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BEHAVIOR OF AMERICAN CROWS IN THE EARLY PART OF THE BREEDING CYCLE

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Although Townsend (1923) makes a brief mention of allopreening and Townsend (1927) and Good (1952) of the bowing of American Crows (*Corvus brachyrhynchos*), much of crow behavior in the early part of the breeding cycle remains undescribed. It has been recently established that this species is a cooperative breeder (Kilham 1984a). Here I report on the dominance exerted by the breeding male of the cooperative group and describe details of allopreening, on the differences in behavior of breeding males and females, and on other aspects of behavior in the early breeding season. Copulatory behavior was described in a separate report (Kilham 1984b). The usual breeding season of crows in Florida extends from January into May.

METHODS AND STUDY SITE

I observed crows from January to May 1981-1984 at the Hendrie ranch, 24 km south of Lake Placid, Florida. The crows were tame because of years of protection and feeding and allowed me, at times, to observe them within 5-7 m. Although none was banded, I was able to recognize some individuals by their broken or missing rectrices or remiges or by peculiarities of vocalizations or behavior. Yearlings were identified using the method of Emlen (1936), particularly by the squarish outline of the tail, the worn appearance of rectrices and the general brownish cast of the plumage. I fed corn daily to keep track of the number of crows in two groups that I labeled A and B. Each defended a communal territory. Although this report is based on 4 years of observations, descriptions are centered on group A in 1984 because I was able to recognize most of its members.

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OBSERVATIONS

Dominance of breeding male.—The dominance exerted by breeding males was a feature of early breeding behavior. When I scattered corn in territory A in early January, eight crows came to feed. I identified the breeding male, MA, by both physical and behavioral characteristics. He did the most cawing and wing-tail flicking and was the last to approach the corn. When among the others he stood out by being heavier and broader, a size difference accentuated by his standing with head up and holding his "shoulders" out. While picking up corn he tried continually to edge away another crow (X), identifiable by a broken feather projecting vertically from the upper middle portion of its folded right wing. Since X was aggressive and drove away another crow, he also seemed to me to be a male. MA became increasingly intolerant of X during the study period. He initially walked behind in driving him away, but changed to attacking and pursuing by early February. On 14 February he supplanted X from 9 fence posts in succession. By the end of the month X ceased to appear and MA was driving another adult crow away.

By this time, I found that the size of group A varied according to where I scattered corn. If within 90 m of the nest that was being built, four crows of what I called the inner group, the breeding pair plus two yearlings, came down, but if at 200 m, seven crows gathered, the extras being adults. All groups followed much the same pattern in the 4 years of my watching, with an original group of 8-10 crows being reduced to an inner one of 4-6. This was until late incubation when the aggressiveness of breeding males declined.

Allopreening.—Female A was identifiable being about 5 cm shorter than her mate, a difference best seen when the two perched together, as well as in being the only one of her group to give G-dong calls, an individual peculiarity.

On 10 February I found MA and FA perched on a limb 5 m above my head. This was in the interim period of several weeks between completion of nest building and egg laying. When MA held his head low, she preened the feathers on the top. In the midst of this she put her bill under his to tip his head so that she could reach the feathers of his throat. MA closed his nictitans when she nibbled the feathers by his eye. FA paused at times to preen herself.

FA was on a canal bank giving G-dong vocalizations on another occasion when MA alighted near her. He picked up a rootlet and,

moving close, bent his head, still holding the rootlet as she allopreened him. After a few minutes he dropped the rootlet, picked up some fibrous material, then returned for more allopreening. She mounted a cow pie three times and preened the top of his head. Allopreening largely ceased during incubation. FA tried to preen a yearling when it came to feed her on incubation day 3 and when MA came, she preened him for 3 sec. The nest failed late in incubation and pair A did not reneest. The pair reverted to allopreening in late March. Although nearly all allopreenings that I have watched were unilateral ($n = 100+$), they were occasionally reciprocal. Thus when MA came to feed his mate early in incubation, she allopreened him for a minute, standing on the nest rim to do so. She then settled on the nest and he allopreened her.

Holding objects in bill.—In addition to debris occasionally held in the bill at times of allopreening, breeding males sometimes picked up objects as part of copulatory behavior (Kilham 1984b). When a pair assumed precopulatory poses on the ground below their nest on 6 March, the male picked up a raccoon (*Procyon lotor*) vertebral column with pelvis and a femur attached and leaned it against his mate. Four days later when the female flew from her nest on what was her second day of incubation, the male performed a vigorous precopulatory display below the nest tree, then picked up the raccoon bones again. Some precopulatory displays were play-like. When pair A were on a canal bank near their nest 4 days before incubation began, MA picked up a wad of debris and walked to his mate. She immediately crouched in a precopulatory display. But MA, instead of mounting, lay on his side holding the debris toward her. Then he assumed a precopulatory pose and she attempted to mount him in a reverse mounting.

This "play" of the adults was, seemingly, mimicked to some extent by the two yearlings later on. When one picked up a lump of clay, it ran to its companion and lay down on its side. It stood up as the second yearling came behind and poked it on the back. At this the first one threw its head back as females do in copulating, while it still held the lump of clay.

Third crows.—A feature of all pairs of crows that I studied was the persistence with which they were attended by third crows. A third crow might be a yearling or, if there were no yearlings in the group, a nonbreeding adult. The third crow with pair A in 1984 was a yearling. On 12 February, when MA flew away after being allopreened, the yearling took its place and female A allopreened it

for 3 min. A few days later the yearling crowded close along the wire when FA was on a fence post. MA, returning, hovered, then settled between the two, forcing the yearling away. Although males drove older third crows away by rougher methods, such as pecking at their feet, MA never more than nudged the yearling. The yearling responded at times by holding its wings out in appeasement begging or, rarely, by holding a foot out sideways to keep the larger crow away. All third crows in 1982 were yearlings. Of episodes particularly noted ($n = 29$), a third crow tried to crowd in on the two of a pair when they were allopreening in five and when they were engaged in copulatory behavior in three. On 10 February a yearling flew to the nest immediately after a pair had copulated and tried to push its head under the two of them. On another occasion, when a pair was flying, the male tried to drive a third crow away without success. When the trio landed on a branch with little room, the third crow hung upside down below the pair. Begging cries, probably an appeasement behavior, were a frequent vocalization in all early breeding seasons.

Other behaviors in courtship.—Other forms of courtship included bowing, billing and exchange of low notes. The members of breeding pairs frequently rested within 5-6 cm of each other. While MA and FA might allopreen at these times, they several times ($n = 3$) bowed together, both facing out in the same direction. On 8 January MA, with head feathers raised and wings a little out, made a moaning sound, then a Cu-koo in bowing. FA also bowed, but less deeply. These joint performances were repeated six times. I saw similar bowing on 9 and 10 January. In 1982 what I believe was the same pair together on the back of a cow. One then tried to mount the other.

Bowing, however, is not only performed in courtship. When MA alighted at corn in February in the presence of rival male X, he assumed an upright posture with tail spread and wings a little out, then bowed deeply, giving a Cu-koo.

Billing was infrequent in courtship. When MA and FA came close to each other on 13 and 17 February, they fenced gently with their bills tips, with one grasping the terminal half of the bill of the other. Low notes were ones I heard particularly when the two of a pair settled together on nests prior to egg-laying.

DISCUSSION

Because crows within a group do not usually supplant each other at food (Kilham 1984c), I suggest that the dominance displayed by breeding males may have led to social or sexual adjustments within groups that facilitated cooperative breeding, a concept discussed by Woolfenden and Fitzpatrick (1979) for Florida Scrub Jays (*Aphelocoma c. coerulescens*). An additional effect of male dominance, among the crows, was to reduce groups to a size and composition compatible with cooperative nesting in its early stages.

One breeding male, MA, was notably larger than any other crow in his group. Predominance in size would seem to be an asset to assertion of dominance. I have not been able to find much information on weights of American Crows. In Hartman's (1955) series of ten individuals of the Florida race *C. b. pascuus*, five males weighed more than the females. Holyoak (1970) found that male Carrion Crows (*C. corone*) could be as much as 12 percent heavier than females and have bills 8 percent larger.

Allopreening with females taking the lead has been described by Lorenz (1970) for the Jackdaw (*C. monedula*) and Common Raven (*C. corax*), by Schaller (1964) for the White-necked Raven (*C. albicollis*) Richards (1976) for the Rook (*C. frugilegus*) and Wittenberg (1968) for the Carrion Crow. Harrison (1965), in his review of allopreening, considers that birds doing the allopreening are dominant. In birds that I have studied, however, including Casqued Hornbills (*Bycanistes subcylindricus*) (Kilham 1956) and Crested Caracaras (*Polyborus plancus*) (Kilham 1979) as well as American Crows, I have found allopreening to be pair-bonding with no indication of one sex or the other being dominant. Both sexes appear to seek allopreening.

Trios are a curious feature of crow behavior. They are seemingly widespread for I have observed them in late fall and winter months in New Hampshire (unpublished data) as well as in Florida. Charles (1972), who noted the persistence with which "third birds" attended pairs of Carrion Crows in spite of efforts of breeding males to drive them away, thought that they were males. Dow (1970) describes a "ubiquitous trio" of a helper and a breeding pair of Noisy Miners (*Myzantha melanocephala*).

Bowing is common to a number of *Corvus* species (Goodwin 1976; Coombs 1978). Bowing is a display that can be used in both courtship and agnostic behavior. It is complicated, however, in being performed at times in solitude in no discernible context. Good (1952), who studied crows that were wary and could only be viewed at a distance, believed that they had little courtship behavior, a characteristic, possibly, of birds that are mated for life. But I have not found this to be true of birds that I have studied. Whether birds pair for life or come together for only a season, they still need courtship to synchronize sexual development as well as to insure the cooperation needed for raising young. With American Crows it is possible to miss much that goes on in the way of courtship unless one studies them at close range and in the absence of fear.

SUMMARY

The courtship of a pair of cooperatively breeding American Crows includes allopreening, bowing, billing and exchange of low call notes. The breeding male appeared dominant over other crows in his territorial group. A phenomenon observed with all pairs was the presence of third crows that tried to attach themselves to mated pairs and were, at times, allopreened by the female. The dominance of breeding males, which took up much of their time in the early breeding season, appeared to be of value in establishing their sexual dominance.

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