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Article in *African Journal of Wildlife Research* · January 1993

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The use of counts of Namaqua sandgrouse at watering sites for population estimates

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Received 19 October 1992; accepted 1 December 1992

The variety of methods used to count Namaqua sandgrouse *Pterocles namaqua* at watering sites, and the apparent lack of consensus concerning the frequency with which they drink, minimizes the usefulness of such counts as population estimates. There were significant differences between counts of overflying Namaqua sandgrouse, and those that landed and drank at a watering site. Counts on the day preceding the hunt and counts during hunts were also significantly different. Furthermore, sandgrouse which do not drink, take part in group socializing or have a dust bath at the watering site. Individually marked sandgrouse drank as frequently as on four consecutive days. Birds landing, or apparently intending to land should be counted, both during hunting and when hunting is not in progress. Because some sandgrouse which are disturbed by hunters attempt to return to the same watering site during a hunt, counts conducted at hunts should be multiplied by a factor slightly less than 1,0 (i.e. 0,74) to obtain more reliable population estimates. Average total counts of birds landing, or apparently intending to land, may be used for population estimates by relating the count to the land area serviced by the watering site.

Die verskeidenheid van metodes wat gebruik word om die kelkiewyn *Pterocles namaqua* by waterplekke te tel, en die klaarblyklike gebrek aan eenstemmigheid betreffende die frekwensie waarteen hulle drink, verminder die bruikbaarheid van sulke tellings vir skatting van bevolkingsgroottes. Daar was statisties betekenisvolle verskille tussen tellings by waterplekke, van kelkiewyne wat oorgevlieg, geland en gedrink het. Tellings op die dag voor die jag en op die dag van die jag, het ook statisties betekenisvol verskil. Voorts is daar die sandpatryse wat nie drink nie, maar wat sosialiseer of bad in die stof by die waterplek. Individueel gemerkte sandpatryse het so dikwels as vier opeenvolgende dae gedrink. Voëls wat land, of wat klaarblyklik van plan is om te land moet getel word, gedurende die jag en wanneer daar nie gejag word nie. As gevolg daarvan dat sekere sandpatryse wat gedurende 'n jag deur die jagters gesteur word, weer probeer om na dieselfde waterplek terug te keer, moet die telling wat tydens 'n jag verkry word met 'n faktor van net minder as 1,0 (bv. 0,74) gemaal word om 'n akkurate populasieskatting te verkry. Gemiddelde totale tellings van voëls wat land, of wat klaarblyklik van plan is om te land, kan gebruik word vir skattings van bevolkingsgrootte deur die telling in verband te bring met landoppervlak wat deur die waterplek bedien word.

Keywords: Namaqua sandgrouse, *Pterocles namaqua*, drinking behaviour, counting, population estimates

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Introduction

Various studies have reported on the life history and behavioural ecology of the Namaqua sandgrouse *Pterocles namaqua* (Maclean 1968; Dixon & Louw 1978; Clancey 1979; Maclean & Fry 1986), and on its various adaptations to arid environments (Cade & Maclean 1967; Maclean 1976, 1985; Thomas & Robin 1977; Thomas & Maclean 1981; Thomas 1984a, 1984b). Other studies have commented on the apparently regular drinking behaviour of Namaqua sandgrouse (Meade-Waldo 1896, 1906; Cade, Willoughby & Maclean 1966; Cade & Maclean 1967; Maclean 1968, 1985; Knight 1989), and have used counts of Namaqua sandgrouse as estimates of population size (Maclean 1968; Knight 1989). Knight (1989) counted birds that drank and, although it appears that Maclean (1968) counted birds that landed at the watering site, this was not stated clearly.

Although Thomas (1984b) stated that sandgrouse frequent watering sites on a daily basis, and presumably drink daily, there is evidence (Thomas & Maclean 1981; Thomas 1984a) that some individuals may drink only once every few days. The clearest evidence for this is from captive Namaqua sandgrouse, which survived three days of water deprivation in an open-air aviary in the Namib Desert during summer without any signs of distress or malfunction (Thomas & Maclean 1981). From comparison of the estimated amount

of water drunk during this experiment, with that taken during field observations, Thomas (1984b) suggested that individuals may drink only every 3–5 days. Furthermore, Thomas (1984b) suggested that one of the advantages of infrequent drinking is the reduction in the number of energetically expensive flights to watering sites. If Thomas's suggestion is correct, it is premature to claim that counts of sandgrouse at watering sites are useful population estimates. Nevertheless, landowners and conservationists in the northern Cape currently estimate sandgrouse populations by counting birds overflying watering sites before, during, and after hunts. These estimates are then often doubled, based on the belief that, at most, only half of the population visits the watering site daily.

The aims of this study were: to compare counts of overflying, landing, and drinking Namaqua sandgrouse at watering sites; to investigate the frequency with which Namaqua sandgrouse visited and drank at watering sites; to use these results to make methods of counting Namaqua sandgrouse at watering sites comparable; and to evaluate the usefulness of such counts for population estimates.

Methods

Field work was conducted during the non-breeding season (May–June; McLachlan 1985) of 1992, at Rooipoort Estate

(28°38'S / 24°17'E) and at the Langberg (28°42'S / 22°34' E) in the northern Cape Province.

Overflying, landing, and drinking

The numbers of Namaqua sandgrouse overflying, landing, and drinking were counted during 14 sessions at three watering sites. Overflying birds were taken as those in the air, visible from the watering site, during the counting period. Observers sat about 30 m from the water hole in a hide, and there was no evidence that their presence prevented overflying birds from landing, or landed birds from drinking. On 15 other occasions, birds overflying the watering site were counted a day before a hunt (reconnaissance), and again at the same site on the day of the hunt. Hunts are conducted at the watering site between about 08h00 and about 11h00. We compared these before-hunt and during-hunt data and the overflying, landing and drinking data, using the Statgraphics (Anon. 1986) One-Sample Analysis procedure for estimating and testing the mean and variance of two paired samples. This procedure examines the difference between the paired scores, rather than the scores themselves.

Frequency of drinking

Birds were trapped and individually marked with numbered or coloured patagial tags. We monitored the visiting and drinking patterns of marked birds at three watering sites for 5–8 days after capture.

Results

Overflying, landing, and drinking

The differences within pairs of numbers of Namaqua sandgrouse overflying, landing and drinking at a watering site (Table 1) were significant ($p < 0,01$; t test). The mean number of landed birds was 20% less than that of overflying sandgrouse. The mean number that drank was 18% less than those that landed. Landed birds that did not drink took part in group socializing, or had dust baths while at the watering site.

There were also significant differences between numbers of Namaqua sandgrouse counted overflying a watering site on the day before a hunt and during the hunt

($\bar{x}_{\text{reconnaissance}} - \text{hunt} = -118,1$; $SD = 198,1$; t value = $-2,31$; $p = 0,04$; $df = 14$; t test). The mean number of birds overflying the sites on the day before the hunt was only 74% of that obtained on the day of the hunt.

Frequency of drinking

No tagged birds were resighted on the day following capture. Thereafter, at least one bird was resighted at each

Table 1 Differences within pairs in numbers of Namaqua sandgrouse overflying, landing and drinking at a watering site ($df = 13$ throughout)

	\bar{x} (SD)	t value	p
Overflying less landed	7,9 (8,6)	3,46	0,004
Landed less drank	6,7 (5,3)	4,72	0,0004
Overflying less drank	14,6 (12,6)	4,33	0,0008

Table 2 Number of tagged Namaqua sandgrouse resighted after tagging at three watering sites, and number of tagged birds that drank, in parentheses

Site	n	Number of days after tagging							
		1	2	3	4	5	6	7	8
1	7	0	1(1)	2(1)	5(0)	2(2)	5(2)	1(1)	4(4)
2	2	0	2(2)	1(1)	2(2)	2(2)	–	–	–
3	19	0	4(4)	2(?)	3(3)	1(1)	1(1)	–	–

n = number of birds tagged at each watering site.

watering site on each day, and the proportion of marked birds which drank was high (Table 2). Two male Namaqua sandgrouse drank on two consecutive days, another two drank on four consecutive days, and a female drank on four out of five consecutive days. The coefficient of variation for the number of birds landing at a watering site counted on eight consecutive days was 12,4% ($\bar{x} = 74,1$; $SD = 9,2$).

Discussion

Overflying, landing, and drinking

Although our results show that counts of Namaqua sandgrouse overflying, landing, and drinking at watering sites differ significantly, these differences probably vary spatially and between seasons according to variation in number of watering sites available, and amount and quality of suitable water during different seasons (Maclean 1968; Knight 1989). However, counting birds which land, or intend to land (but are disturbed) in the case of counting during a hunt, is probably the best estimator of the local Namaqua sandgrouse population because, in contrast, the number overflying includes a significant number of birds that could be using nearby watering sites, and thus be counted twice. Furthermore, not all birds that land drink, possibly indicating that attending the watering site is also a social habit ('non-drinkers' described by Maclean 1968) as well as the result of a need to drink.

The higher counts of overflying birds during a hunt, than during reconnaissance counts, were probably due to the fact that some sandgrouse turn away from the watering site during a hunt, but attempt to return and thus are counted again. The magnitude of this difference might be affected by the availability of alternative watering sites. However, some adjustment should be made to counts conducted during a hunt if they are to be used for population estimates.

Frequency of drinking

The relatively high return rate of tagged Namaqua sandgrouse to the watering sites at which they were captured indicates high site fidelity. The regular return of sandgrouse to favoured watering sites has previously been described by Knight (1989). Although tagged birds drank up to four days in succession at the same site, some birds visited the site with no apparent intention of drinking. Therefore, the number of birds counted at a particular site probably indicates the number of Namaqua sandgrouse in the immediate vicinity.

Recommendations for counting Namaqua sandgrouse and estimating their populations

(i) Birds landing, or apparently intending to land (i.e. disturbed while flying toward the watering site) should be counted both during hunting and when hunting is not in progress.

(ii) Counts conducted during a hunt should be multiplied by a correction factor of 0,74 to offset the 'excess' of birds which return to a watering site after being disturbed by hunting.

(iii) Average total counts of birds landing, or apparently intending to land, can be used for population estimates by relating the count to the land area serviced by the watering site.

(iv) The number of sandgrouse counted at a watering site may be regarded as representative of the total population available for hunting in a specific area.

Acknowledgements

We thank De Beers Consolidated Mines Limited and the African Gamebird Research, Education and Development Trust for financial and logistic support. The Foundation for Research Development (Core Programme) and the University of Cape Town's Research and Equipment Committees also supported TMC's research. We are grateful to Charles Ratcliffe and Bruce Johnson for help in the field, and to Richard Brooke for constructive criticism of the paper.

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