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Maladaptive adoptions in the Hooded Crow *Corvus corone cornix*

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Abstract - Three cases of post fledging adoption were observed in 13 nests located in a northern Italian study area, where Hooded Crows nest at a high density (6.7 nests per km²). Adoptions occurred immediately after fledging: any later attempt of young to obtain food from adults other than own parents was unsuccessful. Feeding frequency was not different between adopted young and true offspring. Feeding performance before fledging did not differ between the pairs from which the adopted young originated and those that became foster parents. It is presumed that Hooded crows lack the ability to recognize their offspring and adoptions are a maladaptive phenomenon due to the high nesting density.

Introduction

Adoption, or parental care for unrelated individuals, might be costly in term of fitness. In birds this phenomenon has sometimes been classified as a maladaptive feature of parental behaviour (Graves and Whiten 1980, Holley 1980 and 1984, Bustamante and Hiraldo 1989, Ferrer 1993, Saino et al. 1994). Kin selection, reciprocal altruism and inter-generational conflict are alternative explanations for this relatively rare altruistic behaviour (Pierotti 1980, Waltz 1981, Pierotti and Murphy 1987).

This paper describes three cases of adoption of young which were observed in a population of Hooded Crows *Corvus corone cornix* nesting at high density.

Methods

The study was conducted during 1989 in Northern Italy, near the city of Pavia (45°N, 9°E) in an intensively cultivated 10 km² plot, mainly dominated by rice and maize. Natural vegetation was almost absent but suitable nesting sites were provided by poplar plantations and tree rows. The density of nests was 6.7 nests/km².

A total of 49 chicks from 22 nests in a core area were individually marked with wing tags and metal rings. Observations on parental behaviour were carried out on 13 nests with chicks aged from 16 days to 36 days, when fledging on average occurred; each nest was observed 4 times, with intervals between observations of 3-5 days; observations were evenly distributed during the day and were carried out only during good weather. Each observation lasted 3 hours during which activity rhythm and adult and young behaviour were recorded. After fledging and until the disappearance of young, the study area was checked almost daily in order to locate fledged young; additional three hours observations were carried out on groups with adopted young. Since adult crows were unmarked, the affirmation that adoption had occurred derived from observation of the same adult simultaneously feeding two fledged young that had hatched in different nests.

Results

Three cases of adoptions were observed (Figure 1); all were first recorded within a few days of fledging. Two adopted young (n.11 and 15) hatched in two contiguous nests and were adopted by a pair (hereafter named pair A) which had nested nearby, and which were caring for two chicks of their own. These two adopted young were observed only within the foster parents home range and were never observed within the home range of their natural parent nest pair, where two adults were caring for the remaining single young. The third adopted young was unmarked and the foster pair (pair B) had one young (n. 47).

During the post-fledging period, two additional intrusions into the home range by strange young were observed that did not result in other permanent adoptions. In one instance an unmarked young approached the adults of pair B and begged many times for food. 28 days after the true offspring (n. 47) had abandoned the nest. The adults ignored this young but the young n. 47 attacked it fiercely. Another case involved pair

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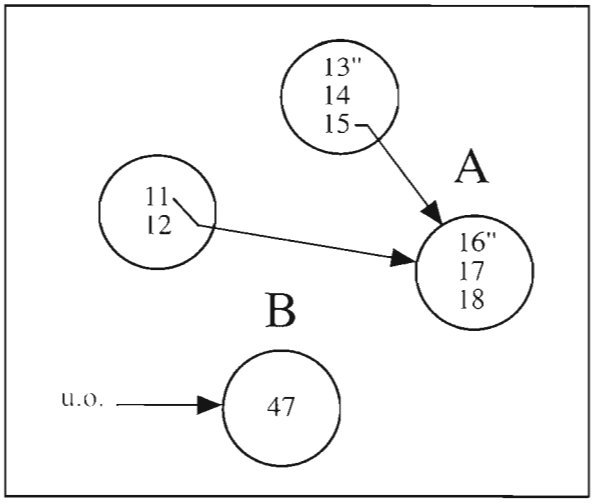

Figure 1 - Schematic view of movements of adopted young. Numbers within circles are tag numbers of young from the same nests; arrows indicate the change of family unit of a young; asterisk shows 2 young which disappeared after fledging; u.o. means unmarked young whose original nest was unknown. A and B are pairs that adopted young.

A; a strange young attempted to be fed by the adults but was only successful once.

Adopted young were fully accepted by foster parents; neither they nor the foster siblings ever showed aggressive behaviour towards the adopted young. Feeding frequency did not differ between adopted and true offspring (data from 10 periods of observations lasting 3 hours, number of feedings per hour; true sons: mean = 1.03, SD = 1.03; adopted young: mean = 1.10, SD = 0.93). Statistical testing cannot be carried out, because data are pseudo-replicas from a limited number of pairs and, therefore, result in an inflated sample size.

The difference in feeding performance, expressed as the rhythm of foraging trips to the nest (see Norris 1990 and Moller 1988) is impossible to test because of the sample size; however, if the 3 hours observation sessions before adoption are used as independent observations, with the same cautions as above, there is no difference between pairs which adopted and genetic parents (genetic parents: mean = 1.43, SD = 0.50, N = 7; pairs which adopted: mean = 1.41, SD = 0.82, N = 6). Mean values of foraging trip frequency of all pairs in the study area was 1.69 (SD = 1.5, N = 56).

All adopted young survived until the abandonment of the foster home range. In this study area there is a strong tendency to disperse, on average at 54 days after fledging (Bogliani *et al.* 1994-a). The two true offspring of pair A disappeared 17 days after fledging and almost certainly died.

Discussion

It is highly improbable that Hooded Crow pairs could gain any advantage by adopting strange young. Poole (1982) and Bustamante and Hiraldo (1989) suggested that kin selection might contribute to adoptions observed in the Osprey *Pandion haliaetus*, the Red Kite *Milvus milvus* and the Black Kite *Milvus migrans* nesting at high density. Some features of the studied Hooded Crow population make this hypothesis unlikely: the lack of philopatry, the strong tendency for early dispersal of young after emancipation (Bogliani *et al.* 1994a), and the lack of breeding opportunities within the study area. Only about 25-43% of the population is involved in nesting activities each year (G. Bogliani and V. Baglione, pers. obs.). These facts make it improbable that neighbouring pairs are related; however one can admit that extra-pair copulations may produce some genetic relationship between young and adults of neighbouring nests. Observations showed that the same home range is used by individuals from different families. Kin selection could play a role in adoption only if kin recognition ability exists (Barnard 1989), but up to now there is no evidence for kin recognition in the Hooded Crow (Yom-Tov 1975). Furthermore reciprocal altruism cannot explain adoptions in this population because, after fledging, young from different nests are not strictly linked to their own nest surroundings; thus foster parents are unable to know the identity of genetic parents and cannot control reciprocation (Waltz 1981).

Pierotti and Murphy (1987) suggested that adoptions could be due to intergenerational conflict. Young with low probability of survival if cared for by their genetic parents, as a result of their low rank within the brood, or the low quality of their genetic parents, are likely candidates to show this strategy. In the study area young changing brood did not suffer high costs, because they were not attacked by strange adults. However, our limited set of data does not suggest any advantage of being adopted. For instance the young n. 15 was the oldest in its brood; n. 11 was the youngest but had only one sibling. Their adoption resulted in a brood of 4 evenly aged young, which is unusual for the study area. In this case one might expect a loss of food intake, especially during the last part of the rearing period, when adults stopped to feed directly but left food items on the ground in front of the young. The closeness of the nests may allow chicks to compare the performance of neighbouring pairs with that of their own parents, and to decide to change family if neigh-

bours were performing better. But this may not be the case as judged from our limited data.

Intensive studies carried out in Europe on this species have not shown any evidence for adoption. However, it is worth noting that nesting density was relatively low: in Scotland 2.2 nests per km^2 (Yom-Tov 1974), in Sweden 1.9-2.5 nests per km^2 (Loman 1985), and in southern France 0.5 nest per km^2 (Salathè and Razumowsky 1986). The density in our study area is among the highest in Europe. Densities can be even higher in Northern Italy, with 14 nests per km^2 in open crops, and 46 and 32 nests per km^2 in poplar plantations (Quadrelli 1985, Bogliani *et al.* 1994b). In Northern Italy there are no historical accounts of density, but most people agree that the population of Hooded Crow has grown dramatically over the last three decades. Thus. Hooded Crows of this area are faced to an unusual social situation. A peculiar feature are spatio-temporal territories, which result in a high overlap of foraging areas (Bogliani *et al.* 1994b). In other areas, the species has sometimes been used as a paradigm of a territorial species whose density is limited by territorial behaviour (Charles 1972, Yom-Tov 1974). At low density, kin recognition is probably location-dependent (Barnard 1989). If nests are spaced out and adults do not tolerate conspecifics, it is highly unlikely that a strange young will be present around the nest. A finely-tuned kin recognition is not necessary and there is no selective pressure for it. Our data show that the parental recognition mechanism of the Hooded Crow does not allow adults to recognize strange young a few days post fledging. Indeed this species proved unable to recognize its own chicks during the nestling period (Yom-Tov 1975). Thereafter, families remain stable and new intrusions by strange young are unsuccessful; this may be due to enhanced parental recognition ability as young grow. This mechanism of parental recognition is suitable at low density, which is, presumably, the original condition of the species, but unsuitable at high density. Adoption could, therefore, be considered maladaptive.

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Riassunto - In un'area dell'Italia settentrionale con una densità di 6.7 nidi di Cornacchia grigia per km^2 sono stati osservati tre casi di adozione di giovani in un campione di 13 nidi. Le adozioni sono avvenute appena dopo l'involo; ogni tentativo successivo di ottenere l'imbeccata di adulti estranei da parte di altri giovani è stata infruttuosa. Le coppie adottive nutrivano i giovani estranei con la stessa frequenza dei figli. Le coppie adottive e quelle che avevano generato i giovani adottati non differivano nell'intensità dei voli di foraggiamento al nido prima dell'involo. Si presume che la Cornacchia grigia non riconosca la propria prole appena dopo l'involo, e che le adozioni siano un fenomeno maladattativo dovuto all'alta densità dei nidi.

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