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Notas Breves

INTRASPECIFIC NEST USURPATION IN THE BEARDED VULTURE *GYPAETUS BARBATUS* IN CATALONIA (NE SPAIN)

USURPACIÓN INTRAESPECÍFICA DE NIDOS POR QUEBRANTAHUESOS *GYPAETUS BARBATUS* EN CATALUÑA (NE DE ESPAÑA)

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SUMMARY.—Although interspecific competition for nests has been described in several raptor species, intraspecific interactions have rarely been reported. We describe three cases of intraspecific nest usurpation in the threatened bearded vulture *Gypaetus barbatus* in the Catalonian Pyrenees, where pairs were found nesting as close as 1.02 km apart. These observations could result from limited availability of suitable nesting habitat for this species, with birds being forced to compete for nest sites.

RESUMEN.—Aunque la competencia interespecífica por los nidos ha sido descrita en varias especies de rapaces, las interacciones intraespecíficas son raramente documentadas. Aquí describimos tres casos de usurpación intraespecífica de los nidos en el quebrantahuesos *Gypaetus barbatus* y documentamos el caso de distancia más próxima entre nidos de parejas reproductoras (1,02 km) en los Pirineos catalanes. Estas usurpaciones podrían ser una consecuencia de la posible limitación de hábitat óptimo para esta especie que forzaría a las parejas a competir por los sectores de nidificación.

Interspecific competition for nests has been described in several cliff-nesting raptor species (Fernández and Donázar, 1991; Newton, 1998; Margalida and García, 1999). As in other avian species, this conflict takes place where suitable nest sites are a limiting

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resource, forcing pairs to compete for the best sites (Gustaffson, 1988; Newton, 1994, 1998). In general, nest usurpation may be due to a population increase of the usurping species, to the existence of similar ecological requirements for both usurped and usurper and to a limited availability of suitable nest sites (e.g. nest holes) for breeding (Collias and Collias, 1984; Newton 1998). Changes in breeding territories in several raptor species have been related to the age of the birds involved and/or territory quality, and also to mate loss (Newton, 1986; Wiklund, 1996; Forero *et al.*, 1999).

In a scenario of usurpation, the benefit for the usurping species and/or individual is obvious as it often avoids the energy costs associated with nest-building and achieves increased breeding success by using *a priori* suitable sites (Collias and Collias, 1984; Newton, 1979). The cost of losing a nest site can involve lower breeding success if the shift to a new site includes the occupation of lower quality habitat, for example one where there is greater human disturbance, more exposure to adverse weather or an increased predation risk (Newton, 1998).

Although interspecific interactions in vultures have been documented in the literature (Fernández and Donázar, 1991; Margalida and García, 1999), intraspecific interactions over nest sites are rarely reported (see however Newton, 1998; Margalida *et al.*, 2003a), probably as a consequence of the difficulty of identifying individuals and confirming such cases.

Here we describe three cases of intraspecific nest usurpation in the bearded vulture *Gypaetus barbatus*, a threatened territorial cliff-nesting species that inhabits mountainous regions of Eurasia and Africa. The Spanish Pyrenean population with 110 territories is the most important in the European Union constituting 61% of the population in 2009. A total of 36 territories were monitored intensively during 18 years (1992-2010) in the Catalonian Pyrenees. Pairs build several alternative nests in their territory from which they can select annually (Brown, 1988; Heredia, 1991; Margalida and Bertran, 2000), a fact that can facilitate inter- and intraspecific nest usurpation (Margalida and García, 1999). The study population has been monitored since 1992. Each territory was checked weekly from November, coinciding with the start of sexual activity (Bertran and Margalida, 1999), until fledging in June-July. In addition, 24 breeding attempts were monitored with video cameras in nine territories selected at random (Margalida *et al.*, 2006).

In the bearded vulture, first-time-paired and territorial individuals were recorded when they were, on average, 6.5 years old, and the mean age of first breeding has been established at 8.1 years (Antor *et al.*, 2007). All birds engaged in usurpation events were adults (> 7 years old) and were identified by specific plumage patterns and breeding behaviour with the help of 20-60x telescopes and video cameras (Margalida *et al.*, 2006, see table 1). Individual differences in pectoral bands, use of perching sites, behaviour at the nests monitored with video cameras, GPS tracking, and laying phenology provided further useful evidence in identifying the individuals and in documenting changes between territories. Laying date in the studied territories varies very little from year to year in this species: the standard deviation in five closely monitored pairs ranged from 1.5 to 4.1 days, the annual change in laying dates ranging from 1.4 to 3.6 days (Margalida *et al.*, 2003b). This suggests that if a large difference in laying date occurs it should be due to a replacement of one of the members of the pair. This fact was already documented in Margalida *et al.*, (2003) to prove the nest switching between two different territories (A and B). In addition, a female (territory C) was ringed and monitored with a GPS satellite (authors' unpubl. data). Video cameras (see Margalida *et al.*, 2006) provided detailed behavioural data on two territories (C and D) that allowed us to com-

pare plumage patterns and individual behaviour (i.e. the male of territory C had a right leg injury that made him stretch continuously). To test whether usurpation could be related to nest site quality, we hypothesised that pairs occupying low quality nest sites should have lower breeding success than usurped pairs, and thus usurping pairs could employ the nest-robbing strategy more often in order to gain access to sites of higher quality. Fecundity in this species has been shown to be density-dependent, declining with population increase (Carrete *et al*., 2006a). We compared the productivity of usurping and usurped pairs by recording the ratio of the number of chicks fledged to the number of breeding attempts for each pair, using data from a minimum of 10 years of monitoring.

The first case of nest usurpation was documented in 2002 when pair A occupied a nest of another pair (B) that possess two nest sites 8 km apart (see Margalida *et al.*, 2003). The nearest distance between neighbouring pairs (measured as the nest of pair A nearest to the nest of pair B) was 1.5 km although the nest usurped by pair A was 11 km from their habitual nest site. After successful breeding, the usurping pair A returned to their habitual area, where they bred during 2004-2010. Pair B continued alternating their breeding

TABLE 1

Characteristics of the bearded vulture pairs involved in the conspecific nest usurpations. *[Características de las parejas de quebrantahuesos implicadas en las usurpaciones conespecíficas de nido.]*

Pair	Known Nests (*n*)	Nearest distance between nests (km)[1]	Distance between nests of usurping *vs* usurped pairs[2]	Productivity (*n*)	Year when pair discovered	Individual identification based on
A	5	3	8	0.27 (15)	1984	Laying date and plumage characteristics, see Margalida *et al*. 2003
B	5			0.67 (15)	1996	
C	5	3.3	1.02	0 (7)	2004	Video camera, telemetry and plumage characteristics
D	9			0.5 (10)	1981	
E	4	5.2	5.2	0.5 (10)	1998	Direct observations and laying date
F	1			1 (1)	2010	

[1] The nearest distance between neighbouring pairs. *[Distancia más próxima entre parejas vecinas]*

[2] The distance between usurped and usurping pairs when nesting simultaneously. *[Distancia entre parejas usurpadas y usurpadoras cuando crían simultaneamente.]*

between nest sites from 2004 until 2010, without further usurpations. The productivity of the usurped pair (B) was higher than that of the usurping pair (A) (Fisher exact test, P = 0.028, table 1).

A second case was observed in 2008 when pair C occupied one of the nests that was previously used for breeding during 2001-2007 by another pair (D). Pair D was discovered in 1981, and formed a trio with the incorporation of a second male in 2007. Pair C was discovered in 2004 and built a minimum of five nests before the usurpation occurred. The nearest distance between nests of pair C and trio D was 3.3 km. In 2008, the usurping pair C laid an egg that failed to hatch in the same nest that had been occupied by pair D during 2001-2007. After their breeding failure, pair C remained in the territory, interacting regularly with the trio D. Trio D built a new nest 1.02 km away on the same cliff but did not breed. In 2010 both pairs (Pair C and trio D) laid eggs again at the same nest sites separated by 1.02 km. Pair C failed during hatching whereas trio D bred successfully. The productivity of the usurped pair (D) was higher than that of the usurping pair (C) (Fisher exact test, P = 0.016, table 1).

A third case was documented in 2010 when a newly discovered pair (F) occupied one of three nest sites occupied by pair E, which was discovered in 1999. Pair E used two alternative nest sites 5.2 km apart that they occupied between 2000 and 2009 . When Pair E was observed rebuilding one of their nests November 2009, the monitoring was focused on this site and no observations were carried out at their alternative site. Egg-laying by Pair E took place in this nest during the first week of January, as in previous years. A visit to the alternative site on May 2010 found a chick in a nest belonging to a new pair (F). Pair F built a new nest on the same cliff 30 m from one of the nests previously occupied by pair E. Both pairs bred successfully at both nest sites, 5.2 km apart.

These observations constitute an unusual example of nest competition in a territorial vulture species and show two occupied nests of different breeding pairs may be as little as 1.02 km apart. The cases documented show that nest usurpation may occurs both in territories where alternative nest sites are separated by several kilometres, facilitating nest robbing and making territorial nest-defence difficult, and between pairs with nests on the same cliff. In addition, our results suggest that breeding success is higher in usurped territories, suggesting that usurping pairs can benefit from occupying higher quality nests or nest sites. Conspecific nest usurpation has not been recorded in other bearded vulture populations (Brown, 1988; Xirouchakis *et al*., 2001; Seguin *et al*., 2010). In the study area, the bearded vulture population increased progressively from 1984 onwards, with a resulting density-dependent depression of fecundity (Carrete *et al.*, 2006a). In addition, the progressive population growth seems to have provoked changes in the mating system, increasing the proportion of polyandrous trios (Carrete *et al.*, 2006b), which suggests territory crowding. In fact, in the Spanish Pyrenees nearest-neighbour distance between territories declined from 11 km in 1993 to 8.9 km in 2002, with a consequence cessation of range expansion (Margalida *et al.*, 2008). As our results suggest (table 1), the cases documented occurred in areas with a high population density. Because nearest distance between nests of the two cases in which territories have been monitored intensively ranged from 3 to 3.3 km, this may indicate that nest usurpation could be considered as a non-competitive phenomenon when both nest availability and the breeding density are high. Given that the study population comprises 36 territories, the three documented cases imply that at least 8.3% of the breeding population has nests or nest sites usurped by conspecifics, and more cases are likely to be reported in the future.

The frequency of nest usurpation is probably underestimated because most birds in the population were not individually identified. In addition, 39.5% of marked individuals over 6 years old were not yet territorial, suggesting that the population includes an important fraction of adult floaters without breeding territories (Antor *et al*., 2007). Our observations of nest usurpation could therefore be considered as new evidence that suitable nesting habitat for this species is limited, so that birds are compelled to compete for nest sites.

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BIBLIOGRAPHY

ANTOR, R. J., MARGALIDA, A., FREY, H., HEREDIA, R., LORENTE, L. and SESÉ, J. A. 2007. First breeding age in captive and wild Bearded Vultures *Gypaetus barbatus*. *Acta Ornithologica*, 42: 114-118.

BERTRAN, J. and MARGALIDA, A. 1999. Copulatory behaviour of the Bearded Vulture. *Condor,* 101: 164-168.

BROWN, C. J. 1988. *A study of the bearded vulture* Gypaetus barbatus *in Southern Africa*. PhD thesis. University of Natal. Pietermaritzburg.

CARRETE, M., DONÁZAR, J. A. and MARGALIDA, A. 2006a. Density-dependent productivity depression in Pyrenean Bearded Vultures: implications for conservation. *Ecological Applications,* 16: 1674-1682.

CARRETE, M., DONÁZAR, J. A. MARGALIDA. A. and BERTRAN, J. 2006b. Linking ecology, behaviour and conservation: does habitat saturation changes mating system in bearded vultures? *Biology Letters,* 2: 624-627.

COLLIAS, N. E. and COLLIAS, E. C. 1984. *Nest Building and Bird Behavior*. Princeton University Press. New Jersey. USA.

FERNÁNDEZ, C. and DONÁZAR, J. A. 1991. Griffon Vultures *Gyps fulvus* occupying eyries of other cliff-nesting raptors. *Bird Study,* 38: 42-44.

FORERO, M. G., DONÁZAR, J. A., BLAS, J. and HIRALDO, F. 1999. Causes and consequences of territory change and breeding dispersal distance in the Black Kite. *Ecology,* 80: 1298-1310.

GUSTAFSSON, L. 1988. Inter- and intraspecific competition for nest holes in a population of the Collared Flycatcher *Ficedula albicollis*. *Ibis,* 130: 11-16.

HEREDIA, R. 1991. Biología de la reproducción. In, R. Heredia and B. Heredia (Eds.): *El quebrantahuesos* Gypaetus barbatus *en los Pirineos*. Colección técnica. Instituto Nacional para la Conservación de la Naturaleza. Madrid.

MARGALIDA, A. and BERTRAN, J. 2000. Nest-building behaviour in the bearded vulture (*Gypaetus barbatus*). *Ardea,* 88: 259-264.

MARGALIDA, A. and BERTRAN, J. 2005. Territorial defence and agonistic behaviour of breeding bearded vultures *Gypaetus barbatus* toward conspecifics and heterospecifics. *Ethology Ecology and Evolution,* 17: 51-63.

MARGALIDA, A., CANUT, J. and GARCÍA, D. 2003a. Territory change and nest site switching in the Bearded Vulture (*Gypaetus barbatus*). *Journal of Raptor Research,* 37: 340-344.

MARGALIDA, A., DONÁZAR, J.A., BUSTAMANTE, J., HERNÁNDEZ, F. and ROMERO-PUJANTE, M. 2008. Application of a predictive model to detect long-term changes in nest-site selection in the Bearded Vulture *Gypaetus barbatus*: conservation in relation to territory shrinkage. *Ibis,* 150: 242-249.

MARGALIDA, A., ECOLAN, E., BOUDET, J., MARTÍNEZ, J. M., HEREDIA, R. and BERTRAN, J. 2006. A solar-powered transmitting video camera for monitoring cliff-nesting raptors. *Journal of Field Ornithology,* 77: 7-12.

MARGALIDA, A., and GARCÍA, D. 1999, Nest use, interspecific relationships and competition for nests in the Bearded Vulture *Gypaetus barbatus* in the Pyrenees: influence on breeding success. *Bird Study,* 46: 224-229.

MARGALIDA, A., GARCÍA, D., BERTRAN, J. and HEREDIA, R. 2003b. Breeding biology and success of the Bearded Vulture *Gypaetus barbatus* in the eastern Pyrenees. *Ibis*, 145: 244-252.

NEWTON, I. 1979. *Population Ecology of Raptors*. T. and A. D. Poyser. Calton. UK.

NEWTON, I. 1986. *The Sparrowhawk*. T. and A. D. Poyser. Calton. UK.

NEWTON, I. 1994. The role of nest sites in limiting the numbers of hole-nesting birds: a review. *Biological Conservation,* 70: 265-276.

NEWTON, I. 1998. *Population limitations in birds*. Academic Press. San Diego. USA.

SEGUIN, J. F., TORRE, J. and BRETAGNOLLE, V. 2010. Distribution, population size and breeding parameters in the insular population of Bearded Vultures *Gypaetus barbatus* of Corsica over 28 years. *Bird Study*, 57: 361-368.

WIKLUND, C. G. 1996. Determinants of dispersal in breeding Merlins (*Falco columbarius*). *Ecology,* 77: 1920-1927.

XIROUCHAKIS, S., SAKOULIS, A. and ANDREOU, G. 2001. The decline of the Bearded Vulture *Gypaetus barbatus* in Greece. *Ardeola*, 48: 183-190.

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