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Group-size effect on scanning behaviour of Maasai Ostrich *Struthio camelus massaicus*

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Summary

Scanning behaviour enables birds to collect information important for their survival, such as detecting predators (anti-predatory strategy) and searching for food. The scanning behaviour of the Common Ostrich *Struthio camelus* was investigated by determining the scanning duration (total seconds during 5-min periods that a bird's head was raised) and scanning rate (number of times an individual raised its head per minute) among different group sizes in late 2006 in Serengeti National Park, Tanzania. A total of 14 males and 20 females were observed. Scanning duration was a function of group size where individuals in small groups scanned for longer times than individuals in large groups. However, increasing group size did not have a significant effect on the scanning rate among the groups. Individual vigilance among ostriches is influenced by group size, whereas individual scanning rate may be influenced by factors other than group size, such as body size and habitat type. Higher scanning duration in small groups is attributed to anti-predatory behaviour.

Introduction

Vigilance is an important behavioural trait in many animal species. Animals, including some birds, are continuously scanning their environment to secure their safety. Scanning behaviour in birds is considered an antipredator behaviour (Pulliam 1973, Caro 2005) and it has been shown to increase with increasing predation risk (Edmunds 1974). Avoiding predation is important for survival and reproduction in birds. Body posture has been used as a measure of anti-predator scanning (Caro 2005). Birds have been assumed to be scanning for predators when individuals' heads are up. But when heads are down, for example when searching for food or foraging, they cannot obtain any visual information through scanning (Lima 1987). Birds with laterally placed eyes, like ostriches, could obtain some information through their wide fields of view (Martin 2007, Fernández-Juricic *et al*. 2008) to the extent that they can gather information laterally even when their heads are down (Bednekoff & Lima 2005, Fernández-Juricic *et al*. 2005). However, their ability to detect a predator is only about 30% of their vision when the head is down (Lima & Bednekoff 1999, Tisdale & Fernández-Juricic 2009) and vigilance with a raised head is therefore still important.

The Common Ostrich is the world's largest flightless, herbivorous bird, and is found in a variety of open habitat types (Brown *et al*. 1982). The Maasai Ostrich *S. c. massaicus* is native to East Africa.

Although scanning behaviour has been studied in ostriches (Bertram 1980), little effort has been devoted to the study of intraspecific variation of scanning duration and scanning rate. Changes in vigilance behaviour in ostriches have usually been attributed to variation in predation risk (Bertram 1980). The main predators of adult ostriches are spotted hyenas *Crocuta crocuta* and lions *Panthera leo* (Bertram 1992). While

Egyptian vultures *Neophron percnopterus* s crack ostrich eggs by dropping large stones on to them (Thouless *et al.* 1989). In northern Tanzania, most of these predators are confined to Serengeti National Park or to regions otherwise remote from human activity (Nyahongo 2004). Ostriches inside the park are speculated to be highly vigilant and form groups as an anti-predatory strategy. The aim of this study was to investigate the influence of group size on scanning duration and scanning rate in ostriches.

Methods

The study was conducted in the central and southern part of the Serengeti National Park (14763 km^2, 1°15'–3°30'S, 34°–36°E). The study area is composed of savanna with mainly thorny woodland trees, with species of *Acacia*, *Commiphora, Ficus, Combretum* and *Podocarpus*, and extensive grass plains (Herlocker 1976). Neither human settlements nor consumptive activities are permitted except ecotourism and photographic tourism.

Data were collected during November and December 2006 for 16 days on 34 individual ostriches (20 females and 14 males). A focal sampling method was used to sample ostrich scanning behaviour. Focal adult subjects were arbitrarily selected from a group or as single individuals, and were followed for five minutes. During each 5-min period, group size scanning frequency, scanning duration and scanning behaviours were recorded. All occurrences of scanning behaviour (stationary or walking while the head is elevated) were recorded. Birds were considered scanning when they raised the tip of their beak to eye level or higher (Hogstad 1988). The bird was considered feeding when it was stationary or walking actively searching for food while its head was at or below body level. Scanning surveys were conducted in the mornings (07:00–12:00) when birds were actively feeding. Ostriches were sampled over a large area, and in order to avoid sampling the same bird twice, sections of the area were sampled once, where only one focal bird per group was identified and monitored. Scanning duration was considered as the total amount of seconds during 5-min periods that the bird's head was raised, while scanning rate was the number of times an individual raised its head per minute.

Analyses were performed using SPSS 20 for Windows. A general linear model (GLM) was used to determine the effects of the predictor variables on dependent variables. In the models, scanning duration and scanning rate were included as dependent variables with group size as the predictor (independent) variable.

Results

A total of 34 behavioural records over a duration of 5 min each was obtained. On average, individual scanning duration decreased with group size whereas scanning rate remained more or less unchanged with group size. A negative relationship between individual scanning duration and group size (Fig. 1) was further supported by multivariate analysis that revealed an effect of group size ($F_{6,27} = 3.712$, $p = 0.008$) on the scanning duration of ostriches. However, there was no effect of group size on the scanning rate of ostriches ($F_{6,27} = 0.595$, $p = 0.731$).

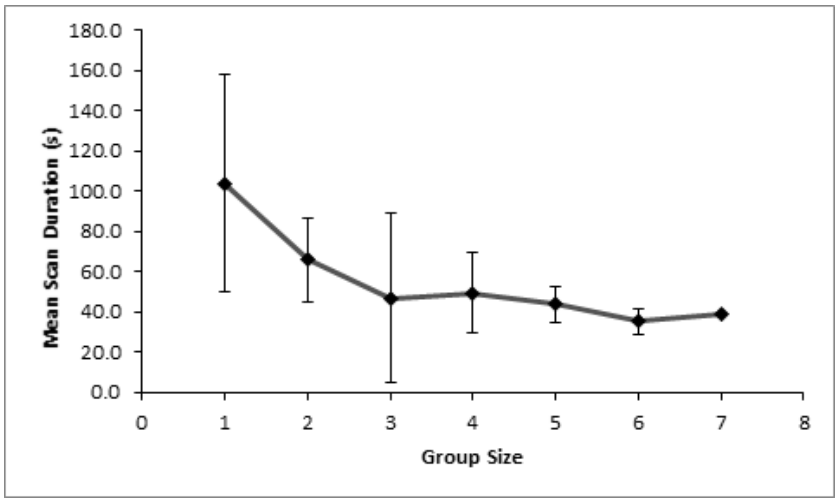

Figure 1. Variation of scanning duration (Mean ± SD) for the different categories of group sizes of ostriches in the Serengeti National Park, Tanzania, November–December 2006.

Discussion

Scanning behaviour of ostriches varied with group size. The inverse relationship between group size and scanning duration could be a function of shared vigilance. Other studies (Elgar & Catterall 1981, Elcavage & Caraco 1983) have shown a similar relationship. According to Pulliam's 'many-eyes' hypothesis (Pulliam 1973), animals in groups can rely on the vigilance of their group mates to increase the probability of detecting predators and so avoid predation (Robinette & Ha 2001). The risk of predation to an individual in small groups is high, and that is probably the reason why birds are more vigilant in small groups, as observed by Bertram (1980) and also other bird studies (Lima *at al*. 1999). However, Lima *et al*. (1999) reported that decreased vigilance in large groups is not always because of a reduced predation risk, but rather because in areas with scarce resources, animals will tend to compete for the resources and consequently reduce vigilance.

Detailed studies are recommended with a longer survey duration, a larger sample size, and over a longer timeframe to determine the trend of scanning rate with factors other than group size, such as body size and habitat type, incorporated.

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