encountered rate of 0.47. This shown low observation since it falls between $0.1 < ER < 0.5$, but recorded the highest number of signs with respect to the other study areas such as the Cha bush areas that recoded a smaller number of signs with a mean encountered rate of 0.28 signs per km.

DISCUSSION

It is no doubt that drills and olive baboons continue to drastically decline around the study areas due to escalating hunting and habitat loss. For instance, the low observation of drills in which only 13 individuals (1 male, 5 females, 4 and 3 unidentified adults and young respectively) were observed in the Black Bush Areas of Waindow with an encountered rate of 0.10 signs/km throughout the entire study areas is evidence of decades of hunting, habitats loss and population

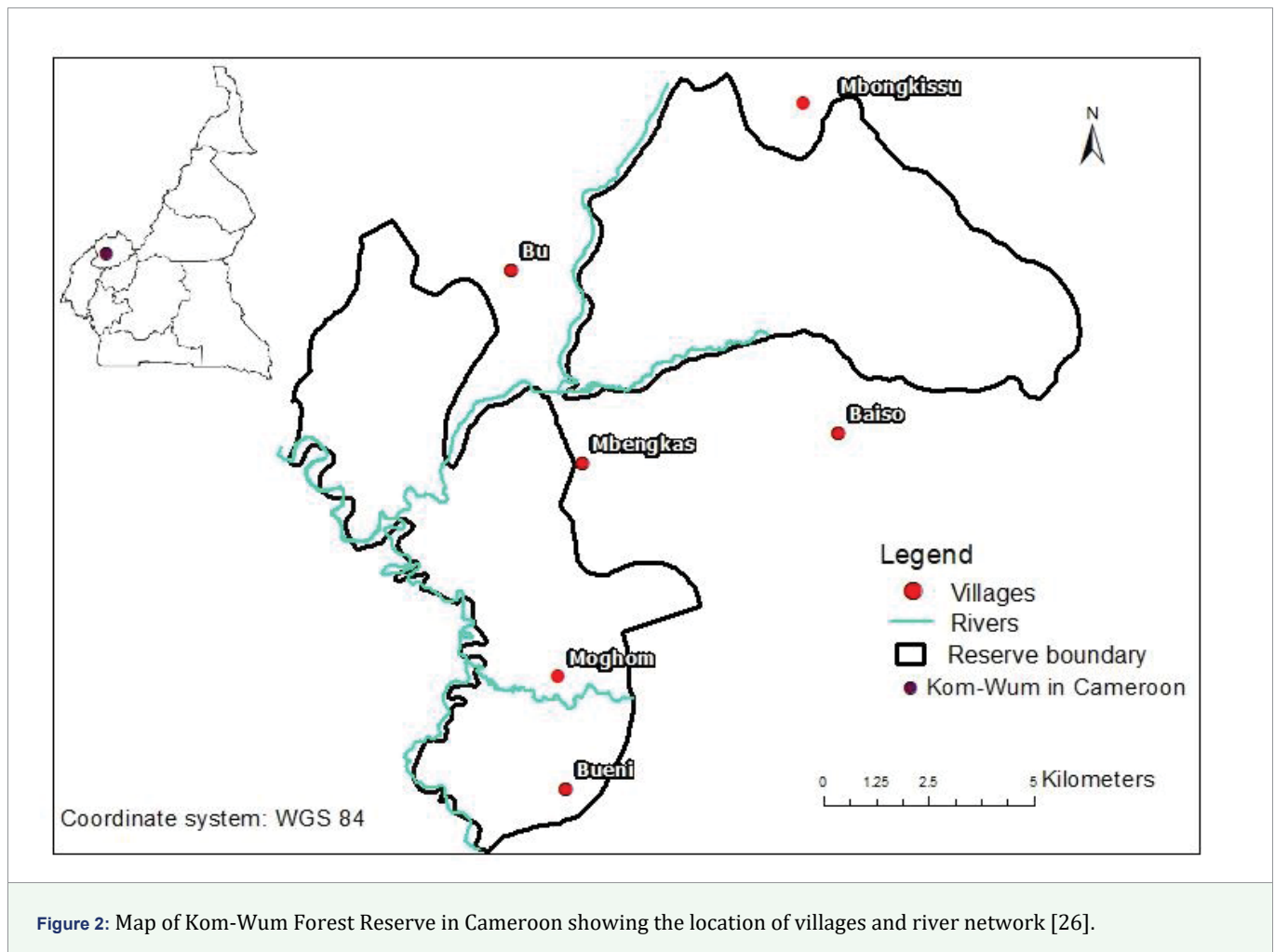


Figure 2: Map of Kom-Wum Forest Reserve in Cameroon showing the location of villages and river network [26].

growth. This confirms with the Menchum Division Delegation of the Ministry of Environment Nature Protection and Sustainable Development (MINEPDED) 2012 report that drills have disappeared in some of their suitable habitats, especially in protected areas such as the former Kimbi game reserve, Fungom, Furu-awa and Attue forest reserves within the region due to over hunting resulting from the growing local population. However, the founding of drills in this area might prove that they migrated to this very far area where they can find habitats security, enough food and shelter since this area is relative far away from the nearby villages when compare to the K-FNP, K-WFR and other areas that are relatively surrounded by nearby villages. Equally, they may have migrated from the cross river state in search of food since drills mostly know where to go and when fruits are in season.

For what concerns olive baboons, they were widely sighted throughout the study areas. Despite the fact that they are heavily hunted for food and for traditional medicine, rituals and festivals purposes. For instance, in the K-FNP, 28 individuals were observed in the Sabon-Gida and Gida-Jukum forested areas (involving 4 males, 12 females, 8 juveniles and 4 unidentified individuals), 15 individuals in the Fungom Forested Area (3males, 8 females and 4 juveniles) and 22 individuals sighted between the forested areas of Nkang toward Nser Forested Areas (3 male, 12 female and 7 juveniles). In the K-WFR, the first group of olive baboons 24 individuals (4 males, 10 females, 6 juveniles and 4 other individuals) were sighted in the Bu forested

areas and the second group of 32 individuals (6 males 9 females, 8 juveniles and others) sighted in the Baiso-Mbengkas forested areas. In the Black Bush Areas of Waindow, one group of 12 individual (2 male, 8 female and 2 young) were observed in the Attwe Forested Areas, in Itiaku Bush Areas, 14 individual were counted directly with only 3 males as the others rapidly disappear in the bush areas. Walking through the hill areas of Foujoughouh-Akalieu, on hearing the voices of baboons, 22 individuals were seen and only 2 females and 6 young were noticed. Furthermore, the last group 30 baboons were sighted in Njoughchou at a very far distance, randomly 8 young, 1 female and 2 male were counted within the group. Walking in Cha I and II Bush Areas 18 and 21 individuals were sighted, respectively. In the Zhongho-fuh forested areas (Kento; the bush name) more than 24 baboons were observed and around the Benakuma forested area, 27 individuals were sighted. In some of the instances, the individual were not differentiated according to their sex or age group due to the nature of the habitats and the fact that most of the animals ran away as they perceived human presence. The high encountered rate of olive baboons within the study areas could be due to the fact that some of these areas are presumed to be virgin areas where these animals are now locating and due to presence of abundant food and safety as their former suitable habitats have been destroyed due to high human disturbance through poor agricultural practices and unsustainable hunting. Equally, some of the sample areas were very distant from populous villages that usually ease hunter's and farmers' intrusion.

The identification of bio-indicator signs around the study areas remain prove of their existence. The encountered rate of baboon's voices heard throughout the study areas, which could have been from the same baboons directly sighted, signifies that despite human disturbances these primates are better comfortable in these zones than elsewhere. Carcasses were observed in some of the hunter's huts, which is a clear indication that these species of animals are still very much hunted. Thus, there is need for conservation attention since conserving olive baboon's means conserving the remaining survived of the drills population. The low observation of bio-indication signs in the study areas, was attributed to the fact that only agile hunters who are able to travel far distances, capable of spending days or weeks or months in constructed bush huts, and able to undertake hunting throughout the seasons visit these areas.

While it remain unclear to say with certainty the different areas in which drills are found in the study areas as compare olive baboons, due to decade of hunting and exaggerated perturbation of primate habitats by human intrusion, 100% of drills and 27% of olive baboons were concentrated in the non-protected Black Bush Areas of Waindow. This indicate that, these animals may have ran away from protected areas to increasing human intrusion that come with too much noise and habitats destruction. This calls for concern, as conservationist should embark on studies that can provide strategies that will maintain and improve connective routes between these non-protected areas to the surrounding protected areas to improve the low encountered rate generally notice in the K-FNP and K-WFR.

The encountered rates of anthropogenic activities around the study areas with all activities associated with hunting showing high observations, imply that drills and olive baboons are still hunted in these areas. This is in line with some researches that human activities especially through hunting will continue to perturb wildlife natural habitats [28,29]. The high recorded number of anthropogenic activities in the K-FNP was due to the abundance of wildlife species and the closeness of some villages that bolder illegal hunters who target these species. Much more, farming inside the park exposes drills and olive baboons to targeted hunting as they turn to feed on farm products. As such, the cultivation of crop near wildlife habitats will always led to a situation of conflict and loss of wildlife as humans seek ways to guide their crops [30]. In addition, exaggerated unguided conservation strategies to reinforced law-abiding majors that can hinder intruders into the park is overwhelming. On the other hand, the low recorded signs of human activities in the study areas such as the Cha Bush Area was due to the fact that wild animals especially drills and baboons may have run away from the protected areas and some of their suitable areas around to find safety in these areas which is less disturbed by human activities. Despite this run, the presence of human indices in these areas shown they are still very much pursued by human in these areas that they may have little mastering of it and instability in food supply, thus further exposed to certain condition of harshness.

CONCLUSION

Based on hunters description, that drills have short tails when compare to olive baboons and that their overall body are dark grey-brown with male having a pink lower lip and white chin on a dark grey to black face with raised grooves, lead to the affirmation that 13 drills are still in existence around the study areas. But more research is require to know their habitat preferences or if they are migratory species. Olive baboons were widely spread throughout the study

areas and face deteriorating anthropogenic activities. All activities associated with hunting shown high encountered observations signs with up to 16 carcasses of olive baboons observed in some of the hunter's huts. This implies, drills and olive baboons are very much still hunted in these areas, and that human activities continue to perturb their natural habitats. Therefore, there is an urgent need for conservation attention since conserving olive baboon's means conserving the remaining survived drills population. The study pointed out an uneven dispersal of these species within the sample areas as 100% of drills and 27% of olive baboons were concentrated in the non-protected Black Bush Areas of Window. This is an indication that, these animals may have ran away from protected areas as a result of increasing human intrusion that comes with too much noise, habitats destruction and settled there because of abundant food, water and safety. This calls for concern, as conservationists should embark on studies that can provide strategies to conserve connective routes between these non-protected areas to the surrounding protected areas to recover the low encountered rate generally notice in the K-FNP and K-WFR. Furthermore, upgrading data on the abundance and distribution of drills and olive baboons, identifying areas of intense anthropogenic activities through effective conservation methods such as line transect; will greatly help to identify hotspots and ensure better protection for these species. Notwithstanding, it is vital to undertake regular educational conservation plans to promote all stakeholders on the necessity to conserve the remaining species, especially the few drills population. Build collaboration among the few primate researchers around the region to encourage primate conservation in protected and non-protected areas.

DECLARATIONS

Authors' contributions

MDC, TEA, FC, TAI and APN were involved in the design, interpretation and analysis of data. MDC, performed the field work and drafted the present article; TEA and TAI, supervised and gave directives on how to conduct the research work. All authors read and approved the final manuscript.

ACKNOWLEDGMENT

Sincere thanks to all those who contributed in one way or the other to the success of this work. We acknowledge the practical field support offered by the Staff of Kimbi-Fungom National Park and and the Wum and Fundong councils support staffs. Our gratitude and appreciations goes to the traditional authority and field assistants. We thankful to the Research Units of Biology and Applied Ecology and the Laboratory for Wildlife, Protected areas, Sylviculture and Wood Technology of the University of Dschang; for working space and material supports.

REFERENCES

1. Modu M, Alarape AA, Omifolaji JK, Burabe BI. The distribution and abundance of baboons (*Papio anubis*) in sambisa game reserve. Journal of Research in Forestry, Wildlife and Environment. 2015;7(2):60-66. <https://tinyurl.com/vhw75w1b>
2. Morgan BJ, Abwe EE, Dixon AF, Astaras C. The distribution, status, and conservation outlook of the drill (*mandrillus leucophaeus*) in cameroon. International Journal of Primatology. Int J Primatol. 2013;34:281-302. Doi: 10.1007/s10764-013-9661-4
3. Astaras C. Ecology and status of the drill (*mandrillus leucophaeus*) in korup national park: Implications for conservation. Georg-August-Universität Göttingen, Göttingen, Germany. 2009. <https://tinyurl.com/18wpvyzr>

4. Oates JF, Bergl RA, Linder JM. Biodiversity and conservation in the gulf of guinea. *Advances in applied biodiversity science*, no. 6. Washington, DC: Conservation International Center for Applied Biodiversity Science Press. 2004. <https://tinyurl.com/2eq6zvz>
5. Hearn G, Morra W. The approaching extinction of monkeys and duikers on bioko island, equatorial guinea, Africa. Glenside: Arcadia University, Bioko Biodiversity Protection Program. 2001.
6. Chuo DM, Tsi EA, Fotang C, Fru BS. Estimation of chimpanzee's (pan troglodytes ellioti) abundance in the kimbi-fungom national park and kom-wum forest reserve, NW, Cameroon. *Journal of Biodiversity Management & Forestry*. 2017d;6(3):1-20. Doi: 10.4172/2327-4417.1000185
7. Chuo DM, Tsi EA. Chimpanzee in ethno-primatological practices and it implications for biodiversity conservation: Kimbi-fungom national park and kom-wum forest reserve, Cameroon. *American Journal of Agriculture and Forestry*. 2017e;5(5):157-172. <https://tinyurl.com/naaa9sy9>
8. Wild C, Morgan BJ, Dixon A. Conservation of drill populations in bakossiland, cameroon: historical trends and current status. *International Journal of Primatology*. 2005;26(4):759-773. <https://tinyurl.com/9msz4h8z>
9. Oates JF, Butynski TM. *Mandrillus leucophaeus*. In IUCN 2011. IUCN Red List of Threatened Species. 2008. <https://tinyurl.com/1p5h6dv8>
10. Mullu D, Melese S. Feeding ecology of olive baboon (papio anubis) in arba minch forest, arba minch, ethiopia. *Journal of Natural Sciences Research*. 2016;6(21):1-5. <https://tinyurl.com/4gajs275>
11. Chuo DM, Tsi EA. Propose strategies to enhance the biodiversity status and traditional knowledge systems relevant for the conservation of pan troglodytes ellioti in the kimbi-fungom national park and kom-wum forest reserve. *International Journal of Advanced Engineering, Management and Science (IAEMS)*. 2018;4(4):329-350. Doi: 10.22161/ijaems.4.4.15
12. Chuo DM, Tsi EA, Tchamba MN. Indigenous people conflicts on chimpanzee (pan troglodytes ellioti) crop raiding and natural resource exploitation, case study: Kimbi-fungom national park and kom-wum forest reserve nw, cameroon. *International Journal of Rural Development, Environment and Health Research (IJREH)*. 2017c;1(3):32-50. Doi: 10.22161/ijreh.1.3.5
13. Akwo CE, Tsi EA, Chuo DM. Status of blue duiker (cephalophus monticola) and bushbuck (tragelaphus scriptus) in kom-wum forest reserve, North West region, Cameroon. *International Journal of Environment, Agriculture and Biotechnology (IJEAB)*. 2018;3(2):619-636. Doi: 10.22161/ijeab/3.2.42.
14. Nda NF, Tsi EA, Fominyam C, Chuo DM, Fotang C, Bate AA, Christian E. Status of bushbuck (tragelaphus scriptus) and buffalo (syncerus caffer) in the north and south eastern parts of the kimbi-fungom national park, north west region of Cameroon. *International Journal of Forest, Animal and Fisheries Research (IJFAF)*. 2018;2(3):1-25. doi: 10.22161/ijfaf.2.3.2
15. Chuo DM, Tsi EA. Status of large mammals: Case study of gorilla (gorilla gorilla diehi), chimpanzee (pan troglodytes ellioti) and buffalo (syncerus caffer), menchum south, NW Cameroon. *International Journal of Environment, Agriculture and Biotechnology (IJEAB)*. 2017a;2(4):1523-1529. Doi: 10.22161/ijeab/2.4.11.
16. Tsi EA, Chuo DM. Contributions of indigenous knowledge of gorilla (gorilla gorilla diehi), chimpanzee (pan troglodytes ellioti) and buffalo (syncerus caffer) conservation, in waindow, North West Cameroon. *Annual Research & Review in Biology*. 2016;11(2):1-14. <https://tinyurl.com/4guhkw4z>
17. Tsi EA, Benazia NM, Chuo DM. Implications of human-wildlife conflict on local livelihood: Case study, kimbi-fungom national park Cameroon. *International Journal of Research-GRANTHAALAYAH*. 2020a;8(5):146-157. doi: 10.29121/granthaalayah.v8.i5.2020.54.
18. Tsi EA, Kaimo NK, Chuo DM, Woyu HB. Abundance and distribution of pangolins (manis spp.) In the kimbi-fungom national park, North West region, Cameroon. *Journal of Entomology and Zoology Studies*. 2019a;7(6):71-78. <https://tinyurl.com/2aksd4oo>
19. Kaimo NK, Tsi EA, Chuo DM, Ghasarah GL. Community perception and pangolins (manis spp.) Conservation in the kimbi-fungom national park, North West Cameroon. *International Journal of Forest, Animal and Fisheries Research (IJFAF)*. 2019;3(3):86-96. Doi: 10.22161/ijfaf.3.3.3.
20. Ekinde A, Ashu M, Groves JS. Preliminary ape surveys around the fungom forest reserve and furuawa sub division, North West province, Cameroon. *Wildlife Conservation Society, Cross River Gorilla Project*. 2005:45. <https://tinyurl.com/56dmv838>
21. Doumbé OA. Habitat mapping of the babanki-finge forest, and survey on the rarest chimpanzee (pan troglodytes ellioti) in the bamenda highlands, North-West Cameroon. University of Roehampton, London 2014. <https://tinyurl.com/42hveraz>
22. Tata FT. The kimbi-fungom national park-a situation report. Green works company Ltd, Bamenda. 2015.
23. Kam Kah H. History and livelihood challenges in a Cameroon's montane forest reserve. *Economic & Ecohistory/Ekonomiska i Ekohistorija*. 2015;11(11).
24. Chefor F. Ecology and behaviour of the nigeria-Cameroon chimpanzee in kom-wum forest reserve and mbi crater kefem landscape in the north-west region of Cameroon. Rufford. 2018. <https://tinyurl.com/1binjclck>
25. Morgan BJ, Adeleke A, Bassey T, Bergl R, Dunn A, Fotso R. Regional action plan for the conservation of the nigeria-Cameroon chimpanzee (pan troglodytes ellioti), IUCN/SSC Primate Specialist Group and Zoological Society of San Diego. 2011. <https://tinyurl.com/5a7k7uxf>
26. Chuo MD, Angwafo TE, Chefor F, Taku Awa II. Valorization of great apes wild materials in traditional medicine; threats to apes conservation in the menchum landscape areas, nw Cameroon. *Int J Primatol Res*. 2021;4(1):001-009. <https://tinyurl.com/1p12etdd>
27. White L, Edwards A. Conservation research in the African rain forests: A technical handbook. *Wildlife Conservation Society*. 2000:444. <https://tinyurl.com/1qg59jxa>
28. Njukang AP, Tsi EA, Seino RA, Lebga AK, Chuo DM. Effects of anthropogenic activities on chimpanzee nest location in the tofala hill wildlife sanctuary (thws), south west region, Cameroon. *International Journal of Forest, Animal and Fisheries Research (IJFAF)*. 2019a;3(1):1-9. Doi: 10.22161/ijfaf.3.1.1.
29. Bobo KS, Aghomo FF, Ntumwel BC. Wildlife use and the role of taboos in the conservation of wildlife around the nkwende hills forest reserve; south-west Cameroon. *J Ethnobiol Ethnomed*. 2015 Jan 7;11(1):2. doi: 10.1186/1746-4269-11-2. PMID: 25567094; PMCID: PMC4326412.
30. Attia TSN, Tchamba NM, Forbuizie TP, Tsi EA, Chuo DM. Human wildlife conflict: Causes, consequences and management strategies in mount Cameroon national park south west region, Cameroon. *International Journal of Forest, Animal and Fisheries Research*. 2018;2(2):34-49. Doi : 10.22161/ijfaf.2.2.1.