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CAUSES OF MISSISSIPPI SANDHILL CRANE MORTALITY IN CAPTIVITY, 1984-95

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Abstract: During 1984-95, 111 deaths were documented in the captive flock of Mississippi sandhill cranes (*Grus canadensis pulla*) housed at the Patuxent Wildlife Research Center. Trauma was the leading cause of death (37%), followed by infectious/parasitic diseases (25%), anatomic abnormalities (15%), and miscellaneous (8%). No positive diagnosis of cause of death was found in 19% of the necropsies. Chicks <2 months old suffered 76% of captive deaths. Trauma, the greatest cause of deaths of captive juveniles and adults, is likely limited to collisions in the wild. Infectious/parasitic diseases and anatomic abnormalities could affect wild chick survival at similar rates to those of captive chicks.

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Key words: disseminated visceral coccidiosis, *Grus canadensis pulla*, heart defects, Mississippi sandhill crane, mortality, necropsy, trauma.

The Patuxent Wildlife Research Center (Patuxent) held the only captive propagation colony of endangered Mississippi sandhill cranes (MSCH) until 1995. In the early 1970's the population was at a low of approximately 38 birds (Anonymous 1973). The captive flock was started in 1966 from 4 eggs collected in the wild.

Mortality continues to be a significant factor affecting the status of this crane in captivity and the wild. A summary of mortality factors in the captive propagation program at Patuxent (Carpenter et al. 1976) covered all 3 subspecies of sandhill cranes resident at Patuxent (greater sandhill crane [*G. c. tabida*], Florida sandhill crane [*G. c. pratensis*], and Mississippi sandhill crane) during the years 1966-75 but did not separate the subspecies for cause of death. At that time the Mississippi sandhill crane propagation program was in its infancy, and only 11 had been necropsied. A Population and Habitat Viability Assessment Workshop reported mortality of Mississippi sandhill cranes in the wild from 1981 to 1992 and in captivity (Langenberg et al. 1992).

In 1994 the U.S. Fish and Wildlife Service decided to end propagation of this subspecies at Patuxent and divide the captive flock between White Oak Conservation Center in Yulee, Florida, and the Audubon Institute in New Orleans, Louisiana. Therefore, a final examination of the mortality factors affecting this crane flock at Patuxent is needed to aid in managing the 2 new flocks and as a comparison with mortality factors in the wild flock.

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METHODS

The captive propagation program at Patuxent cares for 300-350 cranes annually, primarily sandhill cranes, but 25% of the flock is whooping cranes (*G. americana*). Adult cranes are housed in pairs in outdoor pens and provided with fresh water and a diet of specially formulated pellets (Olsen and Carpenter 1996). Juveniles (≥ 2 and < 12 months) and some unpaired adults live in community pens containing 2-12 unmated birds. Chicks (< 2 months) are housed with surrogate sandhill crane parents or are raised in individual pens by costumed caretakers. Since 1989, Patuxent caretakers have worn gray costumes to disguise their human shape. Crane chicks raised by costumed caretakers are also exposed to adult cranes in adjacent pens.

Diagnoses of cause of mortality were based on medical history, clinical signs, radiology, necropsy results, and laboratory findings (microbiological, parasitological, toxicological, clinical pathological, and histopathological) as delineated in previous studies (Carpenter et al. 1976, Carpenter and Derrickson 1982).

RESULTS

From 1984 through August 1995, 111 Mississippi sandhill cranes died in captivity from various causes (Table 1). Most deaths (76%) occurred among chicks (from hatching to fledging at age 2 months); only 20% were juveniles, and 14% were subadults or adults (≥ 12 months old). Of the 5 major categories of mortality listed, trauma was the most common cause of death (34%), followed by infectious/parasitic diseases (25%), no definitive diagnosis (19%), anatomic abnormalities (15%), and miscellaneous conditions (8%) (Table 1).

Among chicks, the causes of death were infectious/

Table 1. Causes of mortality in Mississippi sandhill cranes by age class at Patuxent Wildlife Research Center, Laurel, Maryland, 1984-95.

Cause of mortality	Age class ^a (n)			All ages	
	Chick	Juvenile	Adult	n	%
Trauma	19	8	11	38	34
Aggression	14	2	6	22	20
Predation	2	2	2	6	5
Spinal trauma	0	0	2	2	2
Fractures	0	4	1	5	4
Miscellaneous	3	0	0	3	3
Congenital abnormalities	16	0	0	16	14
Scoliosis	3	0	0	3	3
Heart defects	8	0	0	8	7
Miscellaneous	5	0	0	5	4
Infectious or parasitic disease	23	4	0	27	25
Pneumonia/respiratory disease	8	2	0	10	9
Colibacillosis	1	0	0	1	1
Yolk sac infection or rupture	12	0	0	12	11
Cloacal prolapse or septicemia	1	0	0	1	1
Disseminated visceral coccidiosis	1	2	0	3	3
Miscellaneous mortality factors	4	3	2	9	8
Maggot infestation	0	1	0	1	1
Intestinal adhesions	1	0	0	1	1
Drowning	0	1	0	1	1
Cloacal impaction	1	0	0	1	1
Capture myopathy	0	0	2	2	2
Stunting syndrome	0	1	0	1	1
Enteritis	2	0	0	2	2
No diagnosis/open	12	7	2	21	19
Totals	76	22	13	111	100

^a Chicks (<2 months); juveniles (≥2 and <12 months); adults (≥12 months).

parasitic diseases (30%), trauma (25%), anatomic abnormalities (21%), miscellaneous conditions (8%), and no definitive diagnosis (16%). For juvenile and adult cranes, trauma was the greatest cause of mortality (juvenile 37%, adult 73%). No mortalities were attributed to anatomic abnormalities in cranes older than 2 months. Likewise, infectious/parasitic diseases were not a mortality factor in subadults and adults. Most deaths were seasonal, occurring in May (15%), June (37%), and July (22%), as expected given the high mortality rate in chicks. There were no deaths in January, and only 1 death each in February, March, and April during the study. Deaths during August through December ranged from 2% to 8% of total mortalities.

DISCUSSION

Trauma was the most common cause of mortality, and

the highest ranking mortality factor in cranes > 2 months old. Trauma is often associated with pair formation in subadult and adult cranes housed in community pens. When a pair forms, they become aggressive, often defending the food or water resources from penmates. Another form of aggression occurs when a crane jumps or flies into a nearby pen occupied by a pair. The trespasser is usually severely attacked by the pair. Trauma to chicks being reared by parent cranes can result when one of the adult cranes accidentally injures the chick, often by stepping on the chick while defending the pen from intruders. An inexperienced parent crane will occasionally attack and kill a chick. Of the different forms of trauma/aggression that occur in the captive flock, only that directed against chicks may occur in the wild.

Predation accounted for 5% of mortality. The predators were primarily great horned owls (*Bubo virginianus*). In the wild flock, predation caused 30.8% of the mortality seen in

released birds (Langenberg et al. 1992) and also contributed to mortality in chicks. Five percent of the mortality in the captive flock has been a result of fractures of long bones and ensuing complications. This problem characterizes several crane species raised in captivity (Olsen 1994) and may not be as serious a mortality factor in the wild. Cervical or spinal trauma represented 3% of mortality in captivity, resulting in the deaths of 3 MSHC in 12 years. These injuries often occur when birds fly into obstacles such as fences or feed sheds. It is likely that this type of mortality is also found in the wild flock, as it occurs in other sandhill crane populations, when individual cranes fly into fences or powerlines (Morkill and Anderson 1991, Faanes and Johnson 1992, Fannin 1992, Brown and Drewien 1995).

Congenital anatomic abnormalities accounted for 21% of deaths in chicks. Chicks with severe abnormalities were often euthanized if their chance of survival was low, rather than waiting for natural death to occur. If a similar mortality rate occurred in the wild flock, we would expect 1 of 5 wild-hatched chick deaths to be due to anatomic abnormalities.

Cardiac murmurs accounted for 50% of the deaths listed under anatomic abnormalities. Lesions seen at necropsy were either a ventricular septal defect or an atrial septal defect. Preliminary studies of the genetics of these chicks show a possible recessive genetic factor in certain members of the captive population. Currently, there is no evidence that such a factor exists in the wild population, but we assume such a recessive gene does exist. Not all Mississippi sandhill cranes diagnosed with serious heart defects die as chicks. Some were reared successfully to fledging and released in Mississippi. Eleven cranes with heart murmurs were released in 1989-91. Of these, 7 (64%) died, compared to a 17% mortality rate for the 53 cranes released without murmurs during the same period (Langenberg et al. 1992). Clearly, those birds with serious identifiable murmurs are at high risk. Since 1992 such cranes have not been included in the release program. However, when the wild population becomes self-sustaining, there may be some mortality of juveniles or young adults where a heart defect is a contributing factor.

All identifiable anatomic abnormalities may occur due to congenital factors inherent in the population, but many may also be attributed to contaminants, improper incubation, or other factors (Olsen et al. 1990, Olsen and Clubb 1996). However, because of the controlled situation at Patuxent, contaminant exposure in the captive flock is unlikely. Likewise, incubation technique is not suspect because natural and artificial incubation is used, and no link has been identified between incubation technique and anatomic abnormalities in any of the crane species found at Patuxent.

Infectious diseases are also more common in chicks. Omphalitis/ruptured yolk sac/yolk peritonitis caused one-half

of all chick mortality. No one causative agent was common to all cases, although *Escherichia coli* was the most often isolated bacteria. Infectious diseases may occur with the same frequency in the wild population, but this is unknown at the present time.

Pneumonia/respiratory disease-related mortality occurs each year, especially among crane chicks; 8 of the 10 deaths from infectious disease were in chicks, the other 2 deaths occurred in juveniles. No single identifiable etiological agent linked all cases. However, cranes with chronic respiratory problems often develop aspergillosis. Because respiratory infections occur in chicks raised by costumed caretakers and by surrogate crane parents, and because no common etiological agent was identified, we believe this disease would occur with similar frequency in the wild population.

Disseminated visceral coccidiosis (DVC) has caused the death of a number of crane chicks of all species/subspecies in captivity at Patuxent in the past. However, only 3 deaths of Mississippi sandhill cranes in the 12 years covered by this study were attributed to DVC. Two of these deaths occurred in 1988, when the coccidiostat amprolium failed to prevent the disease for the first time. Subsequently, Patuxent switched to the coccidiostat monensin, which has since been effective in controlling DVC. Further investigation into methods for controlling coccidiosis in captive cranes continues. DVC as a cause of mortality in wild Mississippi sandhill cranes is not documented and is probably rare in chicks.

MANAGEMENT IMPLICATIONS

The results of necropsies from captive Mississippi sandhill cranes dwelling at Patuxent are useful to monitor the status of the captive flock as it is divided and moved to new locations. Any increases in mortality factors may indicate problems for the captive propagation program. In addition, by continuing to monitor mortality in the captive flock and comparing these losses to those of the wild flock, we have the opportunity to identify health issues that warrant further investigation.

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