

A POSSIBLE CASE OF A POLYANDROUS QUARTET IN THE BEARDED VULTURE (*GYPAETUS BARBATUS*)

POSIBLE CASO DE CUARTETO POLIANDRICO EN QUEBRANTAHUESOS (*GYPAETUS BARBATUS*)

Antoni MARGALIDA *, Diego GARCÍA ** and Joan BERTRAN *

As in several other species of Palearctic raptors (Bergo, 1988; Tella, 1993; Arroyo, 1996), some small populations of the Bearded Vulture (*Gypaetus barbatus*) include polyandrous females (Fasce *et al.*, 1989; Heredia & Donazar, 1990). The number of polyandrous formations in the Pyrenean population of this species has increased in the last few years (Heredia & Donazar, 1990; Donazar, 1993), and it has been estimated that 20.5% of the 73 territories found in 1996 on both sides of the Pyrenees (R. Heredia and M. Razin, pers. comm.) held cooperative associations (Faaborg & Patterson, 1981; Oring, 1986) involving three individuals (Elosegi, 1988; Fasce *et al.*, 1989; Heredia & Donazar, 1990). In this note we report and describe the incorporation to a breeding area held by one breeding pair of two adult Bearded Vultures within the same year. Hence, we report the formation of a quartet in which signs of breeding have been observed.

The data correspond to a breeding area situated on the southern side of the Central Pyrenees (NE Spain, Pyrenean subpopulation; Canut *et al.*, 1987). The average distance to the breeding areas of neighbouring pairs was 13.6 ± 4.3 km ($n = 5$). The average productivity for this breeding area has been 0.89 young/year (García *et al.*, 1996) from the first report of occupancy by a pair in 1984 to their last successful breeding in 1992.

From January 1992 to July 1994, the monitoring of the pair involved 337 hours of field observations. During the breeding season of 1992, several agonistic interactions with a third adult who frequented the breeding area

were observed. Later monitoring revealed the progressive establishment of this bird between November 1992 and January 1993. Simultaneously, the sporadic presence of a fourth adult was detected; from December 1993 onwards, it was seen patrolling the area regularly with the other three birds. No successful breeding occurred in 1993 or 1994. In fact, we could not ascertain whether it was even attempted, since the inaccessible location of the nest precluded its close observation.

On 21 January, 15 April and 19 May 1994, we detected visits of the group of four birds to three nests situated within a radius of 300 m. After observing these signs of breeding, regular monitoring of the area was carried out between September 1994 and March 1995. During this period the survey involved a total of 161 field hours, spread over 30 days. Observations were made using 20-60x telescopes. The individualization of the members of the quartet was based on plumage differences. Molt peculiarities were noted, this being favoured since two of the individuals presented clear differences in the sizes of the flight feathers throughout the survey. The individual characteristics of the shapes of pectoral bands and crowns (Hiraldo *et al.*, 1979) were also taken into account, whereas variations in the colours of feathers were not considered since they can change over short time intervals (see Berthold, 1967; Frey & Roth-Callies, 1994). The survey ended when it was clear that no breeding had taken place. However, the continued presence of four individuals in the breeding area was confirmed.

* Grup d'Estudi i Protecció del Trencalòs (GEPT). Ap. Correus 43. E-25520 El Pont de Suert. Lleida.

** Generalitat de Catalunya. DARP. Direcció General del Medi Natural. Servei de Protecció i Gestió de la Fauna. Gran Via, 612-614. E-08007 Barcelona.

A total of 32 visits to a nest previously used by the original pair were recorded. Out of these, 25 (78.1%) consisted in the bringing of nest material by individuals, which could be identified in 18 cases. From these 18 observations, it appeared that the contribution of each bird to the rebuilding of the nest was of similar importance (4.5 ± 1.1 visits/individual; average \pm SD; $n = 18$). Furthermore, we recorded 17 copulations between November and January, all individuals being involved in such copulations (Table 1). Individuals A, B and C were involved in 7 copulations (41.2%) among them, whereas individual D never mounted individuals A, B or C but was mounted by them in the remaining 10 copulations (58.8%).

The fact that some individuals exhibited bisexual behaviour makes sexing such individuals difficult by means of the classical method of copulation record. It is worth noting that reverse and homosexual mountings are not infrequent in birds (see Jamieson & Craig, 1985; Nuechterlein & Storer, 1989; Wagner, 1996). However, it seems reasonable to conclude that the individual D, who did not mount any other and was mounted in most of the copulations, may be a female. On the other hand, the results concerning mating positions closely match those previously observed in a Pyrenean trio, in which homosexual mounting between the two hypothetical males accounted for 26% of the 123 recorded copulations (authors, in prep.). In short, the whole data suggest

that polyandry was the most plausible mating system for the quartet.

On the other hand, our results also point out that the group sizes observed up to now in the Bearded Vulture's polyandrous formations (trios) are not constant or definitive. As described for the Galapagos Hawk (*Buteo galapagoensis*), several males could share the same breeding area and female (Faaborg, 1986). Since the polyandry in the Pyrenean population of Bearded Vultures is of relatively recent occurrence (Heredia & Donazar, 1990), there is currently not enough data to allow the evaluation of its causes and consequences for this population. Despite this, the most probable explanation for the incorporation of adults to areas already occupied by breeding pairs may be the saturation of the optimal territories, as suggested by Heredia & Donazar (1990) and García *et al.* (1996).

ACKNOWLEDGMENTS.—We thank J. Feixa, P. Pelayo and J. Boudet for field assistance, and R. Heredia for unpublished data. We especially thank S. Mañosa, J. A. Donazar and J. L. Tella for their comments on an earlier version of this manuscript, and S. Hardie, J. Orta and M. Díaz for their help with the English translation. We also appreciate comments made by R. J. Antor, X. Parellada and X. Bellés. Support for this study was provided by the Departament d'Agricultura, Ramaderia i Pesca de la Generalitat de Catalunya and by a LIFE Program of the European Union (1973/92/0211) on Conservación de Vertebrados Amenazados de los Pirineos.

TABLE 1

Mating positions observed in copulations involving the four studied individuals of Bearded Vulture (*Gypaetus barbatus*).

[Posiciones en las cópulas observadas entre los cuatro individuos de Quebrantahuesos (*Gypaetus barbatus*) estudiados.]

		Times the bird mounts [Veces que el ave monta]				Individual [Individuo]			
		Times the bird is mounted [Veces que el ave es montada]				A	B	C	D
Individual [Individuo]	A	—	0	1	0	1			
	B	1	—	3	0	4			
	C	2	0	—	0	2			
	D	5	4	1	—	10			
Total		8	4	5	0	17			

BIBLIOGRAPHY

- ARROYO, B. 1996. A possible case of polyandry in Montagu's Harrier. *Journal of Raptor Research*, 30: 100-102.
- BERGO, G. 1988. Trios in the Golden Eagle *Aquila chrysaetos* (L.). *Fauna Norvegica, Serie C Cinclus*, 11: 40-44.
- BERTHOLD, P. 1967. Über haftfarben bei vögeln: rostfärbung durch eisenoxid beim Bartgeier (*Gypaetus barbatus*) und bei anderen arten. *Zoologische Jahrbücher anlage Systematisch für Ökologie und Geografie*, 93: 507-595.
- CANUT, J., GARCÍA, D., HEREDIA, R. & MARCO, J. 1987. Status, características ecológicas, recursos alimenticios y evolución del Quebrantahuesos *Gypaetus barbatus* en la vertiente sur de los Pirineos. *Acta Biologica Montana*, 7: 83-99.
- DONÁZAR, J. A. 1993. *Los buitres ibéricos: biología y conservación*. J. M. Reyero Editor. Madrid.
- ELOSEGI, I. 1988. Le gypaète barbu. In, C. Dendalctche (Ed.): *Grands Rapaces et Corvidés des Montagnes d'Europe*, pp. 51-68. CPBAM. Pau.
- FAABORG, J. & PATTERSON, C. B. 1981. The characteristics and occurrence of cooperative polyandry. *Ibis*, 123: 477-484.
- FAABORG, J. 1986. Reproductive success and survivorship of the Galapagos hawk *Buteo galapagensis*: potential costs and benefits of cooperative polyandry. *Ibis*, 128: 337-347.
- FASCE, P., FASCE, L. & TORRE, J. 1989. Census and observations on the biology of the Bearded Vulture *Gypaetus barbatus* on the island of Corsica. In, B.-U. Meyburg & R. D. Chancellor (Eds.): *Raptors in the modern world*, pp. 335-339. WWGBP. Berlin.
- FREY, H. & ROTH-CALLIES, N. 1994. Zur genese der haftfarbe (rostfärbung durch eisenoxid) beim Bartgeier. *Gypaetus barbatus*. *Egretta*, 37: 1-22.
- GARCÍA, D., MARGALIDA, A., PARELLADA, X. & CANUT, J. 1996. Evolución y parámetros reproductores del Quebrantahuesos (*Gypaetus barbatus*) en Catalunya (N. E. España). *Alauda*, 64: 229-238.
- HEREDIA, R. & DONÁZAR, J. A. 1990. High frequency of polyandrous trios in an endangered population of Lammergeiers *Gypaetus barbatus* in northern Spain. *Biological Conservation*, 53: 163-171.
- HIRALDO, F., DELIBES, M. & CALDERÓN, J. 1979. *El Quebrantahuesos Gypaetus barbatus* (L.). Monografías 22. ICONA, Madrid.
- JAMIESON, I. G. & CRAIG, J. L. 1987. Male-male and female-female courtship and copulation behaviour in a communally breeding bird. *Animal Behaviour*, 35: 1251-1253.
- NUECHTERLEIN, G. L. & STORER, R. W. 1989. Reverse mounting in grebes. *Condor*, 91: 341-346.
- ORING, L.W. 1986. Avian polyandry. In, R. F. Johnston (Ed.): *Current Ornithology*, pp. 309-351. Plenum Press. New York.
- TELLA, J. L. 1993. Polyandrous trios in a population of Egyptian Vultures (*Neophron percnopterus*). *Journal of Raptor Research*, 27: 119-120.
- WAGNER, R. H. 1996. Male-male mountings by a sexually monomorphic bird: mistaken identity or fighting tactic?. *Journal of Avian Biology*, 27: 209-214.

[Recibido: 17.9.96]

[Aceptado: 5.2.97]