Assessment of the Distribution and Abundance of Western Hartebeest (*Alcelaphus Buslaphus)* in the Southern Sector of Gashaka Gumti National Park, Taraba State, Nigeria

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ABSTRACT

Objective: To Assess the Population Distribution and Cornucopia of Western Hartebeest and Demographic Characteristics of and coitus Structure, of Western Hartebeest in the National Park

Material and Method: The exploration employed a transect- grounded check design, to estimate the population size and structure of hartebeest in the southern sector at Mayo Selbe Range(MSR), Fillinga Range (FR), and Gam- Gam Range (GGR) and Gumti (GR). Data were collected over a 12- weeks period(January- March 2023) during the dry season and 12- weeks period of April- July 2023) during the wet season. Direct counts were conducted doubly weekly, during morning (0600- 1100) and evening (1600- 1900) ages, when hartebeest were most active. Compliances were recorded using a standardized data distance. Four transects from each with 3.5 km long and 50m wide, were established in each range using a methodical arbitrary slice approach. Transects were marked with flags at regular intervals (every 100 m) to insure harmonious range and length.

Results: The results revealed significant spatial and temporal variations in hartebeest cornucopia across four transect areas T1- T4 specifically, T3 recorded the loftiest mean total cornucopia during the dry season (January- March), while T1 showed the smallest. In discrepancy, T1 had the loftiest cornucopia during the wet season (April- May) followed by T3. Anthropogenic factors, including coddling, cattle herdsmen, and niche declination, were linked as major motorists of these variations. The study's findings have important counteraccusations for conservation sweats aimed at guarding Western Hartebeest populations in GGNP. Data were subordinated to descriptive statistical analysis to cipher means and standard diversions of the results. These statistics were used to estimate the population size, age- coitus structure, and exertion pattern hartebeest.

Conclusion: The study's results punctuate the complex interplay between environmental and anthropogenic factors impacting Western Hartebeest distribution and cornucopia in GGNP. The findings emphasize the need for critical conservation action to address the impacts of coddling, cattle herding, and niche declination on hartebeest populations within the area. Effective conservation strategies, including enhance danti-poaching details, cooperative operation with original communities, and niche restoration enterprise, are critical for icing the long- term survival of Western Hartebeest populations in GGNP.

Keywords: Assessment, Distribution, Abundance, Western hartebeest, Anthropogenic, Factors Poaching, Cattle herding, Habitat degradation.

INTRODUCTION

The western hartebeest is an antelope native to the medium to altitudinous Champaign plains of Nigeria, Benin, Burkina faso, Cameroon, Chad, Cote d'Ivoire, Ghana Guinea, Guinea- Bissau, Mali, Niger, Senegal and Togo, among numerous other in the central African democracy. The beast is an beasties feeding on meadows, leaves and fruits known for their emotional jumping capability and speed, frequently set up in lower herds or solitary, average grown-ups stand 1.4 m(4.6 ft) altitudinous at the shoulder and weigh 145 kg(320 lb)(IUCN SSC 2017). Western hartebeest fleece is fawn- multicolored, ranging from tan to dark brown. It has slim legs and a veritably narrow face. Both relations are horned. Horn may be 45- 70 cm(18- 28 am) long.(Western Hartebeest Hunting African Safari 2006). Hartebeest is substantially active during the day, it grazes during the cooler morning and autumn ages, resting in shadowed areas during the hot day. Womanish form herds of five to 12 members while males generally remain solitary (Adeleke *et al.*, 2018). While the herd is feeding, one member will act as a watch, watching for possible predators. However, the herd flees as a single train, reaching pets of over to 80km/ h (50mph) making it one of the fastest antelopes, If hovered. The beast is a water loving beast they move as a herd to find water. In particularly dry seasons or during failure period herd of lady will resettle together, seeking water or better grazing. Western hartebeest are generally not aggressive, but they will fight to cover their youthful or their claimed area. Males claim areas of plains comprising 31ha (0.31 km2), for period of four to five times. The males cover their claimed area fiercely. However, another joker may convert the home, if a man leaves his home to find water. In the southern sector of Gashaka Gumti National Park which encompasses of colorful foliage cover types that serve as feed for the western hartebeest, according to study by Saidu *et al*., (2020) the demesne's different foliage is shaped by its position in the transition zone between the Guinea Savannah and the Sudan Savannah ecosystems. The main foliage cover types in the demesne that give feed for western hartebeest are the campaigns which dominated by altitudinous meadows like the *Hyporrhenia rufa*, *Andropogon gayanus Andimperata* spherical Adepetu *et al*., 2017). The forestland Savanna are characterized by scattered trees like Acacia *sieberiana*, *Afzilia africana* and *Terminalia macroptera*, with a lawn sub caste dominated by species like *Loudetia* simplex and *Tricholaena tenax*. In the backcountry- lands foliage which were substantially thick chaparrals of shrubs including the *Diospyros mespiliformis*, *Maytenus sensgalensis*, and *Gardinia ternifolia*; that are substantially served as cover and source of food for western hartebeest within their niche, other foliage like the Riverine foliage along gutters and aqueducts, foliage like the *Phragmites mauritanus*, *Typha domingensis*, and *Ipomonea* submarine. (Adeleke *et al*., 2018). In the Montane foliage at advanced elevations, foliage is characterized different species like *Erica mannii*, *Philippa mannii*, and *Hilichrysum mechowianum* (Chime *et al.*, 2020). According to Ariya (2015), conservation of wildlife in Nigeria is faced with numerous and inviting socio- profitable and ecological challenges, one unique bone being the rampant wildlife stalking by communities living conterminous these defended areas, substantially during the dry seasons. Hartebeest populations are under trouble, having declined by nearly 50 in the last 30 times (Burger *et al*., 2020). This led to list status of hartebeest species as largely vulnerable encyclopedically; IUCN Red List reported 2016. Muller, 2016; also reveals specific information on the IUCN Red List status of Western hartebeest in Gashaka gumti National Park as a hovered species in the area. This study aimed to ground the gap left by the studies through assessing the ecological approach.

MATERIAL AND METHODS

Study Area and Research Design

Study Area

Study Area Gashaka Gumti National Park is the largest and most diverse park in Nigeria, covering an area of approximately 6,671sq. km^2, and is characterized by its split between Adamawa and Taraba States. It's located in the Northeast of Nigeria between latitudes 60 55' and 80 05'N, and between longitudes 110 11' and 120 13'E with the Federal Republic of Cameroon as its eastern border. The park's name is derived from two of the region's oldest and most historic settlements: Gashaka village in Taraba State, and Gumti village in Adamawa State. Gashaka Gumti National Park was created (along with other seven national parks) by Decree No. 36 of August, 1991, and repealed by Decree N0. 46 of 1999 (now Act) by the merging of Gashaka Game reserve with Gumti Game Reserve (Saka *et al, 2016).*

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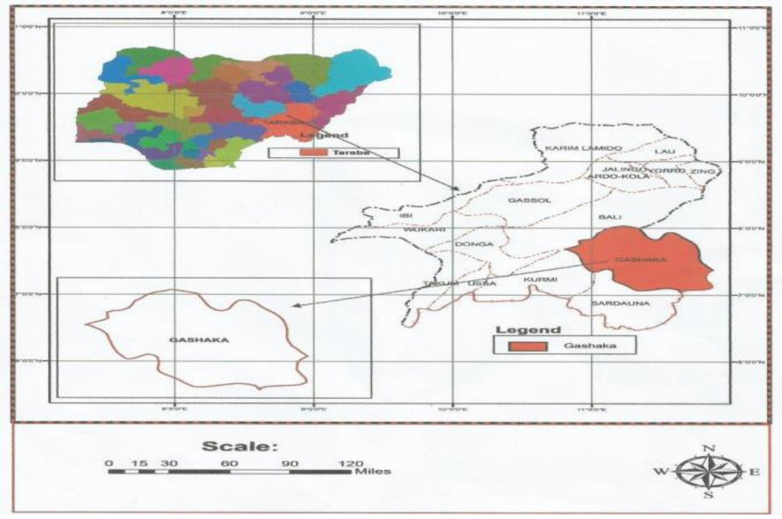

Figure 2: Map of Nigeria, Showing the Study Location.

Source: (Garba *et al.*, 2017).

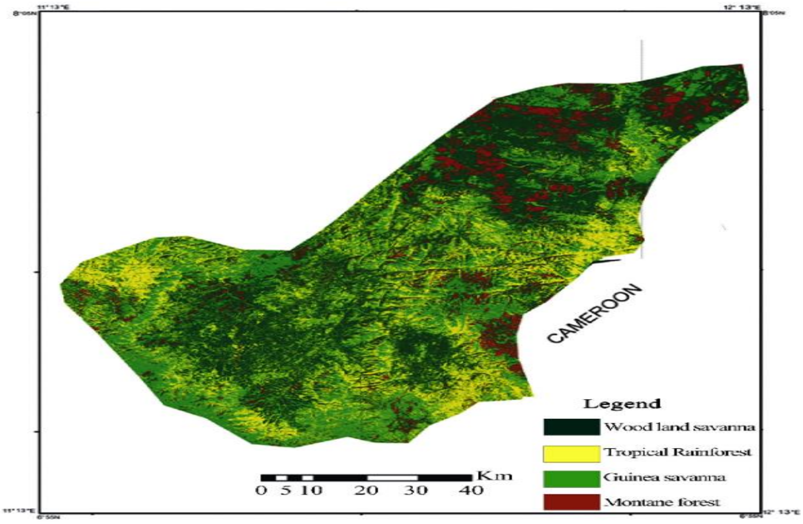

Fig 3: Classified vegetation of Gashaka Gumti National Park.

Source: (Gashaka Management Plan, 2021).

Research Design

This study employed a transect-based survey design to estimate the population size and structure of western hartebeest (*Alcelaphus buselaphus*) in four ranges: Mayo-Selbe Range (MSR), Fillinga Range (FR), Gam-Gam Range (GGR) and Gunti Range (GR).

Transect Layout

Four transects, each 3.5 km long and 50m wide, were established in each range using a systematic random sampling approach. The four transects were marked with flags at regular intervals (every 100 m) to ensure consistent width and length. This design allowed for efficient sampling of the study area while minimizing observer bias.

Camera Trap Survey

Six camera traps were placed along each transect, spaced approximately 583m apart. Cameras were programmed to capture images every 24 hours, providing data on hartebeest activity patterns and abundance.

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Field Team Composition and Training

The research team were consisted of six experienced researchers, three park rangers, and three local guides familiar with the study area. Prior to data collection, the team underwent a comprehensive training session to ensure consistency in data collection and observation techniques.

Data Collection

Data were collected over a 12-weeks period (January-March 2023) during the dry season and 12-weeks period of April-July 2023) during the raining season. Direct counts were conducted twice weekly, during morning (06:00-11:00) and evening (16:00-19:00) periods, when hartebeest were most active. Observations were recorded using a standardized data sheet.

Data Recording

The following data were recorded for each hartebeest sighting: Age (Adult, Sub-adult, and Calves) Sex group, and Sighting location (GPS coordinates).

METHOD OF DATA COLLECTION

To assess the population distribution and abundance of western hartebeest in the National Park, a direct method of census was used to collect data using line transect. The line transect was established using a systematic random sampling to collect data on hartebeest population Size, and age structure assessment using Photograph Mark Recapture (PMR) method following Bolger (2012). The researcher mapped a total road network of 12.0 kilometers (km) that was divided into four transects to include:

2 Transects in Filinga range (Dutesen Bature and Kwanu N07. 285710, E011.29076^0, N07. 296120, E011.20872^0 respectively).

1 Transect in Mayo Selbe range, (Mashayin' Zafi =N07. 28320^0, E011.33379^0).

1 Transect in Gamgam range Mayo kam = N07. 215390, E011.25274^0).

The data collection was conducted over a two-day period each week, spanning both the wet and dry seasons, and covering approximately 3.0 km per hour. Along each transect, all hartebeest sightings were recorded, taking into account the vegetation type in each sector, as per Bolger *et al*. (2012). To ensure accurate and consistent data collection, the four transects were marked with flags at 100-meter intervals. Photographs of the sighted hartebeest were taken for identification purposes, and the GPS coordinates of each sighting location were recorded. This methodology enabled efficient sampling of the study area while minimizing observer bias.

Data Analysis

Data were subjected to descriptive statistical analysis to compute means and standard deviations of the results. These statistics were used to estimate the population size, age-sex structure, and activity pattern hartebeest**.**

Permissions and Ethical consideration

This study was conducted with approval from National Park Service Head Quarter Abuja, Nigeria, and in collaboration with local authorities/park management. All necessary permits and permissions were obtained prior to data collection.

Ethical consideration

Ethical considerations were taken into account to ensure the well-being and safety of both humans and animals involved in the study. The research was conducted in a non-invasive manner, with minimal disturbance to the western hartebeest and their habitats. Informed consent was obtained from all participants, and their rights to

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privacy and confidentiality were respected. The researchers ensured that all data collection activities were carried out in compliance with relevant national and international regulations, as well as institutional guidelines for research involving animals and the environment.

RESULTS

Transect Location	GPS Values
T1 (Kwanu	N07. 29612^0, E011.20872^0
T2 Dutse' Bature	N07. 28571^0, E011.29076^0
T3 Mashayin' Zafi	N07. 28320^0, E011.33379^0
T4 Mayo Kam	N07. 21539^0, E011.25274^0

Table 2: Population Distribution and Abundance

Season	T1	T2	T3	T4
Jan –Feb	1.91±0.79^c	2.14±1.53^{bc}	3.00±1.91^b	4.29 ± 1.83^a
Feb-Mar	2.61±1.02^{bc}	2.50±0.80^c	4.33±2.62^a	3.33 ± 2.75^b
Mar-Apr	2.42±0.87^c	4.01±2.41^{ab}	4.50±3.20^a	3.00 ± 1.58^b
Mean Total	6.94±2.68^c	8.65±4.74^{bc}	11.83±7.73^a	10.62 ± 8.97^b

Numbers are means and one standard deviation from the mean. Means with different superscripts within the same row are significantly ($p<0.05$) different.

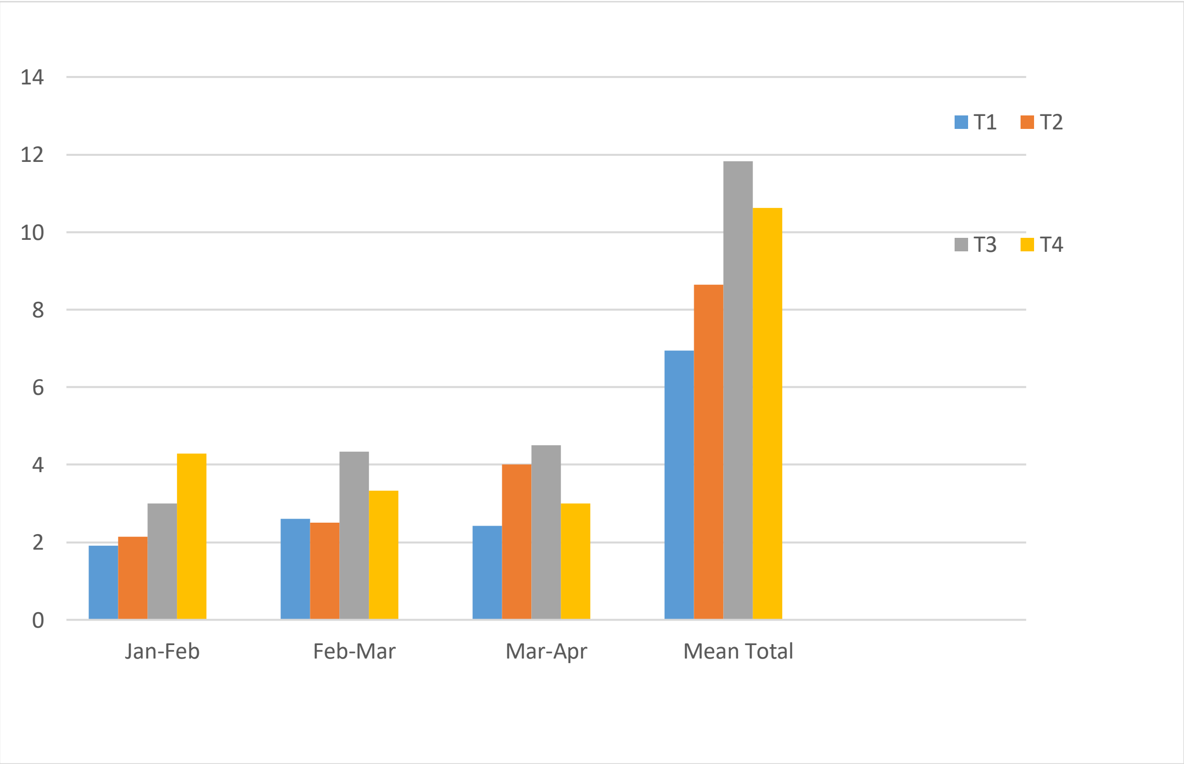

Fig: 2 Graphical Representation of the Mean population Distribution and Abundance of Hartebeest during the Dry season Across the Four Transect Areas in the Southern Sector of GGNP

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The table 2 results indicate significant variations in Western hartebeest abundance across transects and seasons.T_3, recorded the highest mean total abundance (11.83±6.82[a]), while T_1 showed the lowest mean total (6.94±2.68[c]). Seasonally, T_4 had the highest abundance during January-February (4.29±1.83[a]), while T_3 dominated during February-March (4.33±2.62) and March-April (4.50±3.20).

Table 3, Mean Population Distribution And Abundance

Season	**T_1**	**T_2**	**T_3**	**T_4**
Apr-May	$4.00±3.50^{a}$	$2.00±2.69^{c}$	$3.00±3.57^{bc}$	$3.25±2.37^{b}$
May-June	$1.63±1.37^{b}$	$2.13±2.02^{a}$	$1.00±1.70^{c}$	$1.00±1.66^{c}$
June-July	$1.13±2.45^{b}$	$1.63±1.28^{a}$	$1.63±0.79^{a}$	$0.25±0.56^{c}$
Total Mean	**$6.76±7.32^{a}$**	**$5.76±5.99^{b}$**	**$5.63±6.06^{bc}$**	**$4.50±4.89^{c}$**

Numbers are means and one standard deviation from the mean.

Means with different superscripts within the same row are significantly ($p<0.05$) different.

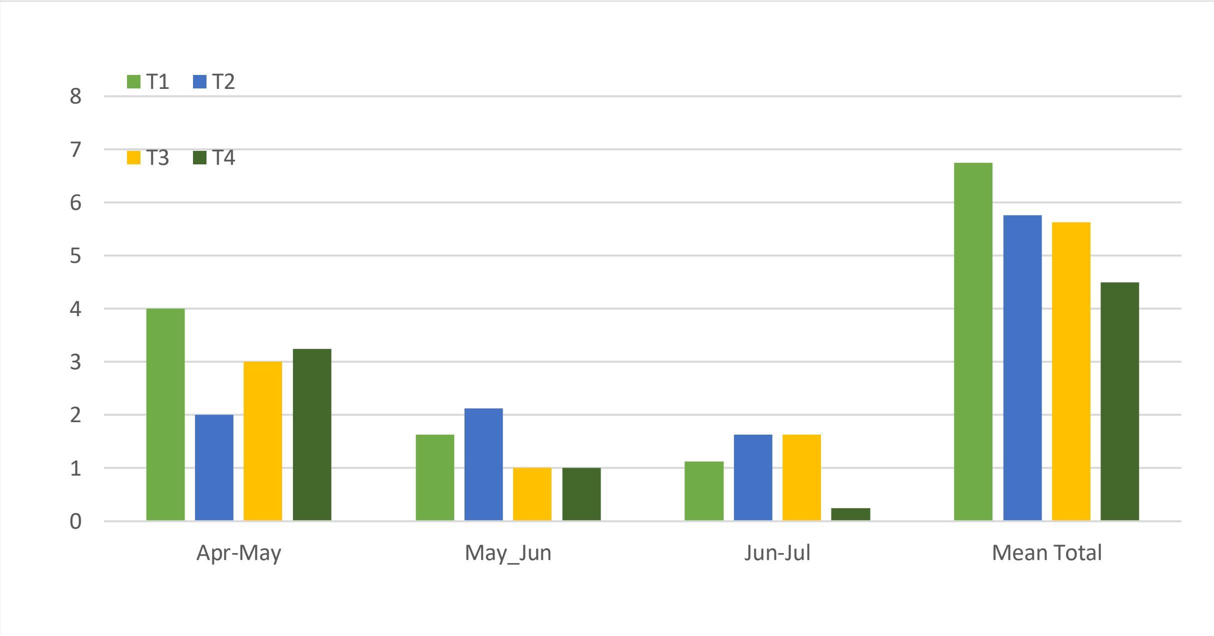

Fig: 2 Graphical Representation of the Mean population Distribution and Abundance of Hartebeest during the Wet season Across the Four Transect Areas in the Southern Sector of GGNP

The data presented in Table 3 reveals significant spatial variation in the mean population distribution and abundance of hartebeest across four transect areas (T1-T4) in GGNP's southern sector during the wet season.

Temporal variation in Hartebeest abundance

April-May: T_1 records the highest abundance (4.00±3.50), followed by T_3 (3.00±3.57), while T_2 (2.00±2.69) and T_4 (3.25±2.37) exhibit moderate levels. May-June: T_2's abundance increases significantly (2.13±2.02), whereas T_1 (1.63±1.37) and T3 (1.00±1.70) decline substantially.

Through June-July: All transects display low abundance across the study area.

Graphical representation of Hartebeest Abundance:

Figure 2, illustrates the graphical overall mean total abundance of hartebeest in GGNP's Southern Sector during the wet season, highlighting the significant variation across the four transect areas.

These finding submit that hartebeest abundance varies significantly across different transect areas and time periods within the wet season of the GGNP's Southern Sector.

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Hartebeest Population Characteristic of Age and sex Structure

Table 4: Population Abundance *by sex and age as* observed across the transect location

Transect Location	Age	Sex		Total Percentage
		Male	Female	
T1	Adult	7	6	13(31.0%)
	Sub-adult	8	11	19(45.2%)
	Calf	3	7	10(23.8%)
	Total	18(42.9%)	24(57.1%)	42(100%)
	$\chi2(2, N=30) = 2.33, p<0.05$			
T2	Adult	12	10	22(51.2%)
	Sub-adult	2	3	5(11.6%)
	Calf	7	9	16(37.2%)
	Total	21(48.8%)	22(51.2%)	43(100%)
	$\chi2(2, N=15) = 1.94, p<0.315$			
T3	Adult	4	2	6(10.9%)
	Sub-adult	19	10	29(52.7%)
	Calf	12	8	20(36.4%)
	Total	35 (63.6 %.)	20(36.4%)	55(100%)
	$\chi2(2, N=21) = 6.35, p<0.05$			
T4	Adult	13	17	30(8.4%)
	Sub-adult	8	12	20(32.3%)
	Calf	7	5	12(19.4%)
	Total	28(45.2%)	34(54.8%)	62(100%)
	$\chi2(2, N=24) = 5.11, p<0.078$			

Source Field Survey, 2024

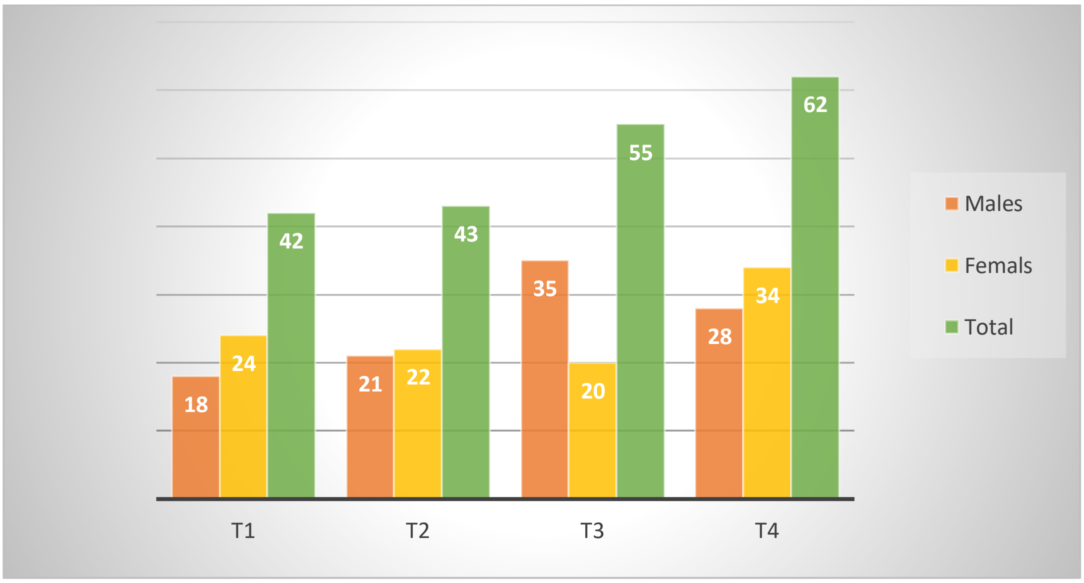

Figure 3: Graphical Representation of the Abundance of Hartebeest by Age and sexes as Observed across the Ranges

Table 3, above revealed significant variations in age and sex structural distribution across the four transect locations. Notably, females outnumber males in all locations except T_3, where males comprise 63.6%, Sub-adults predominate in T_1 (45.2%) and T3 (52.7%), whereas adults dominate in T_2 (51.2%). Fig.3, provides a visual percentage representation of these results.

DISCUSSION

The study aimed to assess the population characteristics of Western Hartebeest (*Alcelaphus buselaphus*) in the Southern Sector of Gashaka Gumti National Park which substantially revealed variation at all position within the study area. This observed variations in Western hartebeest cornucopia across transects and seasons, as shown in Table 1, aligned with established ecological principles, pressing the dynamic nature of critter populations by Owen- Smith *et al*, (2002). still, this study also reveals more complex patterns, suggesting that anthropogenic factors have significantly impacted hartebeest distribution during the dry season. With critical coddling conditioning and the affluence of cattle herdsmen into the National Park which have disintegrated the delicate balance of the ecosystem, leading to niche fragmentation, where cattle herdsman encroachment has disintegrated territories, segregating hartebeest populations and reducing access to vital coffers. The results of this study are in concurrence with those of Saka *et al*., (2016), who set up that, increase in pressure, particularly from nimrods to exclude wild beast, similar as western hartebeest, despite the government's warning and sweats on conservation of wildlife species in the southern sector of National Park. Also, the affluence of domestic beast intensifies competition for food and water, forcing hartebeest to alter distribution patterns within the study area.

Also, increased mortal exertion also alters bloodsucker- prey dynamics, potentially adding predation pressure on hartebeest. Targeted coddling further reduces population sizes, particularly in areas with high mortal exertion. Aman *et al*., (2015) conducted a analogous study, examining the goods of climate change and mortal population growth on Swayne's hartebeest conservation in Senkele Swayne's Hartebeest Sanctuary, Ethiopia, and linked fresh factors that impact the species' conservation status. Specially, the study stressed that the fleetly adding mortal population and climate change- related impacts pose significant challenges to conserving the only feasible population of the aboriginal hartebeest in Senkele. Likewise, cattle herding and coddling disrupt hartebeest seasonal migration patterns, forcing acclimations to altered environmental conditions. These anthropogenic factors, including niche declination and mortal exertion, likely drive the observed variations in hartebeest cornucopia across transects. Specifically, T3's high cornucopia is associated with complete niche and reduced mortal exertion, while T1's low cornucopia is linked to coddling and declination. T4's intermediate cornucopia reflects propinquity to cattle driving routes and resource competition. These findings aligned with former exploration conducted by Saka *et al*.(2016), who also delved hartebeest distribution and cornucopia in Gashaka Gumti National Park, pressing the ongoing impact of mortal conditioning on hartebeest populations. The gender distribution patterns suggest adaptive reproductive strategies in womanish- prejudiced populations (T1, T4), competitive lovemaking actions in manly- prejudiced populations (T3), and informed conservation strategies considering gender-specific population trends. probing factors driving these patterns and developing gender-informed conservation operation plans are abecedarian for effective conservation. The Chi-Square Test Results ($\chi 2$) indicate significant differences in Western hartebeest population distribution across transects and age classes, with varying degrees of significance ($p<0.05$, $p<0.078$, $p<0.315$) suggesting non-random patterns in sex and age class distribution. The Western hartebeest population exhibits varying gender distributions across the four transects, with T1 having a female-biased population (18 males, 24 females, 42.9% male, 57.1% female), T2 displaying a relatively balanced sex ratio (21 males, 22 females, 48.8% male, 51.2% female),

Further Research study:

Further research should focus on quantifying cattle herding and poaching impacts on hartebeest distribution, investigating conservation strategies like habitat restoration and anti-poaching efforts, and developing adaptive management plans to mitigate anthropogenic effects.

Conservation Implications

The findings of this study underscore the urgent need for effective conservation measures to protect Western hartebeest populations in Gashaka Gumti National Park. To address these concerns, enhanced anti-poaching

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patrols and law enforcement are necessary. Collaborative management with local communities to reduce cattle herding impacts, habitat restoration and connectivity initiatives, and monitoring programs to track hartebeest population trends which are also life-threatening. By addressing these critical conservation concerns, we can work towards preserving the integrity of GGNP's ecosystems and ensuring the long-term survival of Western hartebeest populations in the area.




Plate1 **Plate 2** **Plate 3** **Plate 4**




Plate 5 **Plate 6** **Plate 7** **Plate 8**



Plate 9 **Plate 10** **Plate 11**

Plate Legend:

Plate1, Hartebeest Carcass killed by poachers, Plate 2: Hartebeest feeding activities, Plate 3 and 4: The influx of cattle exhibiting the park vegetation on the same wildlife rangeland, Plate: Plate 5: Mayo-Kam River, Plate 6: the research daily sighting activity, plate7: Hartebeest Dropping (Feces), Plate 8: Research team. All hartebeest in plate 9 – 11 were sighted during the dry season at by the river side.

CONCLUSION

The study's results highlight the complex interplay between environmental and anthropogenic factors influencing Western Hartebeest distribution and abundance in GGNP. The findings emphasize the need for urgent conservation action to address the impacts of poaching, cattle herding, and habitat degradation on hartebeest populations within the area. Effective conservation strategies, including enhanced anti-poaching patrols, collaborative management with local communities, and habitat restoration initiatives, are critical for ensuring the long-term survival of Western Hartebeest populations in GGNP.

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RECOMMENDATIONS

1. Enhanced Anti-Poaching Patrols: Strengthen anti-poaching efforts through increased patrols and law enforcement to reduce poaching impacts on hartebeest populations.
2. Collaborative Management with Local Communities: Engage local communities in conservation efforts through collaborative management initiatives, aiming to reduce cattle herding impacts and promote coexistence with hartebeest.
3. Habitat Restoration and Connectivity Initiatives: Implement habitat restoration and connectivity initiatives to mitigate the effects of habitat fragmentation and degradation on hartebeest populations.
4. Monitoring Programs: Establish monitoring programs to track hartebeest population trends, allowing for adaptive management and conservation strategies.
5. Community-Based Conservation: Promote community-based conservation initiatives, empowering local communities to take ownership of conservation efforts and promoting the value of hartebeest conservation.

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