

Original Article

Seasonal Variation in Herd Size and Composition of Waterbuck
Kobus ellipsiprymnus defassa between years, months, meadows and day time in
Dinder National Park, Sudan

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Abstract:

Background: The size and composition of the group are the most basic elements of social organization in herding ungulates. The aim of this study was to investigate the herd composition of waterbuck *Kobus ellipsiprymnus defassa* "Katambour" in Dinder National Park.

Methods: Direct observation method was used to estimate the herd size and composition, the study was conducted in February, March, April and May 2018-2019.

Results: The results of herd composition revealed the effect of independent variables (year, meadows, month and time) on the dependent variable (herd composition) showed statistically significant differences where all P-values were less than 0.0001. *Defassa* waterbuck herd did not exist in Beit-alwahash meadows during the study period.

Comment: Three solitary males were seen in different meadows. A lonely female with very young calf (about one week or less of age) was seen in Abdel-Gani meadow. A bachelor herd of about 17-21 males was seen in Ras-amir meadow in March 2018. Nursery herd exist commonly in Abdel-Gani and Ein-alshamis meadow. Three predations were recorded. Further studies of *Defassa* waterbuck in different seasons with emphasis on the effect of war in their numbers, composition and distribution are needed.

Keywords: Dinder Biosphere Reserve, Herd Composition

Introduction

The group size and group composition are the major element of social organization in the ungulate population [1, 2].

Waterbuck is a sexually dimorphic antelope; males are taller as well as heavier than females. Females have two nipples but lack the pre-orbital glands, foot glands and inguinal glands are absent [3,4]. The hair is coarse, and they have a mane on their necks, the lower part of the legs is black with white rings above the hooves. Only male have horns [5 - 8], which are curved forward and vary in length from 55 - 99 cm. Body color ranges from gray to red-brown and darkens with age. Their head and body length ranges from 177-235 cm and shoulder height from 120-136 cm. The pelage is coarse [7,8].

Large mammals' population are strongly structured [9, 10], accordingly additional demographic indicators, such as sex ratios, group composition and recruitment rates, are often used to monitor populations [11- 13]. Herd composition counts are commonly used to estimate sex ratios, fawn/100 female ratios and fawn's recruitment in deer populations [14 - 16].

The herd composition of ungulates and other social mammals is affected by many factors which play important roles in shaping the group size. These are environmental factors, predation risk and reproductive strategies [17, 18]. One of the main benefits of group living is reduced predation risk through increased vigilance [17,19–21]. These studies also emphasize that effective species management within fenced areas requires an understanding of group size and seasonal variations.

Three social groups of bovidae family were distinguished, nursery/breeding herds comprising females with or without calves, bachelor herds (all males), and solitary adult males [22]. *Defassa* waterbucks form small herds of 6-12 individuals and larger herds of up to 30 individuals [7]. During dry seasons the herd fragment seeking adequate forage [23]. The social groups can be clearly noticed during foraging, migration and other daily activities [24]. The aim of this study is to investigate the herd composition of waterbuck *Kobus ellipsiprymnus defassa* "Katambour" in Dinder National Park (DNP), Sudan.

Material and methods:

Study was carried out in DNP, which is located in the Blue Nile State bordering the Ethiopia country and it is surrounded by three States (Sinnar, Gadarif and Blue Nile) (Figure 1).



Figure 1: Location of Dinder National Park.

Source: https://en.Wikipedia.org/wiki/Dinder_National_ParkResults (2020)

Observation covered herd types, structure and organization in the five meadows namely (Abdelgani N 12.61037 E 35.02751, Ein-el-Shams N 12.64413 E 35.00760, Ras Amir N 12.61553 E 35.08929, Gererisa N 12 36 272 E 35 01 277 and Beit-alwahish N 12.50576 E 35.03881). Field surveys were executed during the dry seasons February, March, April and May 2018 and 2019. Recording started from 6 AM to 6 PM using binoculars (Deluxe 10 X 50). *Acacia nilotica*, *ziziphus spinachristi* and other large trees were used as a hide to avoid unduly disturbances. The herd composition monitoring covers 4 months February, March, April and May in 2018 and also

in 2019. The day was divided to period's morning (6:00 to 11:59 am), afternoon (12:00 to 2:59 pm) and evening (3:00 to 5:59 pm).

Results:

Table (I) showed the number of males, females, young and calves recorded during February, March, April and May. The highest number of males recorded was in April 27, followed by March, May and February 14, 10 and 9 respectively. The highest number of females recorded was in April 155 followed by 67, 64 and 54, March, May and February respectively. The highest number of young recorded was in April 51, followed by 33, 26 and 10 February, March and May respectively. The highest number of calves recorded was in April 18, followed by 17 in February, 14 in March and 7 in May.

Table (1) Number and average of herd composition seen at the five sites (2018)

Months	Herd composition	Number	Mean	Standard deviation
February	Male	9	0.375	0.924
	Female	54	2.25	1.225
	Young	33	1.38	0.88
	Calves	17	0.71	1.00
March	Male	14	0.58	0.78
	Female	67	2.79	0.98
	Young	26	1.08	1.44
	Calves	14	0.58	0.83
April	Male	27	1.125	0.54
	Female	155	6.58	1.56
	Young	51	2.13	2.21
	Calves	18	0.75	0.68
May	Male	10	0.417	0.50
	Female	64	2.67	1.56
	Young	10	0.417	0.72
	Calves	7	0.29	0.62

Table (2) showed the number of males, females, young and calves recorded during February, March, April and May. The highest number of males recorded was in April which was 42, followed by March, February and May 15, 12 and 6 respectively. The highest number of females recorded was in April which was 267 followed by 94, 79 and 53, February, March and May respectively. The highest number of young recorded was in April which was 11, followed by 9, 6 and 4 February,

March and May respectively. The highest number of calves recorded was in April which was 21, followed by 9 in March, 8 in May and 4 in February.



Fig 2: Nursery herds consists of females with their calves in Abdelgani meadow

Table (2): Number and average of herd composition seen at the five sites (2019)

Months	Herd composition	Number	Average	Standard deviation
February	Male	10	0.5	0.830
	Female	94	3.92	3.092
	Young	9	0.375	1.056
	Calves	4	0.167	0.565
March	Male	15	0.625	1.135
	Female	79	3.29	4.639
	Young	6	0.25	0.737
	Calves	9	0.375	1.279
April	Male	42	1.75	2.436
	Female	267	11.13	12.188
	Young	11	0.46	1.318
	Calves	21	0.875	1.624
May	Male	6	3.125	0.737
	Female	53	20.55	5.666
	Young	4	1.252	0.816
	Calves	8	1.747	0.917



Fig 3: Female with calf less than two week's age in Abdelgani Meadow

ANOVA test:

The effect of independent variables (year, meadows, month and time) on dependent variable (herd composition) was statistically significant where all P-values less than 0.05 (Table, 3).

Table (3): ANOVA for impact of independent variables on dependent variable (herd composition)

Variables	Sum of square	DF	Mean square	F	P. value
Year	359.125	1	359.125	52.521	0.000
Meadow	1387.492	4	346.873	50.529	0.000
Month	101.387	3	33.796	12.708	0.000
Time	8012.725	11	728.430	106.530	0.000



Fig 3: A herd of waterbucks; males can be distinguished by their long horns whereas females have none.

Discussion:

There was a variation in herd composition and size in the two years of the study, where (P-value 0.000). This result is consistent with a study conducted in southern India [24], which reported that many mammal species form social groups during various activities such as foraging, migration, and other daily behaviors. Similarly, a study from Sri Lanka [1] highlighted that factors such as group size and composition influence the social organization of herding ungulates.

There was a variation in herd composition in the **meadows**, where (P-value 0.000) (Table 3) this is because Abdel-Gani has greater amounts of forage biomass (biomass was estimated) and has water for most of the dry season, This result is consistent with the findings of Roberts et al. [17] and Bon et al. [18], who reported that predation risk and reproductive strategies reported to be key factors in description, formation and shaping of social organization of ungulates and group size and many other factors. Bachelor herd was recorded in Ras-amir, while the nursery

herd was not common in it. This may be due to the presence of pastoralists and fishermen, so all these factors disturb the herd of *defassa* waterbuck and drive their occurrence to use more safety meadow.

There were statically significant differences of the herd composition and size in **months**. This result is consistent with studies on territorial and mating behavior in large antelopes [25–27]. They found that many factors play roles in the great variation in mammalian sex ratio within and among species. These factors are attributed to competition among males for females and predation. This result also agrees with Peterson [28], who found that differences in life history and reproductive strategies among ungulates often cause males and females to form separate groups, leading to distinct patterns of habitat use known as 'social segregation'.

There was a statistical significant different in herd composition of *defassa* waterbuck during the **day time** P-value less than 0.05. That is may due to strategies of the different herds in utilizing the meadows, herds start entering meadows before 6:00 am and as the day goes on more herds join the other feeding herds. The nursing herds with calves stay in the meadow, while males leave. The bachelor herds wander along the park. I noticed a

group of 5-7 males sometimes coming at 10-11 am drinking and the then leaving the Abdel-Gani meadow, in April 2019.

Conclusion:

Three solitary males were seen, one in Ras-amir meadow N 12 61 553 E 35 08929, one in Abdel-Gani meadow N 12. 61 037 E 35 02 751 and third one in Idres Abdelbagi road N 12 38 515 E 34 59 048. Lonely female with very young calf (about one week or less of age) was seen in February 2018 at Abdel-Gani meadow.

Bachelor herd of about 17-21 males were seen in Ras-amir meadow in March 2018. Nursery herd exist commonly in Abdel-Gani and Ein-alshamis meadow. Three predations were recorded, one female in Ein-alshamis, one male in Abdel-Gani and the third on near Ras-amir meadow.

Recommendations:

Further studies of *Defassa* waterbuck in different seasons with emphasis on the effect of war in their numbers, composition and distribution.

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References:

1. Barrette C. The size of axis deer fluid groups in Wilpattu National Park, Sri Lanka. *Mammalia*, 1991; 55:207–20. .
2. Shi J, Dunbar RI, Buckland D, Miller D. Dynamics of grouping patterns and social segregation in feral goats (*Capra hircus*) on the Isle of Rum, NW Scotland. *Mammalia*, 2005, 69: 185 – 199.
3. Estes RD. The behavior guide to African mammals: including hoofed mammals, carnivores, primates. Univ of California Press; 2012 Mar 28.
4. Cunningham PL, Wronski T. Seasonal changes in group size and composition of Arabian sand gazelle *Gazella subgutturosa marica* Thomas, 1897 during a period of drought in central western Saudi Arabia. *Current Zoology*. 2011 1;57(1):36-42.
5. Kingdon J. The Kingdon field guide to African mammals. Bloomsbury Publishing; 2015 Apr 23.
6. Kingdon, J.. East African Mammals. An Atlas of Evolution in Africa; Volume III Part C (Bovids). Academic Press. London, New York, and San Francisco. 1982.
7. Skinner JD, Chimimba CT. The mammals of the southern African sub-region. Cambridge University Press; Third edition. 2005 Nov 15.
8. Wilson DE, Wilson DE, Mittermeier RA. Handbook of the mammals of the world, volume 2: hoofed mammals. Barcelona: Lynx Ediciones; 2011.
9. Buuveibaatar B, Young JK, Berger J, Fine AE, Lkhagvasuren B, Zahler P, Fuller TK. Factors affecting survival and cause-specific mortality of saiga calves in Mongolia. *Journal of Mammalogy*. 2013; 15;94(1):127-36.
10. Gaillard JM, Festa-Bianchet M, Yoccoz NG. Population dynamics of large herbivores: variable recruitment with constant adult survival. *Trends in ecology & evolution*. 1998; 1;13(2):58-63.
11. Ginsberg JR, Milner-Gulland EJ. Sex-biased harvesting and population dynamics in ungulates: implications for conservation and sustainable use. *Conservation Biology*. 1994;8(1):157-66.
12. Milner-Gulland EJ, Bukreeva OM, Coulson T, Lushchekina AA, Kholodova MV, Bekenov AB, Grachev IA. Reproductive collapse in saiga antelope harems. *Nature*. 2003; 13;422(6928):135-.
13. Buuveibaatar, B. Factors affecting survival and cause-specific mortality of saiga calves (*Saiga tatarica mongolica*) in Mongolia. 2011, M.Sc. thesis, University of Massachusetts Amherst, Massachusetts.
14. Woolley TP, Lindzey FG. Relative precision and sources of bias in pronghorn sex and age composition surveys. *The Journal of wildlife management*. 1997; 1:57-63.

15. Rabe MJ, Rosenstock SS, deVos Jr JC. Review of big-game survey methods used by wildlife agencies of the western United States. *Wildlife Society Bulletin*. 2002; 1:46-52.
16. Kaji K, Takahashi H, Tanaka J, Tanaka Y. Variation in the herd composition counts of sika deer. *Population Ecology*. 2005;47(1):53-59.
17. Roberts G. Why individual vigilance declines as group size increases. *Animal behaviour*. 1996;1;51(5):1077-86.
18. Bon R, Rideau C, Villaret JC, Joachim J. Segregation is not only a matter of sex in Alpine ibex, *Capra ibex ibex*. *Animal Behaviour*. 2001; 1;62(3):495-504.
19. Berger J. Group size, foraging, and antipredator ploys: an analysis of bighorn sheep decisions. *Behavioral Ecology and Sociobiology*. 1978; 4:91-100.
20. Li C, Jiang Z, Li L, Li Z, Fang H, Li C, Beauchamp G. Effects of reproductive status, social rank, sex and group size on vigilance patterns in Przewalski's gazelle. *Plos one*. 2012 ; 28;7(2):e32607.
21. Cunningham PL, Wronski T. Seasonal changes in group size and composition of Arabian sand gazelle *Gazella subgutturosa marica* Thomas, 1897 during a period of drought in central western Saudi Arabia. *Current Zoology*. 2011; 1;57(1):36-42.
22. Estes RD. Social organization of the African Bovidae. The behaviour of ungulates and its relation to management. 1974; 1:166-205.
23. Melton DA. Ecology of waterbuck *Kobus ellipsiprymnus* (Ogilby, 1833) in the Umfolozi game reserve. 1978 D.Sc. Thesis, University of Pretoria.
24. Raman TS. Factors influencing seasonal and monthly changes in the group size of chital or axis deer in southern India. *Journal of Biosciences*. 1997;22(2):203-18.
25. Jarman, M. V. Impala social behaviour: territory, hierarchy, mating, and the use of space. *Z. Tierpsychol. Beih*. 1979; 21, 1-92.
26. Murray ML. The rut of impala: aspects of seasonal mating under tropical conditions. *Zeitschrift für Tierpsychologie*. 1982; 12;59(4):319-37.
27. Gosling, L. M. The evolution of mating strategies in male antelope. In: *Ecological Aspects of Social Evolution* (Rubenstein, D. I. and Wrangham, R. W., eds). Princeton Univ. Press, Princeton 244-81.
28. Peterson LM, Weckerly FW. Male group size, female distribution and changes in sexual segregation by Roosevelt elk. *PLoS One*. 2017; 9;12(11):e0187829.