Chinese Birds 2012, 3(1):47–53
DOI 10.5122/cbirds.2012.0005

SHORT COMMUNICATION

Observations on movements of Double-banded Sandgrouse (*Pterocles bicinctus*) in Borakalalo National Park, North West province, South Africa

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Abstract The main purpose of this study was to describe the intrinsic (breeding) and extrinsic factors (rainfall/vegetation) that might trigger movements of Double-banded Sandgrouse (*Pterocles bicinctus*) in Borakalalo National Park, South Africa. The park is situated 80 km north of Pretoria and 30 km north of Jericho in the North West province. Data collection was based on traversing the reserve for two days per month along a set route (32 km) with a vehicle at 10 km·h^{-1} during 2010. The mean group size of this Double-banded Sandgrouse was 2.47. The male to female ratio in the population was 1:0.87. They were often observed in the road, on short trampled grass or in burnt thornvelds with green sprouts. Double-banded Sandgrouse were mainly present in the reserve during two relatively dry periods, from February–March and again from July–September 2010. They were more regularly observed in the hinterland of the park in the mornings and conversely, during the late afternoons they were more regularly observed closer to the edge of the Klipvoor Dam. Five possible reasons are discussed that may affect the movement of the Double-banded Sandgrouse: annual rainfall, short spells of high/low rainfall periods within the rainy season, daily flights of 2–4 km to drink water, breeding and veld conditions.

Keywords Double-banded Sandgrouse, breeding, rainfall, vegetation

Introduction

The Double-banded Sandgrouse (*Pterocles bicinctus*) has been hunted in the North West province of South Africa for about the last 170 years (Haagner, 1914; Delegorgue, 1997). They are still hunted today but not at the same commercial level as Burchell's *P. burchelli* or Namaqua *P. namaqua* Sandgrouse (Viljoen, 2005; Little and Crowe, 2011). Despite its sporting potential, this species has received very little scientific scrutiny and therefore very little attempt was made to assess it as a sustainable game bird (Little and Crowe, 2011).

I have visited six farms in the North West province that fall within the distribution range of Double-banded Sandgrouse on a regular basis during the past 20 years. In all the cases, group sizes were generally small (2–4 birds). The birds were sparsely distributed compared to the areas where Namaqua and Burchell's Sandgrouse occur and their visits to these farms were at irregular times of the year. Particularly, on the farms

Received 28 November 2011; accepted 2 March 2012

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Zandfontein, about 50 km northwest of Johannesburg and La Boheme, 40 km north of Rustenburg, Double-banded Sandgrouse have been observed for 15 and six years respectively at a waterhole, with the largest group size of six, but usually more in the order of twos and fours and their visits were unpredictable in terms of annual arrival times (H. Bronkhorst personal communication and J.H. van Niekerk personal observations). Tarboton et al. (1987) described Double-banded Sandgrouse as rare vagrants in this area.

In view of the limitations of small groups and erratic movement patterns in the North West province, an effort was made to observe Double-banded Sandgrouse in Borakalalo National Park, where their visits appeared more consistent during 10 years of casual observations and where Double-banded Sandgrouse were observed in twos and fours about 100 years ago (Haagner, 1914). The main purpose of this study is to describe the intrinsic (breeding) and extrinsic factors (rainfall/vegetation) that may be responsible for the movements of Double-banded Sandgrouse. This is required to gather baseline data in order to conserve the species since it is hunted.

Methods

Study area

Borakalalo National Park (14000 ha) (25°09.262 S, 27° 48.522 E) is situated 80 km north of Pretoria and 30 km north of Jericho in the North West province. Its vegetation is described as Western Sandy Bushveld including tree species such as *Acacia erubescens*, *Combretum apiculatum*, *Terminalia sericea* and *Burkea africana* (Mucina and Rutherford, 2006). Figure 1 shows the location of the park in South Africa and Fig. 2 the focal study area, which is the southern-most portion of Borakalalo National Park from the southern shoreline of the Klipvoor Dam further south. The study site was divided into a 'hinterland' section that denotes sandgrouse habitat 400–5000 m south from the shoreline of the dam and a 'dam area' where sandgrouse were observed 50–400 m from its shoreline. The veld was burnt by park officials in July 2010 (Fig. 2). Various large herbivores in herding groups occur in the park including Impala (*Aepyceros melampus*), White Rhinocerous (*Ceratotherium simum*),

Fig. 1 Location of Borakalalo National Park in South Africa

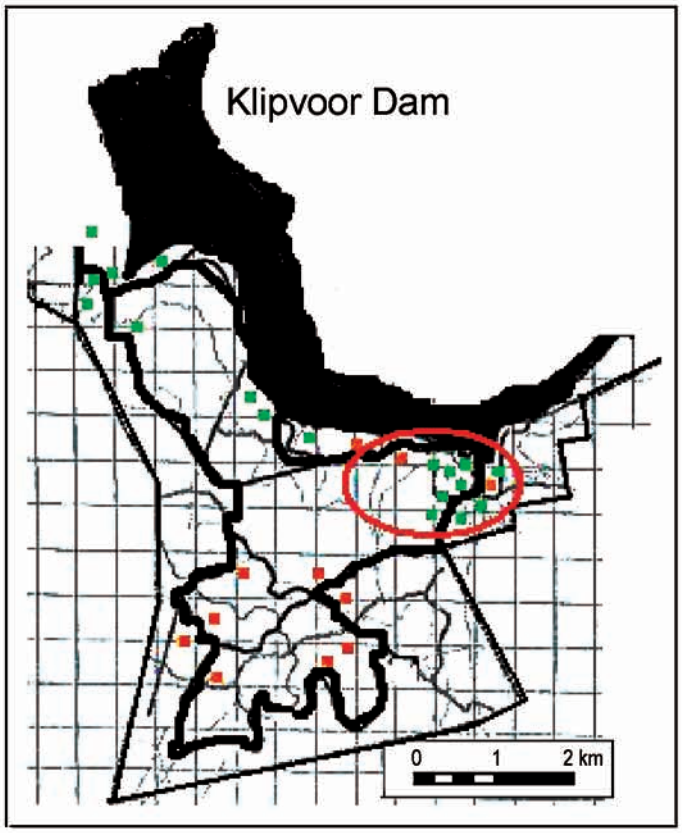

Fig. 2 Southern portion of the Borakalalo National Park, selected for monthly surveys including the southern Klipvoor dam area, mainly depicted by late afternoon sightings of Double-banded Sandgrouse groups (green markings) and the hinterland which is more or less indicated by the orange markings which depict sightings of sandgrouse in the mornings. Each grid represents 500 × 500 m. The scale represents 2 km. The red circle encapsulates the area that was burnt during July 2010.

Kudu (*Tragelaphus strepsiceros*), Zebra (*Equus quagga*), Blue Wildebeest (*Connochaetes taurinus*) and Sable Antelope (*Hippotragus niger*).

Data collection

Data collection was based on traversing the park for two days per month during 2010 along a set route (32 km) with a vehicle at 10 km·h^{-1}. Traversing was done in the mornings from 06:30–09:30 and in the afternoons from 15:30–18:30 and on the following day another morning session, totalling 108 hours (1152 km) during 2010. In the focal study area of the park about two hours were spent in the hinterland and one hour near the dam during each trip (Fig. 2). All sightings of sandgrouse were recorded on a Garmin Colorado 300 GPS and downloaded onto a computer with MapSource. MapSource was used to determine the direct distance from a sandgrouse group to the nearest watering point, i.e., the edge of the Klipvoor Dam. For the purpose of calculating group sizes, sandgrouse recorded outside of the focal study area (Fig. 2) of the park, were also included. Upon encountering sandgrouse, group size, sex and age were recorded with the aid of binoculars. Males possess a prominent transverse black and white band across the forehead and young birds were smaller and possessed female features (Little and Crowe, 2011). At each sighting the distance was also estimated between the male and female of a pair and where applicable, the distance between two pairs. The substrate beneath every sandgrouse sighted was also noted and recorded as 1) open road, 2) short trampled grass or 3) burnt veld.

The height of the observer in the vehicle above ground level during traversing was 160–180 cm. This position allowed the observer to search for sandgrouse in relatively thick grass up to 20 m away from the vehicle on either side of the road. Rainfall data was provided by the North West Parks and Tourism Board (Jericho). Statistical analysis included One-way ANOVA, Pearson correlation coefficients and chi-squares.

Results

Group sizes and population structure

The mean group size of Double-banded Sandgrouse was 2.47 (n = 38, range = 1–5 and SD = 1.22). The largest group was recorded in March which was 3.7 birds (n = 7), mainly consisting of adults. Out of 36 groups recorded, 69.4% (25 groups) were pairs, 16.6% (6 groups) were family groups and 13.8% (5 groups) were single birds. Two groups were not identified. Family groups were observed during March–August 2010 and each family had only one offspring. Double-banded Sandgrouse offspring remained with parents but it is not clear at which age offspring left the natal group. The single birds might have been young birds that left the natal group. Out of 38 groups 25% were groups of four birds, always consisting of two pairs each. Pairs were males and females that foraged or sat at a mean distance of 1.93 m (SD = 196.3, n = 16, range = 0–5 m) apart while the mean distance between pairs in a group was 5.5 m (SD = 206.5, n = 7 and range = 0.2 –8 m) (ANOVA: F = 15.605, df = 21, $p < 0.05$). The short distances between a male and female shows that they formed monogamous bonds throughout the study period. The male to female ratio in the population was 1:0.87 (males = 48, females = 42). This ratio remained more or less constant throughout all months during 2010 revealing a significant positive correlation between numbers of males and females in the population (r = 0.97, df = 11, $p < 0.05$) (Fig. 3). Thus, groups with one sex (e.g. males only) did not dominate in the population and neither were any groups recorded that only contained offspring.

Seasonal movement

Figure 4 shows that Double-banded Sandgrouse were mainly present in the park in two relatively dry periods, from February–March and again from July–September 2010. In other words, their movement was affected by short wet/dry spells. Their absence during the wet summer period was generally also the pattern during the previous 10 years. However, a few birds were observed in a *Teminalia sericea* bush in the park during December 2003, which means they are not necessarily entirely absent during wet conditions.

Daily movement

Table 1 and Fig. 2 shows that Double-banded Sandgrouse were more regularly observed in the hinterland in the mornings and conversely, during the late afternoons they were more regularly observed closer to water (χ^2 = 7.22, df = 3, $p < 0.05$). The mean distance

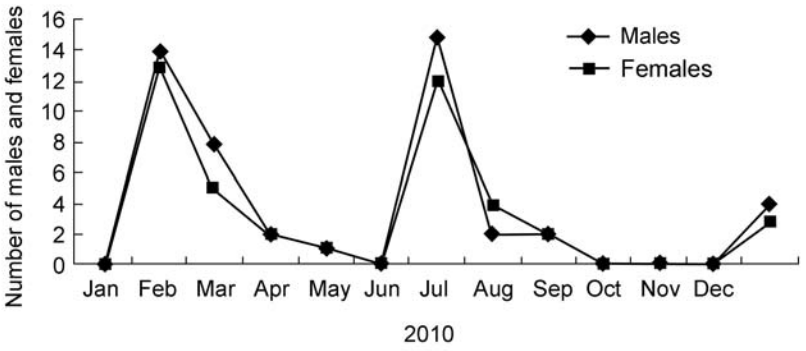

Fig. 3 Number of monthly males and females of Double-banded Sandgrouse recorded in Borakalalo National Park

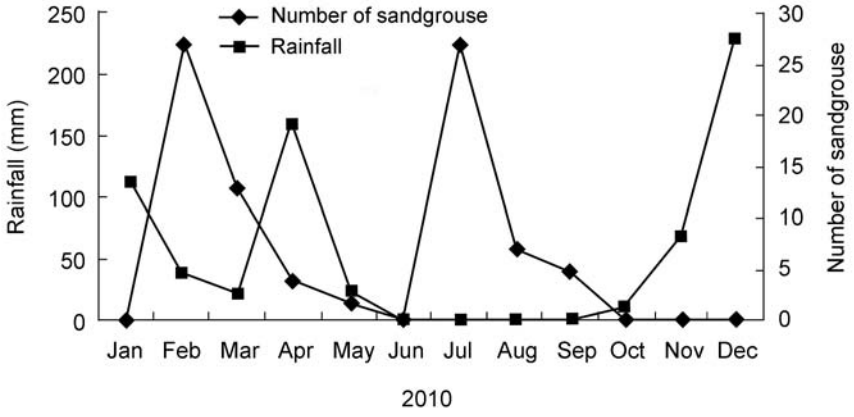

Fig. 4 Monthly Double-banded Sandgrouse populations recorded in Borakalalo National Park during 2010 correlated with mean monthly rainfall figures (from four stations)

of sandgrouse to the edge of the water in the morning was 1979.1 m (SD = 1265.9, $n = 11$, range = 50–3500 m) and in the late afternoons 334.06 m (SD = 304.68, $n = 18$, range = 50–800 m) (ANOVA: $F = 12.19$, df = 26, $p < 0.05$). From here they moved closer to drink water after sunset (also see Hockey et al., 2005).

Basal grass substrate

Overall, Double-banded Sandgrouse were recorded in areas where open basal grass cover conditions prevailed. Table 2 shows that they were observed on the road, on short trampled/grazed grass or in burnt velds with green sprouts in a thornveld (*Acacia* spp. and grass). In fact, just after burning from July–September, Double-banded Sandgrouse were often recorded in burnt velds (Table 2). In previous years they have also been observed in burnt areas in other parts of the park on three occasions but also under the canopy of bushes with high trees such as *Terminalia sericea* and *Burkea africana*, where the grass and shrub cover under these trees were sparse (J.H. van Niekerk, unpublished).

Discussion

The small group size of 1–5 birds that was recorded in Borakalalo National Park is similar to the small group sizes of twos and fours that were recorded in this area more than 100 years ago (Haagner, 1914). This is also consistent with the small groups generally observed in many parts of the North West province during the past 20 years. Reports of this species towards the east of

Table 1 Diurnal movement of Double-banded Sandgrouse between the Klipvoor Dam area and the hinterland of the study area in the Borakalalo National Park

	Morning		Afternoon	
	Hinterland	Dam area	Hinterland	Dam area
Hours traversing	48	24	24	12
Number of sandgrouse	16	4	2	39
Number of sandgrouse per hour	0.3	0.16	0.08	3.25

Table 2 Number of Double-banded Sandgrouse recorded in different basal cover conditions in Borakalalo National Park. The veld was burnt in July and remained short until the end of September.

	Road	Short trampled grass	Burnt grass	Chi-squares
Overall	50 (59%)	9 (10.70%)	25 (29.70%)	$\chi^2 = 133.23$, df = 3, $p < 0.001$
During July–September	15 (35.70%)	2 (4.76%)	25 (59.52%)	$\chi^2 = 62.1$, df = 3, $p < 0.001$

South Africa, in the lowveld of Mpumalanga province and in Kruger National Park, show that they gather in larger groups of 30–50 birds to drink water (Horsbrugh, 1912; Hockey et al., 2005). Payne (1968) also reported that Double-banded Sandgrouse were recorded in twos and fours in scrubby mopane woodlands but flew in groups of dozens to water at dusk in the Hans Merensky Nature Reserve in the lowveld.

Similar to Burchell's Sandgrouse in the Molopo Game Reserve, the Double-banded Sandgrouse also sits in open roads in small groups that are closely knitted, but in Burchell's Sandgrouse these road sitters were generally in groups of 4–8 during winter and in pairs during summer, while in Double-banded Sandgrouse these groups varied between 1–5 (J.H. van Niekerk, unpublished; Little and Crowe, 2011). Unlike Burchell's and the Yellow-throated Sandgrouse (*P. gutturalis*) in the North West province, Double-banded Sandgrouse in Borakalalo National Park did not undertake flights in groups of 20–30 birds to watering points in the late mornings, but instead, flew closer to water in smaller groups during late afternoons and when it was dark they moved for a second time to the edge of the water (J.H. van Niekerk, unpublished). Indeed, Double-banded Sandgrouse formed larger drinking parties after sunset but in this park it is certainly less than 10 (also see Hockey et al., 2005).

This preliminary survey suggests that five factors could trigger the movement of Double-banded Sandgrouse:

1) Double-banded Sandgrouse were absent or fewer in the park during wet summer conditions; this corresponds with lower reporting rates for this species in this area during the wet season (Maclean and Herremans, 1997). This suggests that Double-banded Sandgrouse disperse to more watering points.
2) Their presence/absence in the reserve was also affected by short spells of high/low rainfall periods and not only changing seasons (Fig. 4).
3) They showed a propensity towards short trampled grass as well as recently burnt grass with green sprouts in thornvelds. Double-banded Sandgrouse were suddenly observed back in the park again just after veld burning in July 2010 and remained there for a few months (Fig. 3). Their preference for burnt grass areas was also observed in Kruger National Park (A. Kemp personal communication) which could be a matter of food availability. Their occurrence in relatively open substrates in this survey is coherent with descriptions of their habitat preferences, presented in other publications, such as in tussocky grass and on gravel plains as opposed to dense bush or thick grass (Little and Crowe, 2011). Also, at La Boheme and Magaliesberg, where searches were carried out on foot, they were not observed in thick grassy areas but on open patches (rocky outcrops) or on roads.
4) Double-banded Sandgrouse was observed in the park when they had offspring during late summer and winter, which suggests that they bred outside the park. However, although no signs of breeding was observed in the park during 2010, parents with chicks were certainly observed in April in 2007 in the hinterland of the park ($n = 3$, J.H. van Niekerk personal observations) which suggests that there is not necessarily a cyclic movement between breeding and foraging areas. On the other hand, where Double-banded Sandgrouse visited a farm near Magaliesberg for the last 15 years, no breeding signs were observed.
5) Finally, daily water intake certainly causes movements over a distance of at least 4 km.

Movements were not affected by demographic pressures such as juvenile flocks being rejected to move away from parents or batchelor flocks moving around while breeding takes place. The birds remained in monogamous bonds or family groups throughout. Medium grazing pressure, regular cattle/game watering points and some veld burning during late winter may favor the Double-banded Sandgrouse and are aspects that can be managed in favor of grazing and for the benefit of sandgrouse by landowners.

Acknowledgement I thank Ann Jones for assistance during field work.

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南非Borakalalo国家公园二斑沙鸡(*Pterocles bicinctus*)的迁移

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摘要：本文旨在描述可能引起南非 Borakalalo 国家公园内二斑沙鸡（*Pterocles bicinctus*）迁移行为的内在（繁殖）及外在因素（降雨量及植被情况）。该公园位于西北省比勒陀利亚以北 80 km，Jericho 以北 30 km 处。2010 年，采取乘车辆沿固定路线穿越该保护区的方式搜集数据。车速为每小时 10 km，固定路线长为 32 km，调查强度为每月 2 天。二斑沙鸡平均每群 2.47 个个体。种群内雄性与雌性的比例为 1:0.87。该鸟常出现在路边、遭踩踏过的矮草丛中或经焚烧但长出新叶的金合欢丛中。二斑沙鸡在该保护区主要出现在两个相对干燥的季节，即 2–3 月及 7–9 月。早晨在该公园的腹地能更多地观察到该鸟，而下午晚些时候，在 Klipvoor 河坝的水体边则可多见该鸟。讨论了可能影响二斑沙鸡迁移的 5 个因素，包括年降雨量、雨季中短时雨量大小、2–4 km 的日间饮水飞行、繁殖及草原植被情况。

关键词：二斑沙鸡，繁殖，降雨量，植被