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# Hunter Perception and Population Dynamics of Red Colobus Monkeys in the Rumpi Hills Forest Reserve, Southwest Cameroon

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## ABSTRACT

**Background and Objective:** Preuss's red colobus monkeys are a red colobus primate species endemic to the forests of Southeastern Nigeria and Southwestern Cameroon. The absence of data on the population dynamics of these monkeys around the Rumpi Hills Forests Reserve (RHFR) impedes conservation efforts. This study assessed local hunters' perception of the population dynamics and factors that influence the status of Preuss's red colobus around the RHFR. **Materials and Methods:** Population dynamics data of red colobus monkeys were collected from 42 hunters in 23 villages near RHFR between November, 2023 and February, 2024, using semi-structured interviews with closed and open-ended questions. Hunters, aged 18 or older, were verified through National Identity Cards or approval from local authorities, with interviews conducted in Oroko or Pidgin English when necessary. A One-Sample Student t-test at a 95% confidence interval and pearson's rank correlation analysis ($p = 0.000$) were used to assess the population status of the red colobus. **Results:** Results showed the majority of the hunters (92.9%) were males who have been hunting for more than 20 years. Meanwhile, although everyone hunted red colobus monkeys for marketing and household consumption through snares 40.5% and guns/spears 33.3%, no hunter had a hunting license. In addition, Pearson's rank correlation analysis showed a significant relationship between the length of hunting time and the number of red colobus monkeys killed. A One-Sample Student t-test showed a significant difference between the number of times respondents had observed a monkey, estimated numbers in the wild and the numbers killed. **Conclusion:** Although hunters have a significant role to play in the population dynamics of the existence of red colobus monkeys around the RHFR, alternative income-generating sources should be promoted among local hunting communities to ensure the sustainability and survival of monkey populations.

## KEYWORDS

Red colobus conservation, population dynamics, Rumpi Hills, protected areas, hunting, conservation



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## INTRODUCTION

Around tropical forest zones of Africa, over 106 primate species are under threat of extinction. This is usually likened to increasing demand for bushmeat and a lack of effective government control services. In many tropical African countries, easy access to hunting guns, spears, snares and wires has steadily increased and has become prevalent[1,2]. This phenomenon has in several instances given rise to primary and secondary tropical forests with little or no large mammal species[3]. In a related study, aside from hunting with guns and snares and habitat loss from agricultural expansion[4], also observed logging concessions and livestock farming to be global primary proximate threats to primate conservation.

Preuss's red colobus monkeys *(Piliocolobus preussi)* are a red colobus primate species endemic to lowland, mid-altitude and sub-montane moist forests of Southeastern Nigeria and Southwestern Cameroon[5].This region is characteristic of an exceptionally high level of biodiversity around the largest and last remnants of contiguous West African tropical forest blocks[6,7].

In Southeastern Nigeria, Preuss's red colobus monkeys are found in the Oban Division of the Cross River National Park. Meanwhile, in the Southwest Region of Cameroon, an important population occurs in the Korup National Park. Historically, once widely present in the Ebo-Makombe-Ndokbou forests of Cameroon's Littoral Region, Preuss's red colobus species have largely disappeared from these forests[8].

These monkeys are one of the most threatened mammal species and constitute the most endangered group of African primates. Due to hunting pressure and the destruction of its habitat from agricultural expansion and extractive industries, all 17 species are threatened with extinction and are classified as critically endangered on the IUCN Red List (International Union for Conservation of Nature Red List of Threatened Species)[8].

Bushmeat, often referred to as any wild meat derived from wildlife species, is a glaring example of the interplay between forest resources and local rural livelihoods[9]. The trade-in bushmeat has also shown the conspicuous role played by primates and other mammals living in the wilds of tropical Africa[10,11]. This persistent increasing bushmeat dependence trend across West Africa has pushed researchers to more explicitly assess hunting and the ever-expanding trade in wildlife resources from both unprotected and protected areas. This is because knowledge of interactive zones between wildlife and local forest communities can provide a great understanding of the relationships between larger mammals particularly primates and hunters[12-14].

For instance, human-wildlife studies around the Dzanga-Sangha Reserve in the Central African Republic, have shown population size, behavior and activity patterns of primates to have been altered. This shift has been likened to changing patterns in human-forest interaction and perceptions due to economic, ethnic and political realities[13,15]. In a related study around the Island of Bioko[16], found primate carcass volumes to have increased in tandem with Equatorial Guinea's gross domestic product growth. Their study also observed an increase in local citizens' available disposable income and the accessibility to shotguns. Considering the importance of primates and other wildlife species to human nutrition, health, social and spiritual wellbeing, it is imperative to consider the interdependent connections between human populations and the future of wildlife species[10,17].

As a result of continuous hunting and declining encounter rates, red colobus monkeys have attracted scientific attention and hence, regional conservation efforts[18]. Despite their role in shaping current land use restrictions around the Rumpi Hills Forests Reserve (RHFR), studies have rarely focused on these and other primate species across the area. Research on red colobus monkeys has mainly been conducted around the adjacent Korup National Park and Nkwende Hills Forest Reserve[8,19-21].

Joshua *et al.*[22], documented the population dynamics of two primates *Piliocolobus preussi* and *Cercocebus torquatus* around four protected areas in the Southwest region of Cameroon. These include the Korup National Park, Bayang-Mbo Wildlife Sanctuary, Nkwende-Hills, Nta-Ali and Rumpi-Hills Forest Reserves. The study observed poaching and habitat loss to be the main threats to the population dynamics of both species. Also, the relative abundance of primates and comparative analysis over 26 years across the northeastern fringes of the Korup National Park of Southwest Cameroon. Their study found expanding and booming trade in wildlife resources has pushed up hunting pressures rendering primate conservation and management very critical and less effective[23].

More research in the domain[24] evaluated the level of cultural inclinations and the role of traditional knowledge and taboos in conservation and biodiversity around the Nkwende Hills Forest Reserve of Southwest Cameroon. Their studies observed that the various mechanisms to combat threats to wildlife do not incorporate local taboos and traditional knowledge. They suggested that in reconciling species conservation, top priority should be given to species that are of a higher traditional and cultural value for local human requirements and community livelihood.

Studies addressing the population dynamics of red colobus monkeys in the RHFR are lacking, this is thus the first study that addresses this topic. The present study closes that knowledge gap as it examines hunter characteristics and perception of red colobus monkeys. This information would enhance knowledge on primates and improve conservation policies. It would also serve as a resource base for effective networking between forestry stakeholders, policymakers and forest-reliant communities, to develop effective rural development programs and conservation policies targeted at curbing hunting rates and improving wildlife conservation.

## MATERIALS AND METHODS

**Study area:** The horse-shoe-shaped Rumpi Hills Forest Reserve (RHFR), (Latitude: 4°51'26" Longitude: 9°07'15") is in the Southwest Region of Cameroon particularly Ndian division[25]. It was created in 1941 and spreads across an estimated 455 km$^2$. Much of the population is rural with over 90% involved in agricultural activities growing food and cash crops. Local populations also engage in other livelihood activities such as harvesting of non-timber forest products (NTFPs). The NTFPs are goods of biological origin aside from wood and timber obtained from agroforestry systems, forests, fallows and plantations. Around RHFR, NTFPs are mainly bush mango, land snails, bush pepper, edible mushrooms, bitter cola and njansang[2,26].

**Sampling of rural communities:** Data on population dynamics of red colobus monkeys were collected from local community hunters between November, 2023 and February, 2024 during household interviews in the form of semi-structured, closed and open-ended recall questions[27]. The hunters who reside in villages adjacent to the RHFR also hunted as their main economic activity and therefore are vital historical hunting data sources. Based on a door-to-door survey, participation was voluntary and the hunters were at least 18 years old (as defined by Cameroonian Law). A verification of their National Identity Cards was done and where this was not available, approval was requested from the local community head, village chief or his representative. Additionally, where hunters were not able to understand English, the local Oroko language or Pidgin English was employed by the researchers to make sure the hunter understood before responding. About 42 hunters across 23 villages adjacent to the RHFR were interviewed.

**Analysis:** To evaluate the population status of the red colobus, a One-Sample Student's t-test was conducted on the data using a 95% confidence interval. Additionally, Pearson's rank correlation analysis was performed, yielding statistically significant results ($p = 0.000$).

## RESULTS

**Hunter characteristics:**The majority of the hunters (92.9%) were males, residents (69%) and who had lived in their villages for more than 30 years (35.7%), Table 1. In addition, about 39% were above 60 years old, 66.7% were married, 54.8% had obtained primary education only and most of the hunters (42.9%) had been hunting for more than 20 years.

None of the hunters had a hunting permit, 73.8% hunted for household consumption and everyone hunted red colobus monkeys mainly through snares 40.5% and guns/spears 33.3%. Thus, each of the hunters knew of the existence of the red colobus monkey, 33.3% had encountered the monkey between 30-40 times since they began hunting and every month (57.1%), around their village forests (88.1%). Looking at the last time each hunter had encountered a red colobus monkey, here, 50% had encountered the monkeys a month before this study. Also, 38.1% of the hunters hunted between 100 and 150 red colobus monkeys mainly for household consumption, Table 2 and 3.

**One-sample student t-test:** To assess the population status of the red colobus, a One-Sample Student T-Test was applied to the data at a 95% confidence interval. There was a significant difference between the number of times respondents had observed a monkey, estimated numbers in the wild and the numbers killed. While 3.262% of the hunters had seen the monkeys, 4.167% could estimate the numbers seen and only 2.952% could estimate the number of monkeys they had killed shown in Table 4.

Table 1: Characteristics of the hunters

| Hunter characteristics | Frequency | Percentage | Cumulative percentage |
|---|---|---|---|
| **Gender** | | | |
| Male | 39 | 92.9 | 92.9 |
| Female | 3 | 7.1 | 100.0 |
| **Village of origin** | | | |
| Yes | 29 | 31.0 | 31.0 |
| No | 13 | 69.0 | 100.0 |
| **Age range** | | | |
| 21-30 | 3 | 7.1 | - |
| 31-40 | 5 | 11.9 | - |
| 41-50 | 4 | 9.5 | - |
| 51-60 | 8 | 19.1 | - |
| Above 60 | 22 | 52.4 | - |
| **Marital status** | | | |
| Single | 3 | 7.1 | 7.1 |
| Married | 28 | 66.7 | 73.8 |
| Divorced | 7 | 16.7 | 90.5 |
| Widow | 4 | 9.5 | 100.0 |
| **Level of education** | | | |
| No education | 16 | 38.1 | 38.1 |
| Primary education | 23 | 54.8 | 92.9 |
| Secondary education | 3 | 7.1 | - |
| **Years of hunting** | | | |
| 0-5 | 7 | 16.7 | 16.7 |
| 6-10 | 11 | 26.2 | 42.9 |
| 11-15 | 4 | 9.5 | 52.4 |
| 16-20 | 2 | 4.8 | 57.1 |
| Above 20 | 18 | 42.9 | - |
| **Years of residence** | | | |
| 0-10 | 13 | 31.0 | 31.0 |
| 11-20 | 9 | 21.4 | 52.4 |
| 21-300 | 5 | 11.9 | 64.3 |
| Above 30 | 15 | 35.7 | 100.0 |

Table 2: Population dynamics of red colobus

| Hunting License | Frequency | Percentage | Valid percentage |
|---|---|---|---|
| Yes | 0 | 0 | 0 |
| No | 42 | 100 | 100 |
| **Knowledge of red colobus** | | | |
| Yes | 0 | 0 | 0 |
| No | 42 | 100 | 100 |
| **Observation of red colobus** | | | |
| Yes | 0 | 0 | 0 |
| No | 42 | 100 | 100 |
| **Times of observation** | | | |
| 0-10 | 4 | 9.5 | 9.5 |
| 11-20 | 11 | 26.2 | 26.2 |
| 21-30 | 5 | 11.9 | 11.9 |
| 31-40 | 14 | 33.3 | 33.3 |
| Above 40 | 8 | 19.0 | 19.0 |
| **Frequency of observation** | | | |
| Weekly | 2 | 4.8 | 4.8 |
| 2 weeks | 13 | 31.0 | 31.0 |
| Monthly | 24 | 57.1 | 57.1 |
| Yearly | 3 | 7.1 | 7.1 |
| **Area of observation** | | | |
| Village forest | 37 | 88.1 | 88.1 |
| Another village forest | 5 | 11.9 | 11.9 |
| **Period of observation** | | | |
| This week | 8 | 19.0 | 19.0 |
| Last week | 5 | 11.9 | 11.9 |
| Last month | 21 | 50.0 | 50.0 |
| Last year | 6 | 14.3 | 14.3 |
| More than a year | 2 | 4.8 | 4.8 |
| **Estimated numbers observed** | | | |
| 1-50 | 1 | 2.4 | 2.4 |
| 51-100 | 3 | 7.1 | 7.1 |
| 101-150 | 9 | 21.4 | 21.4 |
| 151-200 | 4 | 9.5 | 9.5 |
| Above 200 | 25 | 59.5 | 59.5 |

Table 3: Hunting of red colobus

| Hunting/killing | Frequency | Percentage | Valid percentage |
|---|---|---|---|
| Yes | 42 | 100 | 100 |
| No | 0 | 0 | 0 |
| **Hunting method** | | | |
| Traps | 17 | 40.5 | 40.5 |
| Gun/spear | 14 | 33.3 | 33.3 |
| Fire | 2 | 4.8 | 4.8 |
| Dogs | 9 | 21.4 | 21.4 |
| **Estimated number killed** | | | |
| 1-50 | 10 | 23.8 | 23.8 |
| 51-100 | 3 | 7.1 | 7.1 |
| 101-150 | 16 | 38.1 | 38.1 |
| 151-200 | 5 | 11.9 | 11.9 |
| >200 | 8 | 19.0 | 19.0 |
| **Reason for hunting** | | | |
| Business | 8 | 19.0 | 19.0 |
| Eat | 31 | 73.8 | 73.8 |
| Traditional use | 3 | 7.1 | 7.1 |
| | | 100.0 | 100.0 |

Table 3: Continue

| Hunting/killing | Frequency | Percentage | Valid percentage |
|---|---|---|---|
| **Population dynamics** | | | |
| Increase | 11 | 26.2 | 26.2 |
| Decrease | 7 | 16.7 | 16.7 |
| No change | 24 | 57.1 | 57.1 |
| **Drivers of population dynamics** | | | |
| Overhunting | 3 | 7.1 | 7.1 |
| Bushmeat trade | 5 | 12 | 12 |
| Population pressure | 4 | 9.5 | 9.5 |
| Forest loss | 27 | 64.3 | 64.3 |
| Lack of forest protection | 3 | 7.1 | 7.1 |
| **Maintaining dynamics population** | | | |
| Job creation | 18 | 42.9 | 42.9 |
| Farm-to-market roads | 3 | 7.1 | 7.1 |
| Capacity building | 11 | 26.2 | 26.2 |
| Involve communities in forest management | 7 | 16.7 | 16.7 |
| Improve forest protection | 3 | 7.1 | 7.1 |

Table 4: One-sample test

| | Test value = 0 | | | | | |
|---|---|---|---|---|---|---|
| | | | | | 95% CI | |
| | t | df | Sig. (2-tailed) | Mean difference | Lower | Upper |
| How many times have you seen? | 16.165 | 41 | 0.000 | 3.262 | 2.85 | 3.67 |
| Can you estimate the number of red colobuses seen? | 23.566 | 41 | 0.000 | 4.167 | 3.81 | 4.52 |
| How many red colobuses have you killed? | 13.706 | 41 | 0.000 | 2.952 | 2.52 | 3.39 |

t: t-distribution, df: Degrees of freedom and 95% CI: 95% Confidence Interval of the Difference

Table 5: Pearson's rank correlation

| | How long have you been hunting | How many red colobuses have you killed |
|---|---|---|
| **How long have you been hunting?** | | |
| Pearson correlation | 1 | 0.853** |
| Sig. (2-tailed) | | 0.000 |
| N | 42 | 42 |
| **How many red colobuses have you killed?** | | |
| Pearson Correlation | 0.853** | 1 |
| Sig. (2-tailed) | 0.000 | |
| N | 42 | 42 |

**Correlation is significant at the 0.01 level (2-tailed)

**Pearson's rank correlation analysis:** To provide evidence that corroborates the perception of hunters on red colobus monkey's existence in thee RHFR, a Pearson's rank correlation analysis was performed. There is a significant relationship between the length of hunting time and the number of monkeys killed. This shows that hunters have a significant role to play in the existence of red colobus monkeys in the Rumpi Hills Forest Reserve. The Pearson correlation between the duration of hunting and the number of red colobuses killed is 0.853, which is statistically significant ($p = 0.000$) with a sample size of 42 as shown in Table 5.

## DISCUSSION

The energy demands of hunting are extremely high, which is often made available by energetic and younger male populations. This thus makes hunting a male-dominated activity mostly practiced by residents because local cultural norms and traditions are intolerant to cross village-border hunting grounds. Most of the villages thus consider their user rights over local hunting grounds thus often forbidding other non-local hunters from trespassing. Besides, with a youthful population and low level of education to direct their livelihood decisions, hunting remains one of the gateways out of poverty, a

source of household proteins and income. Local communities lack basic knowledge about water and soil conservation techniques, as well as other options for livelihood diversification[25,28]. Hence, these diversification setbacks ripple out into more probable livelihood scenarios to increase household proteins and incomes. Furthermore, most of the hunters live together as couples and carry the burden of bearing and early child-upbringing years. These couples thus face the challenges of increasing household income, feeding and nurturing a very labor-inefficient family, which therefore increases dependence on hunting for household consumption and marketing.

Aside from various household drivers, the absence of gun control measures and law enforcement combine to increase dependence on hunting around the study area. Here, the use of snares, especially the available, cheap wired traps as well as the fact that none of the hunters had a hunting permit, they could therefore hunt any animal of their choice. Therefore, the various derived livelihood benefits, mundane socioeconomic opportunities and traditional/customary linkages propel the illegal hunting activity[9].

Similarly, monkeys are hunted based on their encounter rates therefore, the hunting of monkeys is indiscriminate mainly depending on the numbers in the wild. This can also be likened to low estimate rates among hunters on the number of monkeys they had killed.

In addition, the population dynamics of red colobus monkeys in the RHFR are significantly determined by hunting time. As the number of hunting years increased, this increased the number of monkeys killed by a hunter. This is often due to the increase in their family size, easy access to gun and snare traders as well as bushmeat markets. With the absence of effective government control measures, these all combine to drive up the demand for bushmeat. Across tropical Africa, this easy access to hunting guns and wires has steadily driven up hunting rates hence reliance on bushmeat for household consumption and bushmeat trade[1,2].

## CONCLUSION

The study revealed that the majority of hunters (92.9%) were males with over 20 years of experience in hunting, predominantly using snares (40.5%) and guns/spears (33.3%) for hunting red colobus monkeys, yet none possessed a hunting license. Pearson's rank correlation analysis showed a significant relationship between hunting duration and the number of monkeys killed, while a One-Sample Student t-test highlighted significant differences in observed monkey numbers, estimated populations in the wild and those killed. These findings underscore the significant impact of male-dominated, unregulated hunting practices, lack of education and inadequate law enforcement on the red colobus monkey population. The study calls for enhanced conservation policies, government action and stakeholder involvement to address these threats.

## SIGNIFICANCE STATEMENT

The study reveals that hunting practices, particularly targeting red colobus monkeys, are predominantly male-driven, with hunters having extensive experience but lacking proper licenses. The use of snares and guns/spears, coupled with easy access to hunting tools, contributes significantly to the pressure on monkey populations. Pearson's correlation and One-Sample t-test analyses highlight the connection between hunting experience and the number of monkeys killed, as well as discrepancies in hunter observations and estimates of monkey populations. The findings emphasize the need for improved conservation education, stricter law enforcement and more effective management strategies to address these threats to wildlife.

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