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Received 17 October 2002; accepted 30 June 2003  
Associate Editor: Joan L. Morrison

*J. Raptor Res.* 37(4):333–337

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## TERRITORY CHANGE AND NEST-SITE SWITCHING IN THE BEARDED VULTURE (*GYPÆTUS BARBATUS*)

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KEY WORDS: *Bearded Vulture*, *Gypaetus barbatus*; *conspecific interaction*; *nest competition*; *territory change*.

The presence of old nests may indicate the suitability

of a nesting site for a given raptor species (Newton 1979, Collias and Collias 1984). The increase in the size of a species' population can cause a reduction in the availability of suitable nesting sites and lead to intraspecific and interspecific competition for those sites. In this respect, some species may adopt the strategy of occupying

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or usurping other species' nests, as has been documented in several raptors (e.g., Fernández and Donázar 1991, Margalida and García 1999). This process can lead to changes in the territory used by specific birds. In several raptor species, these changes in territories have been related to the age of the birds involved to the quality of the territory, and to mate loss (Newton 1986, Wiklund 1996, Forero et al. 1999).

The Bearded Vulture (*Cypaetus barbatus*) is a territorial, cliff-nesting vulture, whose diet mostly includes bony remains of medium-sized ungulates (Hiraldo et al. 1979, Donázar 1993), a resource which is unpredictable in time and space. In the Pyrenees (northeastern Spain), the number of occupied territories and the number of breeding pairs have shown a significant increase over the last 15 yr (annual increase of 5%; Heredia and Margalida 2001). Each pair has several nests in its territory (2–11; Heredia 1991, Margalida and García 1999), that are used on a rotational basis. These nests are on average 992 m from one another (Donázar et al. 1993). The functionality of having several nests at one territory may be to advertise the birds' territory or to avoid the accumulation of ectoparasites by changing the nest from one year to another (Newton 1979, Margalida and Bertran 2000a).

In the Bearded Vulture, both sexes participate in territorial defense (Margalida and Bertran 2000b), an activity that is generally centered within a radius of 500 m from the nest used that year (Brown 1990, Bertran and Margalida 2002). Despite this territorial behavior, the Bearded Vulture has suffered from nest stealing, mainly by the Eurasian Griffon (*Cyps fulvus*). Also, Bearded Vultures have usurped the nests of other species such as the Golden Eagle (*Aquila chrysaetos*) and the Common Raven (*Corvus corax*) (Margalida and García 1999) suggesting interspecific competition for nest sites. For some species such as the Bearded Vulture, nest building involves a considerable investment of time and energy and, both the nest location and the material it is made of can influence breeding success (Margalida and Bertran 2000a). On the other hand, the increase in density of nesting vultures can lead to a larger number of intraspecific interactions, a factor that can also influence this species' breeding success (Margalida et al. 2003). Nevertheless, probably as a result of the territoriality and the relatively great distance between neighboring nests (11 km; Donázar et al. 1993), the occupation of nests by conspecifics has not been documented in the Bearded Vulture.

Here we document the first case of a Bearded Vulture pair's change of territory and the first conspecific usurpation of a neighboring pair's nest.

#### STUDY AREA AND METHODS

The study was carried out in Catalonia (northeastern Spain). In this region, the population of Bearded Vulture increased from seven territories in 1984 to 30 in 2002 (Margalida and García 2002). Between 1992 and 2002, we intensively monitored 179 breeding attempts of 14–

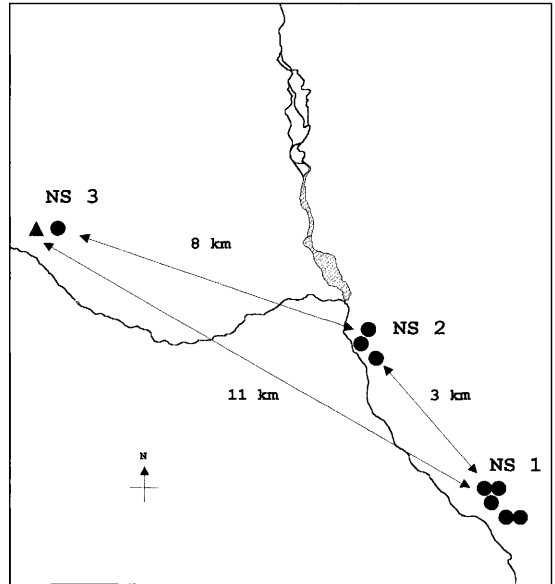


Figure 1. Location and distances between the three nesting sites occupied by the two pairs of Bearded Vultures. The circles indicate the location of the nests. The triangle in NS 3 indicates the nest shared by the two pairs, occupied by PA in 1996 and pair PB in 2001. Pair PA primarily used NS 2 (1997–2002) and pair PB primarily used NS 1 (1995–2000 and 2002).

20 focal pairs per year (García et al. 1996, Margalida et al. 2003). In this area, the mean distance between nests of the same pair was 1.7 km and the mean distance between nests of neighboring pairs was 12.7 km ( $N = 18$ ; García et al. 1996). Nests were observed throughout the breeding season at least once a week. Observations began in September, coinciding with the start of nest building (Margalida and Bertran 2000a), and ended during fledging (June–July, Margalida et al. 2003). The identification of the birds was based on comparison of the individual characteristics of their plumage, specifically the patterns on pectoral bands (black feathers in the breast and ventral region) and crowns, (see Delibes et al. 1984). The long molting process during the breeding period also facilitated identification of the birds during extensive periods of time.

#### RESULTS

Pair A: In 1996, we located this new breeding pair (PA), which occupied a vacant nesting sector (NS 3). The pair laid the eggs, incubated them, but failed during hatching. The nearest breeding pair (PB) was 11 km away in sector NS 1. After the breeding failure, PA built a second nest on the same rock face, ca. 150 m away, and it was not used again. During the pre-laying period of 1996–97, PA moved 8 km east, to an area 3 km from PB (Fig. 1). In this new sector (NS 2) PA bred in three dif-

Table 1. Summary of the breeding chronology and nest success of pairs PA and PB in the three nesting sectors studied, 1995–2002.

YEAR	NESTING SITE 3			NESTING SITE 2			NESTING SITE 1		
	PAIR	LAYING DATE <sup>a</sup>	SUCCESSFUL REPRODUCTION	PAIR	LAYING DATE <sup>a</sup>	SUCCESSFUL REPRODUCTION	PAIR	LAYING DATE <sup>a</sup>	SUCCESSFUL REPRODUCTION
1995	—	—	—	—	—	—	PB	<8 Jan	No
1996	PA	<11 Jan	No	—	—	—	PB	No eggs laid	No
1997	—	—	—	PA	?	Yes	PB	No eggs laid	No
1998	—	—	—	PA	12–13 Jan	Yes	PB	5–6 Feb	No
1999	—	—	—	PA	10 Jan	Yes	PB	5–7 Feb	No
2000	—	—	—	PA	7–10 Jan	Yes	PB	20–26 Jan	Yes
2001	PB	20–26 Jan	Yes	PA	<11 Jan	Yes	—	—	—
2002	—	—	—	PA	<8 Jan	Yes	PB	>20 Jan	No

<sup>a</sup>Jan = January, Feb = February.

ferent nests, that were built between 1996 and 2001. In 2002, PA remained in NS 2 and bred successfully.

Pair B: This pair (PB) was discovered in 1984. From 1984–94 it bred successfully each year in NS 1, using five different nests, which were grouped in a 300 m radius. In 1995, PB failed during breeding and this coincided with the presence of a third individual, who was tolerated and even entered the nest along with the two members of the pair. Between 1996 and 1999, the pair failed in its breeding attempts. In 2000, PB bred successfully in NS 1 and, during the pre-laying period of the next breeding season (2000–01), disappeared from breeding sector NS 1. That year, PA occupied one of the nests in NS 2, while another incubating pair was located in NS 3, whose phenology and plumage characteristics matched that of PB (Table 1). In 2001, PB occupied a second nest in NS 3 (built by PA in 1996) and bred successfully, having moved 11 km.

During 2002, PB rebuilt the first nest occupied by PA in NS 3. PB defended the territory and reconstructed the nest up to 19 January 2002 (the date of the last observation of the two individuals in NS 3). After this, these vultures were not seen again. During a later visit, an individual from PB was located incubating in one of the nests in NS 1.

The mean laying dates obtained between 1996 and 2002 differ significantly from one territory to another (PA: 10 January, PB: 28 January; Table 1; Mann-Whitney *U*-test,  $z = -2.74$ ,  $P = 0.0062$ ). Plumage characteristics of the individuals and egg-laying dates (the latter being very regular each year for all pairs; Margalida et al. 2003) corroborate the fact that NS 3 was shared in different years by PA and PB (Table 1).

#### DISCUSSION

In the study area, the mean distance from one nest to the next nearest nest in the same territory is 1.7 km, a

greater distance than the one obtained by Donázar et al. (1993) in the central Pyrenees (0.99 km). This fact may facilitate nest “stealing” and force the Bearded Vulture to look for other sites to breed (Margalida and García 1999). The territory change observed (moving 11 km) could be a result of nests being occupied by heterospecifics. However, PB had all its nests and had stayed in the same territory for 18 years. In many bird species, the decision to move can be based on the individual’s current breeding success or the quality of the territory (Switzer 1997). On the other hand, in several raptor species, mate loss and lack of breeding success are related to territory changes (Newton and Marquiss 1982, Wiklund 1996, Forero et al. 1999). The change in egg-laying dates (delayed 1 mo) in PB suggests that at least one of the members of the pair was replaced (probably the female), because egg-laying dates are usually very regular from one year to the next in the Bearded Vulture, with a year to year variability of  $\pm 4.2$  d (Margalida et al. 2003). Because the replacement must have taken place 5–6 yr before the territory change, this fact does not appear to explain the territory switch. Moreover, after the successful breeding in NS 3, PB returned to its original territory (NS 1) and this behavior has been observed in other pairs in which there have apparently been no replacement breeders (e.g., in territories with nests usurped by Eurasian Griffons).

Another factor, which might explain the move may be related to human disturbance, which can disrupt this species’ breeding success (Donázar et al. 1993, Margalida et al. 2003). Because human pressure is scarce in the three study sectors (pers. observ.), this factor does not appear to explain the move. Moreover, after success for breeding in NS 3, PB went back to its old breeding sector (NS 1).

Finally, the increases in the density of birds can cause interactions related to competition for the exploitation of trophic resources and nesting sites (Margalida and

Bertran 2003), which lead to the territory change. Nevertheless, during the monitoring of the pairs studied, no agonistic interactions were observed. In addition, in the study area there are pairs that coexist at lesser distances and they breed successfully and have not changed territory (Margalida and García 2002, pers. observ.).

None of the hypotheses consider appear to explain the observed nest change by Bearded Vultures. Although the specific reasons for the move are unknown, one plausible explanation would be related to the availability of trophic resources and the optimization of the time and energy this would have meant for the pair in order to exploit them. The effect of breeding success and mate loss on territory change could be a consequence of a response to local food conditions (Newton and Marquiss 1982). The presence of predictable sources of food, whether these be feeding stations or areas where farmers leave carcasses, may be favoring the settlement of new pairs (Heredia and Razin 1999, A. Margalida pers. observ.). The search for, preparation, and transportation, of food represent a significant part of the parental effort the species invests during breeding (Margalida and Bertran 2000b, Margalida and Bertran 2001). The extensive foraging areas usually exploited by a pair of Bearded Vultures measure over 600 km<sup>2</sup> and lineal movements of over 30 km can be common (pers. observ.). PB regularly exploited areas closer to NS 3 than NS 1 as a result of the abundance of Pyrenean Chamois (*Rupicapra pyrenaica*), a very important trophic resource for breeding pairs in the Pyrenees (Margalida et al. 1997, García and Margalida 1998). Movements during foraging should allow the pair to learn of potential nesting sites as well as the seasonal changes in the availability of trophic resources. A seasonal and temporary abundance in food resources may have caused this move, with the benefits (proximity of abundant food and quality territory indicated by the presence of conspecific nests) outweighing the costs of temporarily abandoning the original territory (loss of the territory and the nests due to conspecifics or heterospecifics occupying them). Nevertheless, more information is needed on territory change in this species to explain the proximate factors stimulating such action.

**RESUMEN.**—Documentamos el cambio de sector de nidificación en una pareja de quebrantahuesos (*Gypaetus barbatus*) y el primer caso de ocupación de un nido de la misma especie. En 1996 una pareja (A) colonizó el sector de nidificación NS 3. La pareja vecina más próxima (B) se encontraba a 11 km en NS 1. En 1997 la pareja A se trasladó a NS 2, situándose a tan sólo 3 km de NS 1. Tras nidificar 18 años en NS 1, en el año 2000 la pareja B se desplazó a NS 3 para ocupar el nido reconstruido por la pareja A en 1996, criando con éxito. Finalmente en 2001 la pareja B volvió a NS 1 quedando vacante de nuevo NS 3. Aunque se desconocen las causas de dicho desplazamiento, el cambio de sector de nidificación podría estar relacionado con la posible abundancia temporal de los

recursos tróficos y la optimización en la explotación de éstos, ya que NS 3 se encuentra en el área de campeo habitual de la pareja B.

[Traducción de los autores]

#### ACKNOWLEDGMENTS

J. Bertran, J.A. Donazar, and J. Viñuela provided helpful comments on an earlier version of this manuscript. S. Hardie translated the text into English. This study was supported by Department de Medi Ambient de la Generalitat de Catalunya.

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Received 31 January 2003; accepted 11 August 2003

*J. Raptor Res.* 37(4):337–340

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## IMMATURE NORTHERN GOSHAWK CAPTURES, KILLS, AND FEEDS ON ADULT-SIZED WILD TURKEY

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**KEY WORDS:** *Northern Goshawk*; *Accipiter gentilis*; *Wild Turkey*; *Meleagris gallopavo*; *food-niche breadth*; *predator-prey interaction*; *sexual size dimorphism*.

The largest prey regularly taken by Northern Goshawks

(*Accipiter gentilis*) are snowshoe hares (*Lepus americanus*) (Squires and Reynolds 1997). Although remains of Wild Turkey (*Meleagris gallopavo*) polts have been reported in goshawk pellets (Bosakowski et al. 1992), we are not aware of any record of a Northern Goshawk killing a full-grown turkey. Here, we document an observation of an immature goshawk killing and feeding on a full-grown juvenile Wild Turkey in Connecticut.

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