Nesting tree utilisation by Brown-necked Ravens *Corvus ruficollis* in west central Saudi Arabia

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Nesting tree utilisation by Brown-necked Ravens *Corvus ruficollis* was recorded in the Mahazat as-Sayd protected area, with most nests located in *Maerua crassifolia*, then *Acacia tortilis*. The mean above ground height of the nests was higher in *M. crassifolia* than *A. tortilis*. The median number of nests/tree was 1 and 2 for *A. tortilis* and *M. crassifolia* respectively, with most nests as single nests/tree in *A. tortilis* and 3 nests/tree making up 21.4% of the nests in *M. crassifolia*. Most nests were either in the same tree as, or within a radius of 500 m from, a Lappet-faced Vulture *Torgos tracheliotus* nest. Just over half the nests in the same tree were located beneath (ie entirely or partially covered by) the Lappet-faced Vulture nest (and most were located under the western and northern sides) while just below half were located away from (ie not covered), but still in the same tree.

INTRODUCTION

Although commonly observed throughout large parts of Saudi Arabia, Brown-necked Ravens *Corvus ruficollis* (Plate 1) are poorly known and their nesting tree utilisation is not well understood. Most references, when referring to trees as nesting sites for Brown-necked Ravens, indicate trees in general and only occasionally is the tree species mentioned (Aspinall 1996, Hollom *et al* 1988, Osborne *et al* 1996, Richardson 1990). Nest sites are extremely variable in location, but with thorny tree species preferred (Jennings 1998). This was supported by Shobrak (2005), who indicated that Brown-necked Ravens prefer *Acacia tortilis*, during a study on their breeding success in the Mahazat as-Sayd protected area. This paper presents more data on their nesting tree utilisation and the apparent nesting association of Brown-necked Ravens with Lappet-faced Vultures *Torgos tracheliotus*, in the Mahazat as-Sayd protected area in west central Saudi Arabia (Plates 2 & 3).

Plate 1. Brown-necked Raven *Corvus ruficollis*, Saudi Arabia. © *Robbie Robinson*

STUDY AREA

This study was conducted opportunistically, during an ongoing study into the feeding ecology of Arabian Sand Gazelles (*Gazella subgutturosa marica*) in the Mahazat as-Sayd protected area (MSPA). MSPA is a flat arid desert steppe located *c*150 km northeast of Taif in west central Saudi Arabia (28° 15′ N, 41° 40′ E, elevation 900–1100 m asl) covering an area of 2244 km^2. Mahazat as-Sayd was designated a nature reserve in 1988 and fenced in 1989, mainly for the re-introduction of Arabian Oryx *Oryx leucoryx* and Asian Houbara Bustard *Chlamydotis undulata macqueenii* (Child & Grainger 1990, Haque & Smith 1996, Chassot *et al* 2005, Shobrak 2005). The climate is arid with annual rainfall highly variable ranging between 50–100 mm and occurring mainly March–May. Mean monthly minimum

Plate 2 (left). Brown-necked Raven *Corvus ruficollis* (smaller nest, below) and Lappet-faced Vulture *Torgos tracheliotus* (larger nest, above) nests in *Acacia tortilis*, Mahazat as-Sayd protected area, Saudi Arabia. © *Peter Cunningham*

Plate 3 (right). Typical Brown-necked Raven *Corvus ruficollis* nest (smaller nest, below right) surrounded by human refuse (mainly rags) with Lappet-faced Vulture *Torgos tracheliotus* nest above it, in *Acacia tortilis*, Mahazat as-Sayd protected area, Saudi Arabia. © *Peter Cunningham*

and maximum temperatures range between 2–21°C and 29–40°C. In general, the MSPA area is undulating sandy and/or gravel plains dominated by *Acacia tortilis* trees, with mean, maximum and minimum densities of *A. tortilis* and *Maerua crassifolia* estimated at 553, 2905 & 21 trees/ha and 0.16, 20 & 0 trees/ha, respectively (Gillet & Launay 1990). Other trees/shrubs, at lower densities, include *A. ehrenbergiana*, *A. oerforta* and *Lycium shawii* (Gillet & Launay 1990). With the exception of two small hills (Sha'fa al Janubi, 1033 m asl, and Sha'fa ash Shimali, 1013 m asl), no cliffs occur within MSPA. Potential mammalian nest predators include Gordon's Wild Cat *Felis silvestris gordoni*, Sand Cat *F. margarita*, Feral Cat *F. catus* and Ratel *Mellivora capensis*. The number and density of Brown-necked Raven and Lappet-faced Vulture nests in MSPA are not known, although they vary between years and seem to be at higher densities within MSPA (Newton & Newton 1996). According to Newton & Newton (1996), the typical inter-vulture nest distance of this species is mostly >2 km (majority between 3–6 km) apart.

STUDY METHODS

Whilst conducting feeding observations of sand gazelle, the locations of Brown-necked Raven and Lappet-faced Vulture nests opportunistically encountered were noted and returned to later, to collect certain nest details. For each Brown-necked Raven nest the following information was collected: tree species, height of the nesting tree, height of nest (and of Lappet-faced Vulture nest if in the same tree), position (under a Lappet-faced Vulture nest or not) and orientation (N, E, S & W) of nest in relation to any Lappet-faced Vulture nest and presence of a Lappet-faced Vulture nest within 500 m if not located in the same tree. Nest height above ground level was measured using a measuring pole, to the nearest 0.25 m. Observations were conducted during September and October 2008, *ie* the non-breeding season for both Brown-necked Ravens and Lappet-faced Vultures.

RESULTS

A total of 84 Brown-necked Raven nests were found (old and recent) with 50 located in *Maerua crassifolia* (n = 29 trees), 32 in *Acacia tortilis* (n = 23 trees), 1 in *Acacia ehrenbergiana* (n = 1 tree) and 1 in an artificial structure (windsock). The majority of these nests (59.5%) were in *Maerua crassifolia* trees and 53.8% of trees with nests were of this species (Table 1). Trees with more than 1 nest had a recently used nest and older nests.

Table 1. Nesting tree (n = 84 nests) utilisation by Brown-necked Ravens *Corvus ruficollis* according to tree species and number of nests/tree in the Mahazat as-Sayd protected area, Saudi Arabia, September and October 2008. Artificial: 1 nest located in windsock at landing strip. Trees with more than 1 raven nest had a recently used nest and older nests.

	A. tortilis	*M. crassifolia*	*A. ehrenbergiana*	Artificial
Nests (%)	38.1	59.5	1.2	1.2
Trees with nests (%)	42.6	53.8	1.8	1.8
1 nest/tree (%)	65.2	42.9		
2 nests/tree (%)	30.4	35.7		
3 nests/tree (%)	4.4	21.4		

The mean height of nests in trees (from the ground) was 2.54 m (SD = ± 0.38, n = 32) and 2.95 m (± 0.63, n = 50) for *A. tortilis* and *M. crassifolia* trees, respectively. The mean tree height of trees with raven nests was 3.08 m (± 0.39, n = 23) and 3.4 m (± 0.72, n = 28) for *A. tortilis* and *M. crassifolia*, respectively. Brown-necked Raven nests were significantly higher in *M. crassifolia* than *A. tortilis* trees (Mann-Whitney U-test, P <0.001) with a significant difference in mean nest heights between all tree species observed (Kruskal-Wallis one way ANOVA on ranks, Dunn's Test P <0.05). The variation in nest height as a function of tree height was positive for *A. tortilis* (Spearman Rank Order correlation 0.607, n = 32), *M. crassifolia* (0.839, n = 50) and both tree species combined (0.834, n = 82).

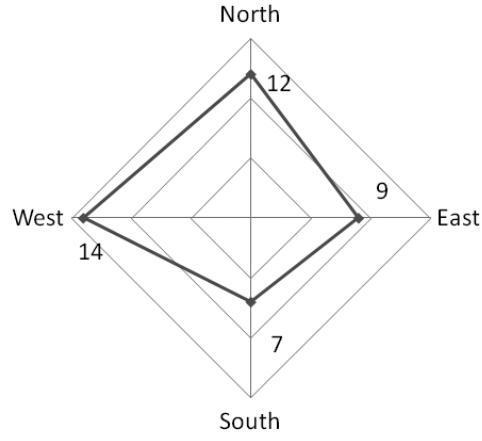

Figure 1. Nest orientation of Brown-necked Raven nests located partially or completely beneath a Lappet-faced Vulture nest in the Mahazat as-Sayd protected area, Saudi Arabia, 2008. Nest orientation refers to whether the nest was under the N, E, S or W section of the vulture's nest.

Most Brown-necked Raven nests were in the upper crowns (96.4%) with only 3 nests being located on top of trees (3.6%). The median number of nests/tree was 1 and 2 for *A. tortilis* and *M. crassifolia* trees respectively, with 65.2% of the nests as single nests in *A. tortilis* and 3 nests/tree making up 21.4% of the nests in *M. crassifolia* trees (Table 1).

Of the 84 Brown-necked Raven nests found, 50% (n = 42) were in the same tree as a Lappet-faced Vulture nest (n = 24) with 38.1% (n = 16) and 61.9% (n = 26) of these nests in *A. tortilis* and *M. crassifolia* trees, respectively. Of the remaining 42 nests, not in the same tree as a Lappet-faced Vulture nest, 66.7% (n = 28) were within a radius of 500 m from a Lappet-faced Vulture nest. Thus 83.3% of the Brown-necked Raven nests (n = 70) were either in the same tree as (n = 42), or within a radius of 500 m (n = 28) from, a Lappet-faced Vulture nest.

Just over half (52.4%, n = 22) of the Brown-necked Raven nests in the same tree as a Lappet-faced Vulture nest were beneath that nest (entirely or partially) and 47.6% (n = 20) were away from, but still in the same tree. Overall, there was no significant difference in nest height between Brown-necked Raven (BNR) and Lappet-faced Vulture (LFV) nests in the same tree (means ± SD; *A. tortilis*: BNR 2.54 ± 0.38 m, LFV 2.67 ± 0.48 m; *M. crassifolia*: BNR 2.95 ± 0.63 m, LFV 3.06 ± 0.52 m; Kruskal-Wallis one way ANOVA on ranks, Dunn's

Test P >0.05). Measured orientation of Brown-necked Raven nests located entirely or partially beneath a Lappet-faced Vulture nest indicated that 61.9% of the nests were located under the western (n = 14) and northern (n = 12) sides of the vulture nest (Figure 1).

DISCUSSION

The low *M. crassifolia* tree densities (Gillet & Launay 1990) and the higher occurrence of Brown-necked Raven nests associated with this tree species rather than *A. tortilis*, indicate its importance as a nest site. In a previous study in MSPA, Shobrak (2005), however, found the majority of his Brown-necked Raven nests in *A. tortilis* trees (n = 24), with the importance of *A. tortilis* as the favoured nesting site in Arabia supported by Jennings (1987). The discrepancy between Shobrak's (2005) and my results is difficult to explain. *M. crassifolia* is dominant in the east of MSPA, though Shobrak (2005) stated that he searched randomly throughout MSPA looking for raven nests. The Lappet-faced Vulture shows a preference for nesting and roosting in the eastern *M. crassifolia* dominated parts of MSPA (Newton & Newton 1996) and the apparent preference for *M. crassifolia* by Brown-necked Ravens may simply reflect that. There might be a thermoregulatory benefit as *M. crassifolia* is evergreen and generally taller than *A. tortilis*

The apparent association of Brown-necked Raven nests with those of Lappet-faced Vultures is interesting, as corvids are known to show hostility at their own nesting sites towards raptors including Lappet-faced Vultures (Harvey & Harvey 1992, Jennings 1998, Bertran & Margalida 2004, Hockey *et al* 2005). Observations are needed during the breeding season to determine the level of interaction at dual nesting sites between the two species. The main benefit of associating with Lappet-faced Vulture nests is probably to scavenge around the nests, as Lappet-faced Vulture nestlings are "messy" feeders. According to Gavashelishvili & McGrady (2006), the presence of *Corvus* spp at carcasses signals relative security to vultures indicating that vultures might benefit from having ravens around although this does not necessarily imply associated breeding. According to Shobrak (2000), Brown-necked Ravens are the first avian species to locate carcasses in MSPA, probably assisting vultures in locating carcasses. It may also be that Lappet-faced Vultures are exhibiting a preference to nest closer to Brown-necked Ravens, to benefit from the latter's aggressiveness to other raptors (as potential nest raiders) or to benefit in the search for carcasses. According to Newton & Newton (1996), the survival rate of Lappet-faced Vulture eggs and chicks in MSPA is higher than that documented from Africa. Active breeding association has been documented for Peregrine Falcons (*Falco peregrinus*) with Common Ravens (*Corvus corax*), with the latter presenting early-warning cues against predators (Fabrizio *et al* 2004).

The orientation of the nests shaded by Lappet-faced Vulture nests suggests a nest site selection preference favouring the west and north, which might provide increased shade during the hotter parts of the day. The breeding season of the Brown-necked Raven is generally accepted as being February–April in Saudi Arabia (Richardson 1990, Aspinall 1996, Shobrak 2004) with nesting known as late as June (Jennings 1993, 1995). Shading during this period, especially the latter period with a dramatic increase in ambient temperatures, may increase successful incubation, hatching and fledging. Shobrak (2005) suggested that breeding earlier, in the cooler season, favoured the successful rearing of Brown-necked Raven chicks. It is possible that later nesting Brown-necked Ravens are more likely to site their nests under Lappet-faced Vulture nests, to benefit from the shade. Whether the north-westerly Shamal winds during the summer months (Bottomley 1996) have an effect on nest orientation also requires investigation.

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REFERENCES

Aspinall, S. 1996. *Status and conservation of the breeding birds of the United Arab Emirates.* Hobby Publications, Dubai.

Bertran, J & A Margalida. 2004. Interactive behaviour between Bearded Vultures *Gypaetus barbatus* and Common Ravens *Corvus corax* in the nesting sites: predation risk and kleptoparasitism. *Ardeola* 51: 269–274.

Bottomley, N. 1996. Recent climate of Abu Dhabi. *In*: Osborne, PE (ed). *Desert ecology of Abu Dhabi—a review and recent studies*. Pisces Publications, Newbury, UK, pp36–49.

Chassot, P, P Mésochina & S Ostrowski. 2005. Re-introducing of Arabian oryx in the Kingdom of Saudi Arabia: up-date on population size in two protected areas. *Re-introduction News* 24: 17–19.

Child, G & J Grainger. 1990. *A System Plan for Protected Areas for Wildlife Conservation and Sustainable Rural development in Saudi Arabia*, Appendix II. National Commission for Wildlife Conservation and Development (NCWCD), Riyadh.

Fabrizio, F, F Rizzolli, L Marchesi & P Pedrini. 2004. The importance of interspecific interactions for breeding-site selection: peregrine falcons seek proximity to raven nests. *Ecography* 27: 818–826.

Gavashelishvili, A & MJ McGrady. 2006. Geographic information system-based modelling of vulture response to carcass appearance in the Caucasus. *Journal of Zoology* 269: 365–372.

Gillet, H & C Launay. 1990. *Flora analysis of the Mahazat as–Sayd vegetation*. NWRC, Taif, Saudi Arabia.

Haque, MN & TR Smith. 1996. Reintroduction of Arabian sand gazelle *Gazella subgutturosa maric*a in Saudi Arabia. *Conservation Biology* 76: 203–207.

Harvey, D & M Harvey. 1992. Breeding observations on the Brown-necked raven in Sana'a, Republic of Yemen. *Phoenix* 9**:** 16–17.

Hockey, PAR, WRJ Dean & PG Ryan (eds). 2005. *Roberts' Birds of Southern Africa*. 7th edition. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

Hollom, PAD, RF Porter, S Christensen & I Willis. 1988. *Birds of the Middle East and North Africa.* T & AD Poyser, Calton, UK.

Jennings, MC. 1987. Progress so far: brown-necked raven. *Phoenix* 4**:** 7.

Jennings, MC. 1993. Progress so far: brown-necked raven. *Phoenix* 10**:** 5.

Jennings, MC. 1995. *An interim atlas of the breeding birds of Arabia.* NCWCD, Riyadh.

Jennings, MC. 1998. Brown-necked raven, *Corvus ruficollis*. *Phoenix* 15**:** 18–19.

Newton, SF & AV Newton. 1996. Breeding biology and seasonal abundance of lappet-faced vultures *Torgos tracheliotus* in western Saudi Arabia. *Ibis* 138**:** 675–683.

Osborne, PE, JA Norton & S Aspinall. 1996. Desert birds of Abu Dhabi. *In*: Osborne PE (ed). *Desert ecology of Abu Dhabi- a review and recent studies*. Pisces Publications, Newbury, UK, pp98–123.

Richardson, C. 1990. *The birds of the United Arab Emirates.* Hobby Publications, Dubai.

Shobrak, M. 2000. The role of avian scavengers in locating and exploiting carcasses in central Saudi Arabia. *In*: Chancellor, RD & BU Meyburg (eds). *Raptors at Risk*. WWGBO, Hancock House, UK.

Shobrak, M. 2005. Breeding success of Brown-necked ravens *Corvus ruficollis* in the Mahazat as-Sayd Protected Area, Saudi Arabia. *Sandgrouse* 27: 152–157.

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