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MORTALITY OF WHOOPING CRANE COLTS IN WOOD BUFFALO NATIONAL PARK, CANADA, 1997–99

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Abstract: Twenty-two whooping crane (*Grus americana*) pairs with 2 young were monitored in Wood Buffalo National Park (WBNP) over 3 years to determine causes of colt mortality. The family groups were monitored from the ground, air, and with the aid of radiotelemetry. We attached transmitters to 18 colts: 5 (28%) fledged, 5 (28%) succumbed to cumulative effects (head trauma, stress, exposure and/or infection), 4 (22%) were lost to unknown causes (3 of these went missing after they had lost their transmitters), 2 (11%) were taken by foxes (*Vulpes vulpes*), 1 (5.5%) was lost to raven (*Corvus corax*) predation, and 1 (5.5%) died of pneumonia. Of the 22 pairs we monitored, 16 young fledged. Of these, 2 (13%) were the younger sibling.

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Key words: *Grus americana*, mortality, predation, radiotelemetry, Wood Buffalo National Park.

Wetland marshes in and around WBNP represent the only continually inhabited breeding grounds of the endangered whooping crane in the world. Whooping crane nesting sites were first observed in WBNP in 1954 (Fuller 1955 unpublished) when 5 pairs were located. The current population numbers close to 190 individuals.

The purpose of this study was to provide baseline information on causes of colt mortality and to gain information on why few whooping crane pairs raise both of their young. This information will aid resource managers in understanding the variability of colt production in addition to potentially reducing mortality of colts in future reintroduction efforts.

STUDY AREA

Wood Buffalo National Park, comprising 44,807 km^2, is located in the Subhumid Mid-Boreal ecoclimatic region of Canada (Ecoregions Working Group 1989). Predominant bedrock underlying the nesting area consists of gypsum karst and is influenced by calcium sulphate groundwater discharge, which originates in the Caribou Hills to the southwest (McNaughton 1991 unpublished). Overall, the nesting grounds are characterized as a mosaic of shallow diatom ponds, bulrush (*Scirpus validus*) marshes, mixed marshes, and water sedge (*Carex* sp.) meadows (Timoney et al. 1997). Upland areas within the nesting grounds consist of narrow ridges and islands of white spruce (*Picea glauca*), black spruce (*P. mariana*), tamarack (*Larix laricina*), willows (*Salix* sp.), and dwarf birch (*Betula glandulosa*) (Novakowski 1966).

METHODS

In May of 1997, we conducted 3 fixed-wing aircraft surveys over the whooping crane nesting area to determine the number and location of nests and the onset of incubation. In June, we intensified the aerial monitoring with at least 1 flight daily (35 surveys) to determine when the colts hatched, their daily movements, and when colts went missing. We plotted the locations of 8 family groups on overlays on 1:15,840 color infrared aerial photographs. Following a fixed-wing aircraft flight that failed to locate all the colts, we flew in a helicopter to the last known location of the colt(s) and conducted a ground search. In addition, 2 nest sites were visited within a day of the second colt hatching. Using a helicopter, we landed 300 m away, hiked to the nest ponds, and located the colts. We weighed the 4 colts and marked them (with a felt marker) under their wings.

In May of 1998, we conducted 5 fixed-wing aircraft surveys to determine nest information. During the first week in June, we selected 6 nesting pairs that had 2 young for telemetry monitoring. We used a helicopter to land 300–400 m away from the family groups, and accompanied by a veterinarian (Dr. R. Cooper) we located and caught the colts. We weighed the colts, gave them a physical examination, and took blood samples and swabs (cloacal and tracheal). We attached a lightweight, 1.45 g transmitter (BD-2G, Holohil Systems, Ontario, Canada) onto the dorsum of the colts. We attached the transmitters onto the skin of the colts using a

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cyanoacrylate glue (Vetbond tissue adhesive). The antennae were glued into the down on the back of the colts. On each of the smaller colts, we cut approximately 4 cm from the 15 cm antennae so it would not extend beyond the colt's back. For 3 sibling pairs, we attached the transmitter to the larger colt and for the 3 remaining pairs we attached the transmitter to the smaller sibling, so that only 1 colt per nest had a transmitter. We only attached 1 transmitter per sibling pair during the first year of telemetry monitoring because we were uncertain of the effects of the transmitters on the colts. On 3 occasions, we located only 1 colt on the ground, so for these colts we estimated their hatching order by their weight.

Following the attachment of the transmitters each family group was monitored daily from a fixed-wing aircraft using a Telonics (Model TR 2) receiver. We connected the receiver to 2 (RA-2A H-Type) Yagi antennae mounted on the wing struts of a Cessna 172. A switch box controlled signal input from either antennae. When a monitoring flight failed to locate a colt, we used a helicopter to land at the last known location of the missing colt and proceeded with ground tracking.

In May of 1999, in addition to the 9 aerial surveys to determine nest information, we set up 2 plywood blinds approximately 70 m from 2 nests. The blinds were enclosed and had viewing ports on 3 sides, the blinds were 120 cm by 120 cm by 195 cm in height. We set the blinds into place using a helicopter. At the same time the blinds were put up, we floated the eggs to determine fertility and to estimate hatching date. We set up camps 800–1000 m away from the nest pond and began observation sessions 1 to 2 days prior to hatching. Observation sessions in the blinds lasted from 2 to 6 hours and varied from 2 to 5 days until the family group departed the nest pond. We recorded information on nesting and feeding behavior of the adults and the colts. In early June, we attached transmitters to both colts from 6 nesting pairs. We located all 12 colts, weighed them and attached transmitters. The transmitters we used were the same as in 1998 and were attached to the colts in the same manner. All transmitters attached to smaller colts had 6 cm of the antenna removed. Following the attachment of the transmitters, we monitored the colts from an aircraft at least daily for 15 consecutive days (19 surveys).

RESULTS

After 6 unsuccessful ground searches in 1997 to locate missing colts, we determined that (due to the relatively large movements of the family groups, the thick vegetation, and the wet terrain) the probability of locating a small colt without the aid of a transmitter was low. Although we did not locate any colts, we gained information on the timing of their disappearance and movements. Colts that went missing did so between 7 and 22 days following hatching, for an average of 14.29 days (n = 7, SE = 2.11). Only 1 nesting pair that we monitored had both young survive the summer.

In 1998, we located 2 intact colt carcasses and necropsies were performed by Dr. R. Cooper. One colt (smaller sibling) died from pneumonia. We located this colt along the shoreline of the same pond where it was captured. This colt appeared weak when handled the previous day. The second colt's remains were dehydrated and had signs of stress including mild head trauma, however, no clear cause of death could be determined. This colt appeared to have been abandoned. We located it on a willow/birch ridge 75 m from where we handled it 2 days earlier and 350 m from the adults and remaining colt. The transmitter for the third mortality (smaller sibling) was located in a raven's roosting tree not far from a raven's nest and 2 km from where we had previously handled the colt. The remaining 3 transmitters on the larger siblings either fell off or were pulled off after 5, 6, and 8 days following attachment. In 1998, colts that went missing did so between days 4 and 22 following hatching, for an average of 9.75 days (n = 4, SE = 4.13).

In 1999, on the first monitoring flight following transmitter attachment, we observed 11 out of the 12 colts with the adults. The colt not located with the adults was observed 400 m away from its parents and its larger sibling. On the previous day, when we had attached the transmitter to this particular colt, we had observed both adults 70 m from the nest with the larger colt. We had found the smaller colt by itself close to the nest. This colt was estimated to be less than a day old and weighed 97 g which was the lightest of all the colts handled. After we attached the transmitter to this colt, we moved it and released it with its larger sibling. However, it appeared that the adults were in the process of abandoning this colt. When we could not locate this colt the following day, we conducted a ground search. We located the colt alive, on a ridge 110 m from where we handled it. We concluded that this colt had been abandoned and would die of exposure if left, so we took the colt, kept it overnight, and then sent it to the Calgary Zoo.

We located 3 carcasses intact and Dr. R. Cooper performed the necropsies. The first carcass was floating in wet sedge. This colt had mild head trauma but the primary cause of death could not be identified, although it was likely from the cumulative effects of trauma, infection, and exposure. The second carcass had severe head trauma and had lost 56 g in 4 days following attachment of the transmitter. It was emaciated and had early signs of pneumonia. We located this colt on a small sedge island in the center of a pond, while we observed the adults with the remaining (larger) sibling 430 m away. We located the third carcass on shore in dry sedge. This colt also had head trauma and signs of exposure and infection. Because the adults were observed over 400 m from

the colt for 2 consecutive days before we located the dead colt on the ground, we concluded that it had been abandoned. We found fox tracks near the remains of 2 colts and concluded that both had been preyed upon by a fox. The 1999 colts went missing between days 4 and 14 following hatching, with an average of 7.57 days (n = 7, SE = 1.53).

Overall, 44% (n = 4) of the larger (older) siblings with transmitters fledged and 11% (n = 1) of the smaller (younger) siblings fledged. The fates of the crane colts are summarized in Table 1.

Table 1. Suspected and known fates of radiotagged whooping crane colts, WBNP, Canada, 1998–99.

Colt number	Age (days)			Suspected fate
	Transmitter attachment	Transmitter off	At death	
98-10	3		4	Raven predation
98-11	5		6	Pneumonia
98-15	5		7	Cumulative effects[a]
98-18	4	8		Fledged
98-40	12	5	22	Unknown
98-45	5	6		Fledged
99-1a	6		10	Cumulative effects[a]
99-1b	8	12		Fledged
99-2a	5		14	Fox predation
99-2b	3	7	11	Unknown
99-6a	6		8	Fox predation
99-6b	3	14		Fledged
99-7a	5	15		Unknown[b]
99-7b	3		7	Cumulative effects[a]
99-10a	4		7	Cumulative effects[a]
99-10b	2		4	Unknown
99-13a	3	12		Fledged
99-13b	1			Cumulative effects[a]

[a]Cumulative effects include mild-severe head trauma, and exposure symptoms (usually signs of pneumonia). Colt 99-1a had severe trauma to the head.

[b]Colt observed at end of June but not observed in August.

Intraspecific Aggression

From the blinds, considerable aggression was observed between the siblings at the nest sites with 2 young. At 1 nest, 2 bouts of aggression were observed prior to the adults leaving the nest with the larger colt and abandoning the smaller colt. In the first bout, the larger sibling pecked the smaller sibling 93 times in a 4-minute period, and in a second bout, the larger sibling pecked the smaller sibling 60 times in an 8-minute period.

At this nest site, within the first day of the second egg hatching, the adults departed the nest with the larger colt to forage 50 m away. Approximately 2 hours after the adults departed the nest a raven circled over the nest, landed, and flew off with the smaller colt in its grasp. The adults were agitated, made alarm calls, and paced back and forth, but both remained with the larger sibling 50 m from the nest.

Observations from a second blind also revealed aggression between the colts, and in one 3-minute bout, the larger colt pecked the smaller colt 30 times. However, the smaller sibling also pecked at the larger sibling several times.

Four out of the 10 smaller sibling colts that we handled for the transmitter work had obvious signs of trauma to the head, beak, and eye region. Every one of these colts perished within 4 days of handling. Based on the 5 necropsies conducted on colt carcasses, 4 had evidence of head trauma and all were the smaller sibling.

We could not observe any sibling aggression from the aerial monitoring, although we did observe that the adults rarely kept the colts separated. Most (70%) of the observations (n = 131) of family groups with 2 colts were of the colts 2 m or less from each other.

DISCUSSION

Handling

Capture of crane colts and attachment of transmitters resulted in temporary disturbance and stress to the colts and the adults. When the helicopter landed and we approached, the adults generally walked off 20–50 m, paced back and forth, displayed, called several times, and then after 5–10 minutes walked or flew out of sight. The colts' behavior depended on how quickly we could get to the pond where the family groups were located. Handling times varied from 7 minutes to 23 minutes with an average of 16 minutes and 7 seconds (n = 14, SE = 1.57). We did not injure any colts during capture and handling. However, the stress involved may have exacerbated the effects of other factors such as infection, exposure, and sibling aggression. Timing of losses of study pairs with both young was comparable to losses in non-study pairs with both young. In 1998, when the last study pair with both young lost a colt, there were no other nesting pairs remaining with both their young (from the 6 additional sets observed in the remainder of the population). In 1999, when the last study pair to have 2 young lost 1 colt, there was, in the remainder of the population, only 1 pair still

with both young. One week later this late nesting pair also lost 1 colt.

Crane Colt Mortality

This was the first study to focus on post-hatching mortality in wild whooping crane colts. In the past, there have been several suspected cases of predation on eggs and colts, however, there have only been a few confirmed cases. In 1977, researchers discovered that a rare clutch of 3 eggs was destroyed, apparently by large birds (Kuyt 1981). In 1978, a black bear's (*Ursus americanus*) tracks indicated that it had raided a nest prior to hatching (Kuyt 1981). In 1979, a wolf (*Canis lupus*) killed a juvenile whooping crane in August (Kuyt 1981). Between 1982 and 1983, researchers suspected that wolves took 6 of 12 radioed whooping crane chicks in August and September (Kuyt 1992). During the 1996 egg collection, 1 egg was found with a 4 by 5 cm hole in it, presumably due to a large avian predator. In this study, ravens and foxes preyed on 3 whooping crane colts.

The only other ground observations made during nesting in WBNP took place in 1974 when a film crew assisted by the Canadian Wildlife Service (CWS) (Muir 1976) observed and recorded severe aggression between siblings at 1 nest. The larger colt vigorously attacked the smaller colt whenever the smaller sibling moved. The main conclusion from their observations was that aggression probably explains why only 1 young survives (Muir 1976). In this study, we found that almost half the smaller siblings had outward signs of head trauma, and ground observations revealed considerable aggression between the colts at the nest site. We believe 1 contributing factor is that, at most nest sites, the older colt hatched at least 2 days earlier than the younger colt, and because these colts grow quickly, each day makes considerable difference in their size and strength. The average difference in weight between the 2 colts from 11 broods was 47.55 g (n = 11, SE = 7.44).

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

In our study, we found that several factors work against both young surviving. These include predation from foxes and ravens, and a combination of trauma (which we believe to be primarily the result of sibling aggression), exposure, and infection. We believe the following scenario to be common in WBNP: when a second egg hatches, the older sibling displays aggression towards the younger colt. This aggression is often severe at the nest site where the colts are confined to a small area. Also at the nest site, the younger sibling may not receive as much food as the older sibling because of its more limited mobility (Bergeson et al. 2001). The adults depart the nest pond when the younger colt is approximately 2 days old; thereafter, the physical demands of keeping pace with the family leads to further stress. The average daily movement of the family groups in the first week following hatching was 338.45 m (n = 115, SE = 37.59). If the younger colt cannot keep pace, it lags behind, and becomes vulnerable to predators and exposure or is eventually abandoned. The above factors, combined, account for the loss of most of the younger siblings, most of which disappear within 2 weeks of hatching.

While this scenario may be relatively common, we had 2 occasions where the smaller colt fledged. Of the 22 pairs monitored, 16 young were fledged. Of these, 2 (13%) were the younger sibling. Data collected during this study indicate that the smaller (younger) colts serve as insurance against the larger (older) colt dying, and survival of both colts in a brood is possible when conditions are favorable. The Aransas-WBNP population is the only self-sustaining wild population of whooping cranes in the world, and every colt that survives in this population is critically important. We therefore recommend leaving nests in WBNP with both eggs.

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