

## Early Parental Care and Chick Development in a Cross-Fostering Trial With White-Naped (*Grus vipio*) and Greater Sandhill (*Grus canadensis tabida*) Cranes

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HARTUP, B. K. and R. H. HORWICH. 1994. Early parental care and chick development in a cross-fostering trial with White-Naped (*Grus vipio*) and Greater Sandhill (*Grus canadensis tabida*) Cranes. *Bird Behaviour* 10: 21-27.

Three captive, adult breeding pairs of White-Naped Cranes (*Grus vipio*) were observed rearing cross-fostered Greater Sandhill Crane chicks (*Grus canadensis tabida*). Daily behavioral scan data of groups obtained during the first 2 weeks posthatching show females exhibited greater levels of brooding, preening and feeding of chicks, foraging, and contact calling than males, whereas males were more vigilant and likely to initiate agonistic bouts in defense of group territory. Chicks showed greater activity levels from week 1 to 2 as their preening and foraging/feeding behavior increased. Weekly observation of groups past week 2 demonstrate recurrence of behavioral performance peaks by chicks in pecking at adults, resting, foraging, and preening. Males also showed significant parental role change from defenders of territory to parental care providers at levels similar to females, whereas females increased their territorial vigilance. Such changes in performance levels to a pattern of equal parental care between adults later in chick development have not been previously described for cranes.

*Cranes    Behavior    Development    Parental care    Cross-fostering*

### Introduction

Despite widening scientific and popular interest in cranes, there are few substantive published reports available on behavioral development and parental care of young crane chicks (5,8,11,12). This is unusual because there has been considerable interest in rearing cranes under a variety of methods for release into the wild, including wild cross-fostering of Whooping Crane chicks with Sandhill Crane adults, captive hand-, parent- and isolation-

rearing, and captive cross-fostering (2,4). Information concerning the early development of crane chicks is crucial to the success of these methods, and to assess their contribution to population recovery programs.

The purpose of this research was to provide information on early development and parental care in captive cranes for a longitudinal cross-fostering study as well as to prepare hand-reared cranes for a wild release (4,6). Our report presents observations of crane parent and chick behavior

for 2 weeks posthatching and preliminary findings of chick behavioral development through the first 5 months of life.

## Methods

### *Subjects, Housing, and Husbandry*

Three adult breeding pairs of White-Naped Cranes (*Grus vipio*) were observed rearing chicks (groups 1-3). Each pair reared a cross-fostered Greater Sandhill Crane chick (*Grus canadensis tabida*) at the International Crane Foundation (ICF), Baraboo, WI. Observations of parent-chick groups were made while the birds resided in indoor/outdoor pie-shaped pens 20 m in length. All pens were surrounded by a 2.5-m tall chain link fencing covered with 5-cm mesh nylon flight netting. Pen fencing was covered with tennis netting material and/or discarded holiday trees to provide visual and physical barriers between aggressive neighboring pairs. Multiple water pans and supplemental food mixes were positioned both away from and close to the outdoor nest site and were changed daily. Pen grass was left uncut, yet did not obscure observations from chosen vantage points. In all instances, access to the indoor enclosures was restricted during the chick's first month after hatching to facilitate parent-chick contact.

### *Cross-Fostering Procedure*

Both new eggs from each of the three White-Naped pairs were removed for artificial incubation and subsequent hand rearing, and were replaced with wax-filled dummy eggs. Previously incubated viable Greater Sandhill Crane eggs replaced one of the two dummy eggs at pipping for rearing by the adult pairs. After hatching, remaining dummy eggs were removed.

### *Behavioral Observations*

Each group was observed daily for a minimum of 1 h between 0800 and 1200 h from hatching (day 1) to day 14 posthatching, except for group 1 because the chick died on day 6. Weekly observations were continued on group 2 until fledging of

the chick at 10 weeks, and on group 3 until the study ended in late November at 22 weeks. Behavioral scan data (1) from members of each group were collected at the beginning of each 30-s interval at 0.5-h blocks. Behaviors recorded for each bird included foraging in the enclosure, feeding from food dishes, resting on hocks or ventrum, preening, walking, standing, and pecking at non-food objects. Specific additional behaviors were noted when they occurred: adults feeding, brooding, and preening the chick; the chick pecking the adults; chick wing flapping; chick head and neck scratching; and any agonistic behavior exhibited by a group member. Adult-chick distances were estimated at each 30-s interval. Any peeping, purring, or brood call vocalizations by chicks or adults were recorded as contact calling, only once per interval. Frequency data, however, were collected for adult vocalizations such as alarm or unison calls.

Data were averaged over individuals to provide an accounting of overall changes in chick and parental behaviors. Each behavior was summarized to yield a percent time the individual devoted to that activity or as an hourly frequency both on a daily and averaged weekly basis for the study periods.

## Results

### *Early Development*

After hatching, only females exhibited brooding behavior, though males were present in close proximity. Females typically initiated the brooding period by extending the carpus, loudly brood calling (best described as a purr), and using the bill to point to or directly preen feathers ventral to the extended appendage. The moving bill tip seemed to attract and induce chicks to enter and brood. All chicks quickly entered the space created and either rested or remained active, shifting from side to side under the wings of the female. In one instance where a chick attempted to brood under a group male, it was promptly refused. Chick brooding occurred only during the first week and exhibited a gradual decrease in frequency until its disappearance by day 8 (Figure 1).

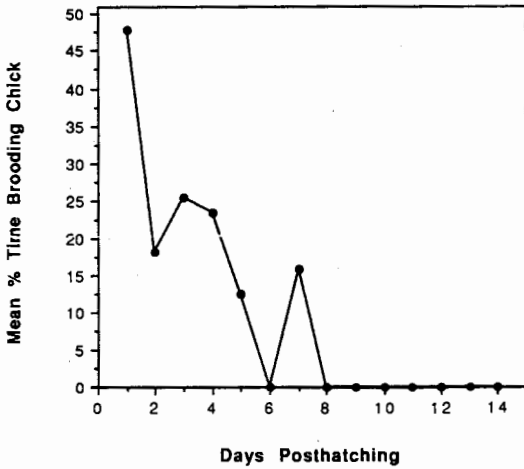


Figure 1. Daily average percent time spent brooding chick by females.

Overt preening of chicks was rarely seen, but was instead recognized when females preened underwing areas while brooding chicks. All females showed a distinct propensity to preen in a front-to-back manner, on the side where the chick was present. This activity was observed predominantly during week 1, closely paralleling the decline in brooding behavior, and was rarely seen at other times.

Parental feeding of chicks exhibited generally high levels during the first 2 weeks apart from an initial low level on days 2 and 3 (Figure 2). Females fed chicks three to four times more frequently than males, though male feeding bouts increased over the first 10 days. Males were more passive initially with chick feeding and would occasionally feed the female or watch her shuttle food items to the chick. Feeding bouts coincided with the pattern of adult foraging and a low level of foraging by the chick (Figure 3). Despite the chicks' constantly dropping food items, both adults persisted with feeding attempts during a single bout (up to 15 before the chick ate the item). Repeated presentations induced the chick to peck at the dropped food and eventually learn to feed itself.

Feeding bouts by adults had decreased by day 14 as chicks increased their own foraging and pan

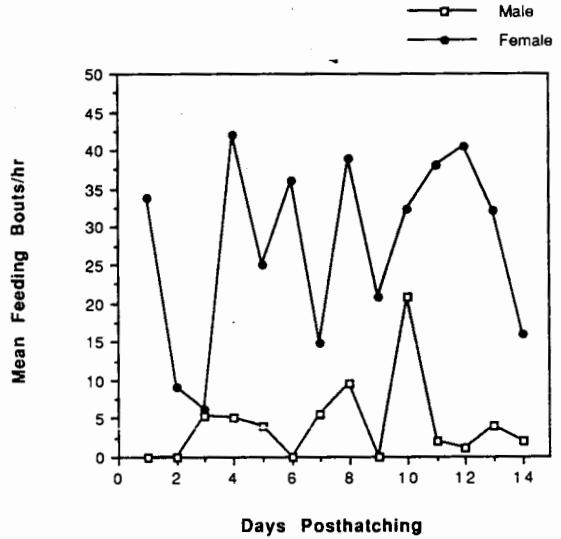


Figure 2. Daily average number of parental feeding bouts per hour.

feeding activity, and chick contact calls and begging became more infrequent (pecking the bill or feathers of an adult by the chick, often observed

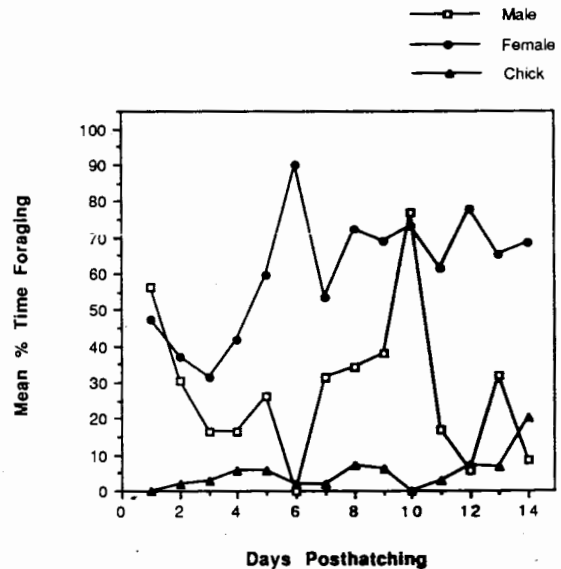


Figure 3. Daily average percent time spent foraging by group members.

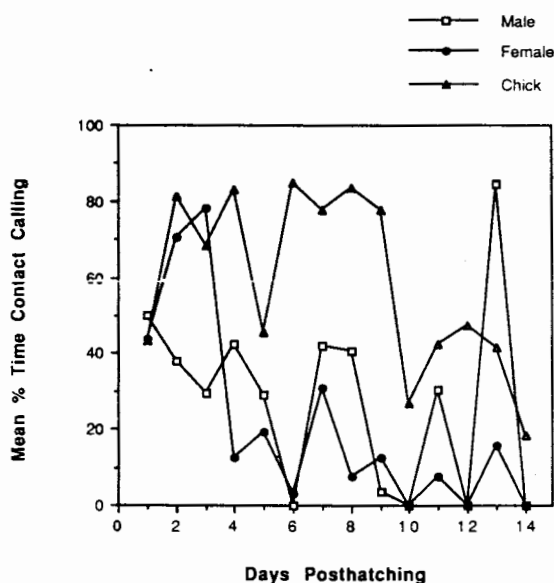


Figure 4. Daily average percent time spent contact calling by group members.

during food begging, decreased between weeks 1 and 2 from an average of 4.0 to 2.2 bouts/h, respectively).

Contact calling of all group members was high immediately after hatching. Adult female and chick calling closely paralleled one another for the first 3 days posthatching. Thereafter, chicks called two to three times more than adults, and persisted at high levels for approximately 5 days past decreased contact calling by adults (Figure 4). Estimates of chick-adult distances reflect the observed initial peak of contact calling and a gradual onset of independence and exploration by the chick by the end of the second week posthatching. Chicks spent an average of 80% of their time < 1 m from an adult during week 1, and decreased to 70% by week 2. Over both weeks, the chicks were most often closest to the female.

Calling over short periods fluctuated with changes in movement and activity within the group. For example, males increased contact calling when females began foraging away from the other group members. Also, agonistic encounters between adults and neighboring cranes intensified contact calling rates in the short term and were

often associated with alarm calling by adults. Adult alarm calling decreased from 6–9 bouts/h in the first 4 days to 0–1 bouts/h for the remainder of the study. Adult males exhibited alarm calling at greater rates than females. Unison calling by adults fluctuated markedly between daily averages of 0–5 calls/h depending on surrounding activity and disturbances.

Agonistic behavior by adults toward the observer and neighboring pairs was shown almost exclusively by males. Violent bouts, typified by lunges at fencing and thrusting of feet and bill [further described by Tacha (10)], increased posthatching to a peak of 8 bouts/h by day 5. These decreased to 0–1 bouts/h by day 9. Less violent nondirected aggression, characterized by pacing and pecking at fencing, averaged 8% and 18% of the males' activity each of the 2 weeks posthatching, respectively. The latter was associated with increased foraging and feeding by females and chicks.

Weekly average activity budgets for chicks and adults are shown in Figure 5. The majority of the group males' time was spent in vigilance (standing alert) and in defense of group territory, whereas females primarily foraged and fed chicks. Chicks were often inactive, either resting or standing. General activity of groups increased from week 1 to 2. Significant decreases in time spent resting by chicks, combined with increased foraging and feeding by the females and chicks as well as increases in aggressive behavior by males, led to an increase in overall group activity. Maintenance activities, such as preening and foraging/feeding by adults, showed little change from week to week, except for the additional foraging/feeding by females that seems to have compensated for time spent brooding chicks in the first week.

Movement, preening, and standing showed specific patterns across individuals. Walking and preening typically occurred as group activities and are reflected by the similarity in both daily and weekly average times spent by individuals in those activities. In addition, chicks often stood near males while females were foraging; chicks and males showed similar performance levels for this behavior.

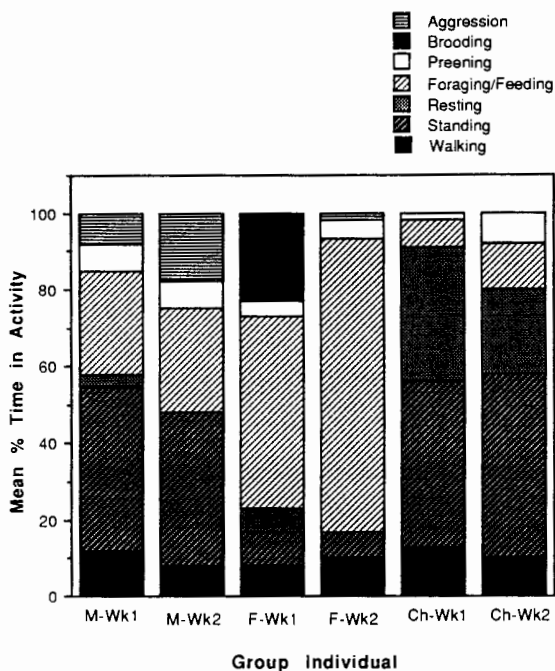


Figure 5. Weekly average activity budgets of group members across seven behavioral categories (Wk1 = week 1; Wk2 = week 2; M = males, F = females, Ch = chicks).

Averaged rates of behaviors reflecting additional motor development in the chicks exhibited increases between the first and second weeks post-hatching. Wing flapping increased from 1.2 to 3.1 bouts/h, and head and neck scratching increased from 0.3 to 1.6 bouts/h from week 1 to 2, respectively.

#### Later Development

Observations made until the fall of the first year posthatching revealed notable individual and group behavioral changes. Most evident were changes in the role of the male from defender of territory to parental care provider and the recurrence of behavioral performance peaks by chicks that had decreased previously.

Male foraging activity and chick feeding increased through week 10, coinciding with reduced agonistic encounters with neighbors, alarm and unison calling, and increased pecking of each adult by chicks. In fact, group 3 parental chick

feeding levels were equivalent between the male and female by week 7 (Figure 6). Foraging was performed more as a group activity, where the chick would move back and forth between the parents as they probed the ground. In addition, females were observed to play more active roles in agonistic encounters with neighbors and territory defense by week 7.

The frequency of pecking at adults by chicks (a greeting by the chick elicited by a stereotyped bill presentation by the adult) exhibited recurrent peaks in performance at weeks 1, 5, 8, and 17 (Figure 7), and included both body feather and bill pecking, often accompanied by intensified contact calling. These high rates of pecking, however, did not correlate with the frequency of chick feeding by adults (which was steadily declining). Recurrent peaks were also recognized for time spent resting, foraging, and preening by the chick. Gradual declines from initial high levels were not observed for any chick behaviors, though single peaks were observed for others (exploration).

#### Discussion

With hatching of young, captive adult White-Naped Cranes exhibited dramatic changes in be-

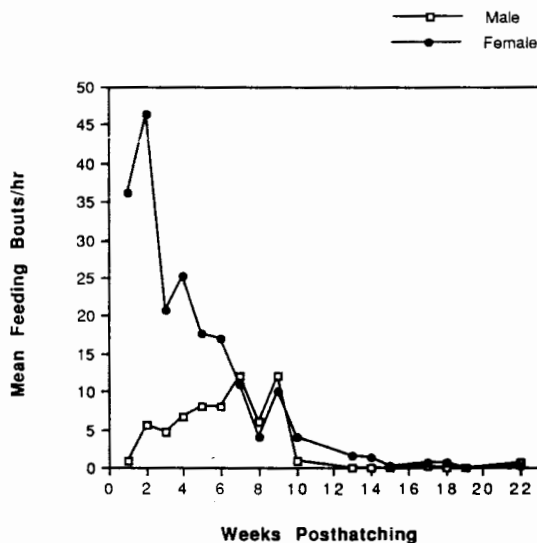


Figure 6. Group 3 average weekly number of parental feeding bouts per hour.

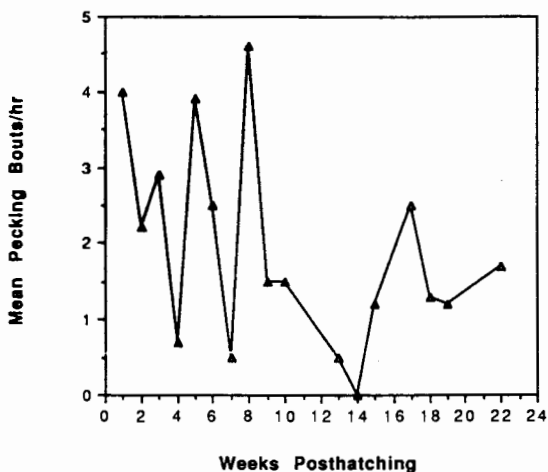


Figure 7. Average weekly frequency of pecking at adults by chicks.

havior that functioned to encourage imprinting and following of chicks and ensure their survival. Such changes have been recorded for Greater Sandhill Cranes in the wild (12). Performance level differences between adults (e.g., agonistic encounters) in the presence of a chick have also been noted in wild Sandhill Cranes (8,10). In our study, females exhibited high levels of contact calling, brooding, and preening of chicks, whereas males were significantly more vigilant and apt to initiate agonistic bouts in defense of their territory. Females alone showed brooding behavior and preening of chicks as well as the highest levels of chick feeding. Though male Sandhill Cranes have been observed to brood chicks (9), neither brooding nor preening of chicks was shown by the White-Naped males of this study. Under free-ranging conditions where two sandhill chicks have hatched, males may play a substantially greater caretaking role, resulting in each parent leading a chick to forage [(7,13), S. Swengel, ICF, personal communication].

A change in performance levels to a pattern of equal parental care between adults later in development has not been previously reported. As crane chicks survive their first weeks, the need for increased parental vigilance and feedings is lessened due to increased mobility and growing inde-

pendence of young; parental care behaviors begin to approach balanced, baseline levels in each sex. At these levels (apparently similar to those exhibited by parents in winter and spring), no costs were attributable to parental investment when time and energy budgets of sandhill crane families and pairs without young were compared (10). However, there were advantages to juveniles maintaining family bonds, such as foraging success and increased lipid levels (10). Indeed, chicks show a variety of fluctuations in their behavior performance levels through the first 6 months that may help maintain family bonds through fledging (4,5).

Single and cyclic peaks of performance levels [as characterized for Golden Eagles (*Aquila chrysaetos*) by Ellis (3)] were observed in the developing Sandhill Crane chicks of this study. Recurrent peaks in resting, preening, and foraging were similar between our extended study chick and hand-reared Sandhill and Red-Crowned chicks observed by Voss (11,12) and Horwich (5), respectively. Our findings also show that more adult parental behaviors are likely to decrease gradually over time than any exhibited by chicks. The significance of cyclic peaks in developing birds remains unclear, although they may function in maintaining group structure during periods of stress or change (5). During release of puppet-reared Sandhill Cranes, periods of regressive, parental-seeking behavior by chicks were observed approximately at the time of fall migration (4). Early social experiences (i.e., imprinting) and recurrent behavioral trends may be synergistic in the development and species identification of cranes. Additional studies of wild cranes and controlled cross-fostering investigations will help clarify the significance of these patterns and help assess the viability of cross-fostering schemes as management tools for endangered crane recovery programs.

#### Acknowledgements

Many thanks are extended to Scott Swengel and Claire Mirande of the International Crane Foundation for their generous assistance with this project.

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