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SOCIAL PREFERENCE OF FOUR CROSS-FOSTER REARED SANDHILL CRANES

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Abstract: Four greater sandhill cranes (*Grus canadensis tabida*) were hatched and reared individually by 4 non-sandhill crane pairs: 2 by white-naped crane (*G. vipio*) pairs, 1 by a Siberian crane (*G. leucogeranus*) pair, and 1 by a red-crowned crane (*G. japonensis*) pair. After 1 year the sandhill cranes (2 male and 2 female) were placed in enclosed pens adjacent to an opposite-sexed, same-age bird of the foster species on 1 side and an opposite-sexed, same-age conspecific on the other side. Data were collected throughout 1 year and included proximity between test and choice birds and behaviors displayed. Each test bird socialized with the foster species more than with a conspecific. This preference was much more apparent for females than for males.

Key Words: conspecific, crane, cross-foster, *Grus*, social preference

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The technique of cross-fostering has had a long and varied history from the pre-automatic incubator practice of allowing hens to raise all manner of fowl to the modern egg switches between endangered and non-endangered birds (Drewien and Bizeau 1978). In captivity, managers usually limit potential mates for a chick raised in this manner to conspecifics. In the wild, however, potential mate choices are not limited, and any aberrant behavior can potentially mean psychological castration. It is vitally important, therefore, that any rearing technique reliably produce young attracted only to conspecifics.

The influences of the foster parents (imprinting) on the chick's adult responses and preferences are a major concern. Schutz (1965, 1970) examined the effects of cross-fostering on various species of ducks and found that foster-reared male ducks frequently mated with the foster species. Extensive research of altricial zebra finches (*Poephila guttata*) cross-fostered to Bengalese finches (*Lonchura striata domestica*) (Immelmann 1972; Sonneman and Sjolander 1977; ten Cate 1982, 1984; ten Cate et. al. 1984) have shown that sexual preference for the foster species was more apparent in male than in female zebra finches.

The model for precocial sexual imprinting is the coturnix quail (*Coturnix coturnix japonica*) for which Gallagher has investigated social experience (1976), persistence and stimulus quality (1978*a*), and variability in mate preference (1978*b*). He found that the timing and duration of the exposure to a foster subject was crucial to imprinting. Harris (1969) conducted an extensive cross-fostering study between herring gulls (*Larus argentatus*) and lesser blaek-backed gulls (*L. fuscus*). He found abnormal migration patterns and a large amount of hybridization. The foster parents had an extremely influential effeet on the behavior and mating of the adult.

Artificial cross-fostering in cranes in the wild at Grays Lake National Wildlife Refuge, Idaho (U.S. Fish and Wildlife Service 1986) began in 1975. Sixteen years later in 1991, 12 whooping cranes (*G. americana*) are the result of 288 eggs transplanted into greater sandhill crane nests. The 4 females in this flock, all presumed sexually mature, disperse widely. The failure of these birds to pair and reproduce has been attributed to the "scarcity of females on the wintering grounds and summering grounds where pair associations have an opportunity to develop" according to the Whooping Crane Recovery Plan (U.S. Fish and Wildlife Service 1986:41). Pairing has also not occurred between whooping cranes and greater sandhill cranes.

Cross-fostering has been used extensively in captivity with many species to let experienced parents care for abandoned young or to give inexperienced parents a chance to learn to raise less valuable young. Cranes are no exception; Ueno Zoo in Japan, St. Catherine's Island in Georgia, and the International Crane Foundation (ICF) in Wisconsin, among others, have included cross-foster methods in their chick rearing programs (Voss 1974). At Ueno Zoo, a red-crowned crane was raised by a white-naped crane pair. Upon maturing, it was not interested in other red-crowned cranes and, instead, courted white-naped cranes. The male was force paired with a female red-crowned crane by eliminating all contact with white-naped cranes. The male accepted the female and remained paired from 1978 to 1983. In 1984 the female was hospitalized and the male again showed interest in white-naped cranes. When the female red-crowned crane was returned, the male rejected and killed her. Thereafter, the male only courted white-naped cranes (Nakayama 1970).

Further literature review suggests that sexual imprinting due to cross-foster rearing is species specific. Powell (1991) found that killdeer (*Charadrius vociferus*) cross-fostered by spotted sandpipers (*Actitis macularia*) showed no preference, as adults, for the foster species.

RED-CROWNED Female (RC-F)	SIBERIAN Male (S-M)
SANDHILL Male (SH-M_1)	SANDHILL Female (SH-F_2)
SANDHILL Female (SH-F_1)	SANDHILL Male (SH-M_2)
WHITE-NAPED Male (WN-M)	WHITE-NAPED Female (WN-F)

Fig. 1. Arrangement of cranes within pens prior to 1 November 1987. Double line indicates a visual barrier.

WHITE-NAPED Male (WN-M)	SIBERIAN Male (S-M)
SANDHILL Female (SH-F_1)	SANDHILL Female (SH-F_2)
SANDHILL Male (SH-M_1)	SANDHILL Male (SH-M_2)
RED-CROWNED Female (RC-F)	WHITE-NAPED Female (WN-F)

Fig. 2. Arrangement of cranes within pens after 1 November 1987. Double line indicates a visual barrier.

In 1987 the International Crane Foundation (ICF) began an investigation into social preferences among several crane species. The previous year, several pairs of endangered cranes had raised young greater sandhill cranes as a means of gaining parenting skills. Mate choice in greater sandhill cranes typically begins with associations in non-breeder flocks late in the second year (Walkinshaw 1973). Florida sandhill cranes averaged 5 associations before a permanent pair bond was established (Nesbitt and Wenner 1987). Based on those studies, Lewis (1986) speculated that greater sandhill cranes have 3–6 associations before a final mate is chosen. Our investigation was designed to start before these initial associations and to document preferences of the cross-fostered birds.

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METHODS

Eight 1-year-old cranes were observed. All were raised at ICF, but under varying conditions. Four sandhill cranes were cross-fostered; their social and mate preferences were examined. One male (SH-M_1) was fostered by red-crowned cranes, a female (SH-F_2) was fostered by Siberian cranes, and a female (SH-F_1) and a male (SH-M_2) were fostered by separate pairs of white-naped cranes. The 4 birds representing foster parents were a female red-crowned crane (RC-F) raised by puppets and humans in costume, i.e., "isolation-reared" (Horwich 1989), a male Siberian crane (S-M), a male white-naped crane (WN-M), and a female white-naped crane (WN-F) that were all hand-reared by ICF staff with other crane chicks. All 8 birds hatched between 20 May and 17 June 1986.

Two adjacent pen units were used for our study, with 4 birds in each (Figs. 1 and 2). The units were visually isolated from each other by tennis netting. Each unit was divided into 4 pens. The interior of each pen was divided by 4 stakes into 3 rows and 9 cells (Fig. 3). The birds were then arranged so that each sandhill crane had a choice of associating with an opposite-sexed conspecific and an opposite-sexed foster species individual. The left unit held RC-F, SH-M_1, SH-F_1, and WN-M (Test Group 1). The right unit held S-M, SH-F_2, SH-M_2, and WN-F (Test Group 2).

Elevated blinds on 2 nearby buildings allowed easy viewing of all study cranes. Data were recorded for 30-minute periods per unit per day of observation. For each 30-minute period, scan samples of behaviors were recorded as well as the location of each bird at 30-second intervals. At the beginning of each interval, a code for each bird's behavior and location was recorded.

There were 98 observation days from 9 September 1987 to 5 August 1988, excluding February and March 1988). Five days of observation per month were randomly chosen from 10 months for the analysis. Only 3 days in December 1987 and 1 day in August 1988 were available because there were fewer observation days in these months. Therefore, the random sample was 44 of the 98 available days.

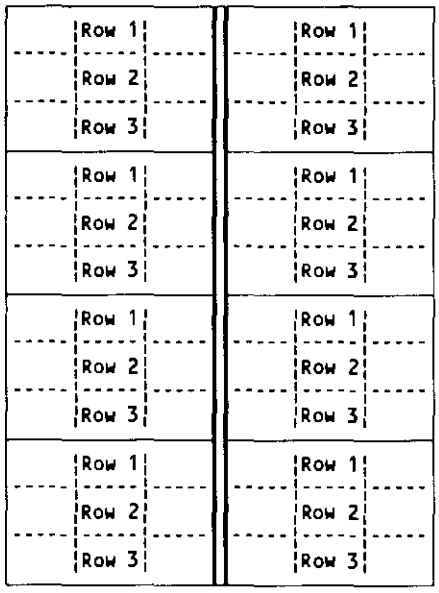

Fig 3. Assignment of rows within the pens. Double line indicates a visual barrier.

Because human (avicultural) activities at the lower edge of the pens might cause birds to spend more time at the far end of their pens, and thus bias the experiment, 1 row of 4 birds (Test Group 1; RC-F, SH-M_1, SH-F_1, and WN-M) was reversed on 1 November 1988, midway through the study (Figs. 1 and 2). Two separate analyses were performed for these cranes, 1 for pre-switch and 1 for post-switch data.

Only behaviors that indicated a social preference (Mirande and Archibald 1990) were analyzed. These included (a) foraging, (b) walking, (c) following, (d) approaching, and (e) maintenance behaviors (resting and preening) performed within 1 cell of an adjacent bird, and (f) run-flapping with or (g) guard calls performed closest to an adjacent bird.

RESULTS

Proximity

Before the rearrangement of Test Group 1 (Fig. 4), SH-M_1 was in the row closest to RC-F 72% of the time and in the row closest to SH-F_1 4% of the time. SH-F_1 was in the row closest to SH-M_1 2% of the time, but in the row closest to WN-M 49% of the time. After the switch (Fig. 5), SH-M_1 spent 18% of his time in the row next to RC-F and 62% of his time in the row closest to SH-F_1. SH-F_1 was in the row closest to SH-M_1 7% of the time, while she spent 91% of her time in the row closest to WN-M.

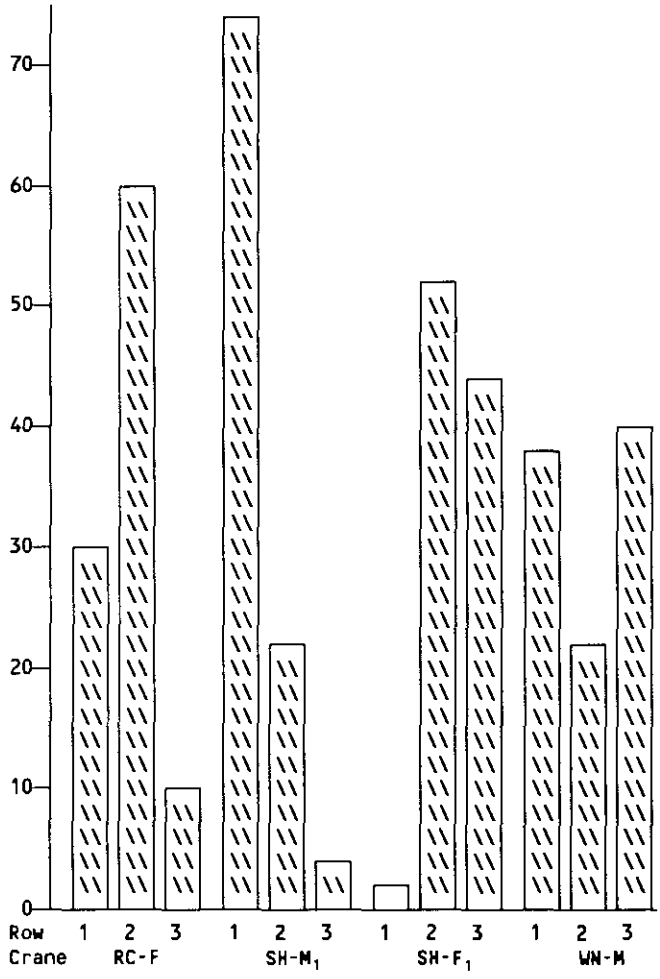

Fig. 4. Percentage of time that test and choice cranes spent in each row in Test Group 1 prior to rearrangement on 1 November 1987.

In Test Group 2, SH-F_2 used the row closest to SH-M_2 4% of the time and the row closest to S-M 82% of the time (Fig. 6). SH-M_2 was in the row closest to SH-F_2 36% of the time and in the row closest to WN-F 27% of the time.

Behavior

The cross-fostered cranes performed some social behaviors much more frequently than other behaviors (Table 1). A χ^2 goodness-of-fit test (df = 1, χ^2 = 2,250.53, $P < 0.001$) showed that cross-fostered birds performed social behaviors near foster species more than near the conspecifics. For this analysis all 4 sandhill cranes were grouped together. Types of behaviors performed adjacent to a conspecific were tested (df = 6, χ^2 = 146.07, $P < 0.001$) and those behaviors performed adjacent to the

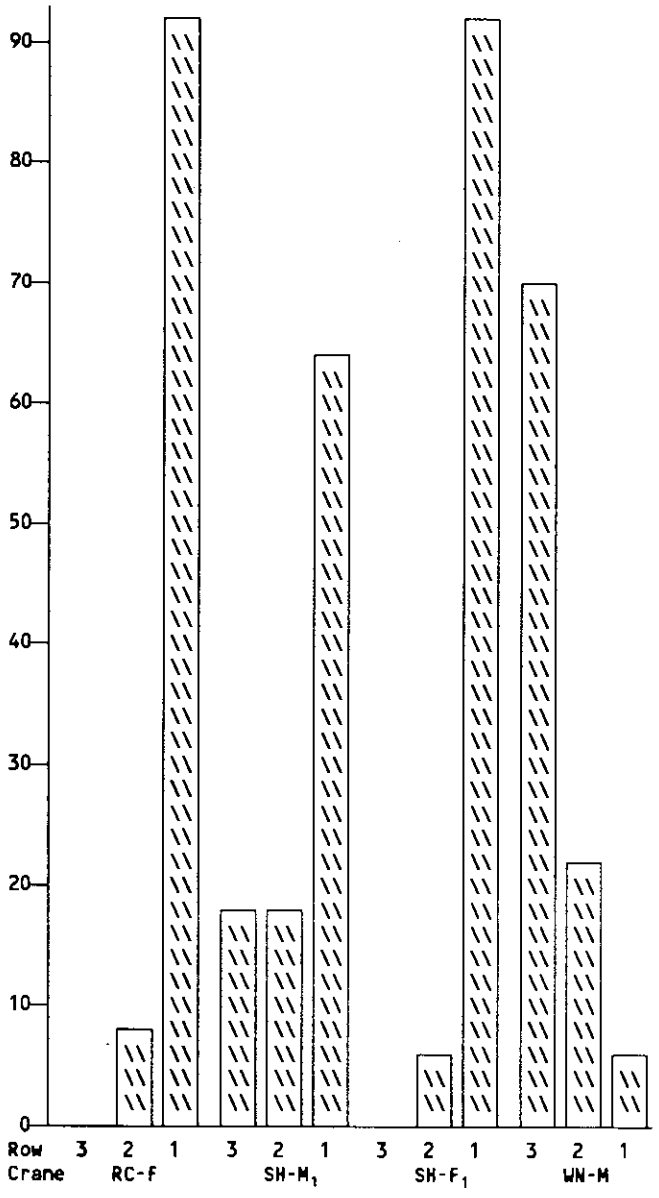

Fig. 5. Percentage of time that test and choice cranes spent in each row in Test Group 1 after rearrangement on 1 November 1987.

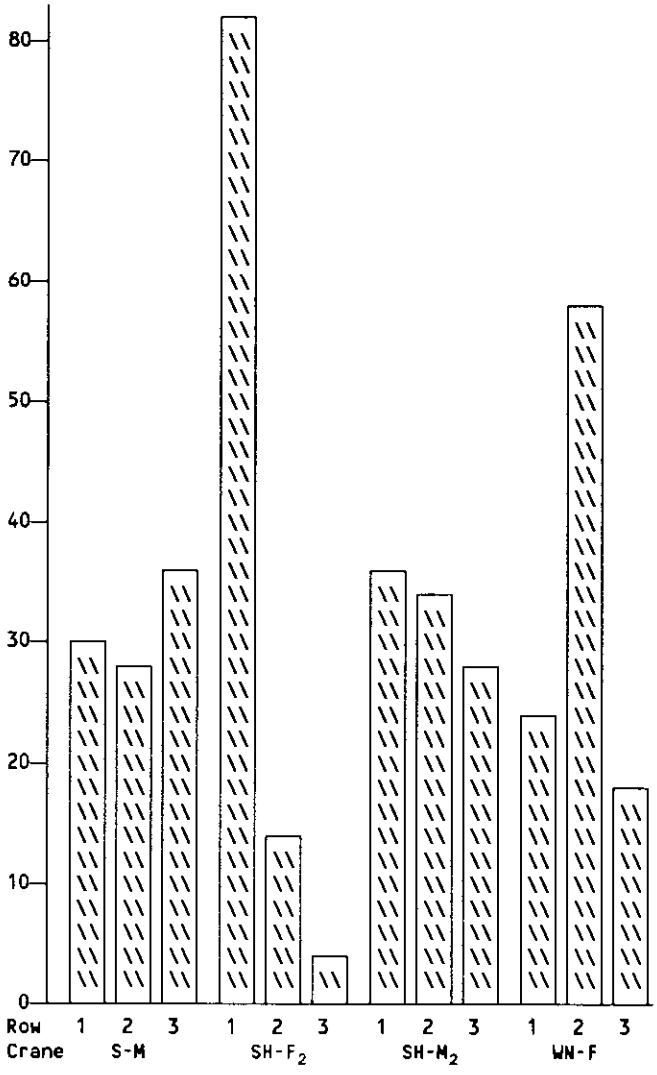

Fig. 6. Percentage of time that test and choice cranes spent in each row in Test Group 2, whose arrangement in the pen unit did not change during the study.

foster species were tested (df = 1, χ^2 = 5,378.75, P < 0.001).

DISCUSSION

Our results indicate that cross-fostering has a major influence on later social choice in sandhill cranes. The 2 female sandhill cranes preferred to be near their respective foster species. This trend persisted after we switched the 1 row of birds. Nesbitt and Wenner (1987) contend that, in natural situations, the female crane is generally the more active individual when pairing occurs, choosing her mate from a large group of prospective bachelors.

The preference of the males is more difficult to ascertain (Figs. 1 and 2). Neither exhibited a tendency to be close to either the foster species or the conspecific. The amount of time SH-M_1 spent near RC-F decreased after his row was switched. Thus his association with RC-F is probably an artifact or result of his fear of humans.

The results of the behavior analysis are clearer. Although no strong indicators of pair formation were observed during data collection (e.g. dancing [only performed once by SH-M_2] and unison calling), other behaviors indicating preference were apparent. Foraging and maintenance behaviors, activities that all birds engage in

Table 1. Number of observations of behaviors that indicate social preference performed by 4 cross-fostered sandhill cranes from 9 September 1987 to 5 August 1988.

Behavior	Near conspecific	Near foster bird
Forage[a]	53	1,404
Maintenance[a,b]	13	928
Run-flap[c]	8	20
Walk[a]	0	57
Guard call[d]	10	1
Approach[a]	9	61
Follow[a]	1	48
Total	94	2,519
χ^2	146.07	5,378.75
P	<0.001	<0.001

[a] Within 1 cell.
[b] Rest, preen.
[c] With another.
[d] Closest to.

throughout their lives, were performed by the greater sandhills within 1 cell of the foster species much more often than they were performed the same distance from the conspecific. A preference for the foster species was further shown when a bird chose to approach, follow, or walk with the adjacent bird.

Preferences may be related to choice of individuals as well as species. One might ask, for example, if SH-F_2 chose S-M because she did not like SH-M_2 and there were no other male sandhills available. If so, our small sample size (n = 4) would have skewed our data. However, the results more likely are the consequence of the cross-foster rearing method. If further studies are conducted, they should include a larger number of test cranes and/or choices.

Even if individual preferences were more significant than species preferences, the cross-foster technique would not be suitable for reintroduction. In a cross-fostering release program, a large number of the foster species would be present compared to a small number of conspecifics, especially in a new population. The cross-fostered young would have to prefer a conspecific over an individual of its foster species in order to obtain a conspecific mate. Even if either species would be accepted, an unsuitable mate choice would be probable. Also, because of its unusual upbringing, the cross-fostered young might be unable to attract a mate of either species.

The study birds remained in their pens after formal observations were completed. On several occasions unison calling was heard from SH-F_2 and S-M (>5 occurrences and initiated by either bird), WN-M and SH-F_1 (initiated by SH-F_1), and RC-F and SH-M_1. Unison calling between sandhill cranes was never heard. Sample sizes were too small to allow for statistical analysis.

Based on the availability of other suitable rearing methods for release programs and the potential for negative impacts on future reproduction, even in captivity, we do not believe it is advisable to rear cranes by the cross-foster method. In the future, ICF will limit cross-fostering to situations where we allow endangered cranes to gain initial rearing experience with a more common crane species, before the parents rear chicks of their own species.

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