Sandhill Crane, *Grus canadensis*, Nesting in the Yorkton Wetland Complex, Saskatchewan

ANN M. BURKE

International Crane Foundation, E-11376 Shady Lane Road, Baraboo, Wisconsin 53913, USA

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Surveys for Sandhill Cranes (*Grus canadensis)* were conducted near Yorkton, Saskatchewan during the summers of 1995, 1996 and 1997. Seven nesting territories were identified and habitat measurements were taken at six nests. All nests were located in the emergent deep marsh zone of open water marshes within residual stands of Hardstem Bulrush (*Scirpus acutus)*. Seven eggs were measured in four nests. Estimated hatching dates ranged from 20 May to 9 June. Total productivity for the three years was 0.80 chick per breeding pair (12 offspring fledged by 15 pairs). Individual pair productivity was impacted by disturbance, mate change, adult mortality, and predation. Hunting mortality may also impact the population.

Key Words: Sandhill Crane, *Grus canadensis*, reproduction, productivity, aspen parkland, crane hunting, Saskatchewan.

In 1993, the [Canadian] National Recovery Plan for the Whooping Crane recommended that "preliminary field studies be conducted to determine migration, staging, and wintering range for resident Sandhill Cranes" (Edwards et al. 1994). Resident Sandhill Crane (*Grus canadensis*) population parameters have, in part, been used to evaluate potential reintroduction sites for the Whooping Crane (*Grus americana*) (Drewien 1973; Bishop 1988; McMillen 1988; Nesbitt 1988*; McMillen et al. 1992) because the Whooping Crane is absent from large portions of its historic range. Establishment of additional Whooping Crane populations reduces the likelihood the species could become extinct in the wild.

In 1994, the Canadian Wildlife Service (CWS) identified and assessed approximately 40 potential reintroduction sites located within the historic range of the Whooping Crane (Lyon et al. 1995*). Three wetland complexes appeared to contain adequate Whooping Crane habitat: (1) the Overflowing River Area (Leaf Lake) in northwestern Manitoba, (2) the Saskatchewan River Delta in northeastern Saskatchewan, and (3) the Yorkton Wetland Complex (YWC) in southeastern Saskatchewan. The YWC was selected for further study due to the presence of Sandhill Cranes, the ability of Ducks Unlimited Canada to manipulate water levels, its size and accessibility, and because its location within the aspen parkland ecotone was thought to have been optimal breeding habitat for the Whooping Crane historically (Lyon et al. 1995*).

Cranes in the study area are referred to as mid-continent Sandhill Cranes as they migrate through the Great Plains of North America (Central Flyway) and winter primarily in Oklahoma, Texas, New Mexico and Mexico (Tacha et al. 1984). This paper describes Sandhill Crane eggs and nests, the habitat surrounding nest sites, and pair productivity within the YWC.

Study Area and Methods

The study area is located in southeastern Saskatchewan in the Aspen Parkland (Bird 1961). The aspen parkland is a zone of transition between the boreal forest to the north and mixed-grass prairie to the south (Rowe 1987). Under pristine conditions, parkland is differentiated from grasslands by the presence of more than 15% tree cover (Strong and Leggat 1981). Prominent wetlands include fresh and variably saline marshes and semi-permanent shallow ponds bordered by emergents, shrubs, and trees (National Wetlands Working Group 1988).

The principal study area (approximately 736 km^2) encompassed the YWC and Rokeby Marsh located to the south and west of Yorkton, Saskatchewan. The YWC comprises 10 major basins that are linked through a series of water control structures. Total basin size is 3394 ha. Rokeby Marsh supports the largest number of resident Sandhill Cranes and was selected as the main study site. Rokeby Marsh (790 ha) is located approximately 17 km southeast of Yorkton, and 8 km west of Saltcoats. Lands within the YWC are predominantly privately owned.

Efforts to locate Sandhill Crane pairs were conducted from 28 May – 20 August 1995, 28 April – 20 August 1996, and 1 May – 25 July 1997. Surveys to locate cranes were conducted daily from 05:00-07:00 h and 18:00-20:00 h from a vehicle on roads external to the marshes, on foot in uplands adjacent to wetland areas, or from a canoe on open water. Landowner permission was obtained before entering private property. Systematic auditory censuses (Bennett 1978) were conducted using a taped recording of Sandhill Crane unison, guard, and flight calls. Calls were broadcast at 15- 25 minute intervals with a battery operated Burnham Brothers™ model TS-12W Predator Call. After playing the tape,

the observer noted responding crane vocalizations and bearing, and scanned the area using a spotting scope and binoculars. After 15 minutes, the observer moved approximately 0.4 km to repeat the broadcast.

During surveys, the following data were recorded: location (township, section, range), number of cranes, age (juvenile or adult based on cheek patch color and feather coloration on head and neck) (Tacha 1988), sex (determined if a bird was observed unison calling, Archibald 1976), behavior, movements, habitat type, and the presence/absence of feather painting (Johnsgard 1983). (After digging in the mud and debris, adult and juvenile Sandhill Cranes preen the material over most of the body feathers, thus producing a stain that is usually a bright rusty brown (Walkinshaw 1973; Lewis 1979). Such feather painting is especially characteristic of adult cranes on nesting territories (Johnsgard 1983)). Wetland type was recorded based on Millar's (1976) classification system for aspen parkland wetlands.

Paired cranes were recorded as breeders or non-breeders. Due to the absence of marked individuals, I used behavior and repeated observations of pairs/families, in specific locations, to identify nesting territories. Pairs engaging in territorial defense, incubating eggs, or seen with young were identified as breeding pairs.

Nests were located by visual observation of incubating birds or when birds exchanged incubation duties. To reduce disturbance and thus the likelihood of abandonment, nest sites were visited only during the later stages of incubation. GPS readings were taken at each nest. Eggs were measured, weighed, and aged (estimated) using the flotation method as described by Fisher and Swengel (1991). Nests and eggs were photographed. Nest diameter, height above water, and water depths at 1 m and 2 m intervals in each cardinal direction were measured.

Once the nest was no longer in use, we recorded species composition within a 5 m radius of each nest using the Daubenmire canopy coverage method of vegetation analysis (Daubenmire 1959). Vegetative composition of the nest was recorded and visual obstruction measurements (a reliable measure of the height and density of vegetation) were determined at 5 m increments up to 20 m in each cardinal direction from the nest using a Robel pole (Robel et al. 1970). Distances to specific habitat features (e.g., nearest fence, woody vegetation, road, residence and upland) were determined by pacing or by measurement from aerial photographs. Pairs with young were located tri-weekly to determine survival rates and monitor habitat use.

Results

Sandhill Cranes arrived on the YWC in late March and early April each year of the study. I located seven nesting pairs within the YWC, five on Rokeby Marsh, one on Leech Lake, and one on Maddaford Marsh. The auditory census technique elicited a vocal response from cranes an average of 41% of the time.

In 1996-1997, five of seven nest sites were evaluated on Rokeby Marsh. Nesting began in late April – early May and ended in early June. All nests were located in the emergent deep marsh zone of open water marshes

TABLE 1. Data on Sandhill Crane eggs (n=7) from nests in Rokeby Marsh, Saskatchewan, May – June 1996 and 1997.

Nest	Date measured	Egg weight (g)	Egg Length (cm)	Egg Width (cm)	Estimated Egg weight at laying[a] (g)	Estimated age (days)[b]	Estimated hatch date
1	11 May 1996	172 158	9.8 10.7	6.0 5.8	193 170	22-23 19-21	20-28 May
2	26 May 1996	192 180	10.5 9.9	6.1 6.0	213 194	18-21 18-21	9-11 June
3	28 May 1996	128 122	8.8 8.6	5.5 5.3	145 132	21-25 18-21	Did not hatch
4	3 June 1996	– –	– –	– –	– –		1-2 June
5	28 May 1997	123	8.1	5.6	139	27-28	29-31 May

[a] Fresh egg weight was estimated in grams by the formula $F_w = (0.546) \times [\text{width}^2\,(\text{cm}) \times \text{length}\,(\text{cm})]$ (Fisher and Swengel 1991).

[b] Estimation based on flotation technique as described by S. Swengel. Unpublished data. General guidelines for estimating the age of Sandhill crane eggs. International Crane Foundation, Baraboo, Wisconsin.

an average of 40 m (r = 14-54 m) from the nearest upland. Nests were composed entirely of Hardstem Bulrush (*Scirpus acutus*) and located in residual stands of Hardstem Bulrush. Visual obstruction measurements, 1, 5, 10 and 20 m from each nest averaged 68 cm, 49 cm, 56 cm, and 51 cm, respectively. Average visual obstruction measurements 1 m from crane nests were greater or equal to those taken 5 m from the nest. Nests were located in an average of 26 cm (r = 13-48 cm) of water, averaged 37 cm (r = 27-55 cm) in height, and alternative nest starts (between two and seven) were discovered within 100 m of each nest (Tacha et al. 1992).

Distance measures to habitat features varied greatly. Nests were 333–1800 m from a gravel road, 23–381 m from woody vegetation, 20–650 m from a barbed-wire fence, and 1.1–2.1 km from a residential building.

Seven eggs were measured in four nests (Table 1). Estimated hatching dates ranged from 20 May – 9 June. No re-nesting attempts were observed by failed pairs and pair productivity varied by year (Table 2). Total productivity for the three years was 0.80 fledged chicks per pair (15 pairs fledged 12 offspring).

Individual pair productivity was affected by disturbance, mate change, and adult mortality. In 1996, two days before the first egg of the clutch was estimated to hatch on Territory 1, cattle trampled the vegetation extensively around the nest and created deep channels in the water <1 m from the pairs' nest. Three days later, the pair and one chick abandoned the nest site. In 1996, I visited the nest in Territory 3 after an estimated 18-21 days of incubation. The pair abandoned the nest within 2 days but remained on the territory until early July. As no egg remains were found in the nest, a Coyote (*Canis latrans)* probably destroyed the clutch based on Stern et al. (1987) observations of crane nest predation. This territory was unoccupied in 1997.

In 1995 and 1996, the pair on Territory 2 was highly territorial, successfully fledging offspring, and was feather painted. The pair copulated successfully on 7 May 1996. In 1997, however, the female did not have feather painting and on three occasions did not respond to the male's pre-copulatory parade or calls. On five occasions, the pair flew across the marsh in the early morning to spend the day feeding with a flock of 130 Sandhill Cranes, Snow Geese (*Chen caerulescens*) and

TABLE 2. Productivity of Sandhill Crane pairs (n=7) on Rokeby Marsh and the Yorkton Wetland Complex, 1995-1997, Saskatchewan, Canada.

Territory Number	Territory Location	Year	Number of Eggs	Number of Fledged Young
1	South end of Rokeby Marsh	1995	?[a]	0
		1996	2	1[c]
		1997	2	2
2	Southwest side Rokeby Marsh	1995	?[a]	1
		1996	2	1
		1997	Did not nest	0
3	Northwest side Rokeby Marsh	1995	Pair absent	–
		1996	2	0[b]
		1997	Pair absent	–
4	East side Rokeby Marsh	1995	?[a]	1
		1996	2	1
		1997	Pair absent	–
5	Northeast side Rokeby Marsh	1995	?[a]	1
		1996	?[a]	2
		1997	1	0[b]
6	Southeast side Maddaford Marsh	1995	?[a]	0[b]
		1996	Pair present	Unknown
		1997	Pair present	Unknown
7	West side Leech Lake	1995	?[a]	1
		1996	?[a]	0[b]
		1997	?[a]	1[c]

[a] Nest not located
[b] Pair observed with pre-fledged chick
c Pair observed with two pre-fledged chicks

Canada Geese (*Branta canadensis*). The pair remained on the territory until late July but did not initiate nesting. These behavioral changes suggest that a different female occupied the territory in 1997 than in the previous two years.

On 3 June 1996, the pair on Territory 4 was observed with two newly hatched chicks. On 14 and 20 July, only a single adult with one chick was observed. On 28 July, a lone fledged juvenile (presumably abandoned by its widowed parent) was seen on the territory. In 1997, cranes were absent from this territory.

All nesting cranes were feather painted. During incubation and early chick rearing in May and June, four breeding adults were in partial molt of primary and secondary feathers. Pairs with fledged chicks remained on territories until mid-to-late August in all years.

Discussion

Sandhill Crane pairs are highly territorial during the breeding season and return each year to the same territory. An undisturbed nest site associated with water is a critical habitat component for Sandhill Cranes and nests are usually constructed using residual vegetation from the previous growing season (Armbruster 1987). Sandhill Cranes may prefer to nest in tall, emergent vegetation (with adequate water depth) because it provides cover during early spring (Provost et al. 1992). Crane productivity is greater in areas where wetlands are bordered by agricultural lands (Meine and Archibald 1996). These factors serve to explain why since the early 1900s, Rokeby Marsh has traditionally supported higher crane nesting densities than other wetlands within the YWC (Houston 1949; Reed 1903).

Historically, Rokeby Marsh has had less human disturbance than other marshes in the YWC and has maintained its vegetative composition of dense Hardstem Bulrush. Rokeby Marsh has the most stable, permanent water levels of any of the wetlands in the YWC and a mosaic of grazed and harvested pastures, fallow areas, and cultivated lands surrounds it. During dry years, water levels on Rokeby Marsh are low, but the marsh has never dried out completely (R. Kirkness, Ducks Unlimited Canada, personal communication). Permanent wetlands retain their character for decades except in years of extreme drought (Eldridge 1990). Under permanent water conditions, Hardstem Bulrush is stable and may survive for many years (Millar 1976).

In other wetlands within the YWC, shorelines and water depths fluctuate more widely, and vary in vegetative structure and diversity (Schmidt 1973*). During the recent study, new growth was sparse along many basin shorelines and residual emergent vegetative growth was virtually non-existent when cranes were initiating nesting in early spring.

Sandhill Crane pairs are capable of producing at most two offspring per year. Year-to-year variation in the number of offspring reared produces significant variation in annual productivity (Johnsgard 1983). The number of young fledged per year was 0.80 young fledged per pair over three years (15 pairs, 12 young), above the norm of 0.35 young per year cited by Nesbitt (1992). In contrast, Dimatteo (1992), in aspen parkland habitat on the Agassiz National Wildlife Refuge in northwestern Minnesota found 1.2 young fledged per pair during a two-year period (34 pairs, 42 young). However, nesting and fledging success rates depend largely upon local and highly variable factors such as weather conditions, water levels, degree of disturbance, and predation rates (Johnsgard 1983).

In my study, disturbance, mate change and adult mortality affected individual pair productivity. Indirect evidence indicated that predation also impacted productivity. We frequently observed Coyotes in uplands adjacent to wetland areas, and I observed American Crows (*Corvus brachyrhynchos)* destroying Blue-winged Teal (*Anas discors)* nests. On one occasion, a Coyote repeatedly flushed an adult crane in an upland adjacent to Rokeby Marsh, and a Coyote flushed a female Sharp-tailed Grouse (*Tympanuchus phasianellus)* and ate five pre-fledged chicks. Depredated duck carcasses were not uncommon in the shallow marsh zones around Rokeby and Maddaford Marsh and the wetlands used by roosting cranes. Coyote predation was found to be the major mortality factor affecting eggs and pre-fledged Sandhill Crane chicks in Oregon (Stern et al. 1987; Littlefield and Lindstedt 1992). Other possible crane predators in the complex include: Common Ravens (*Corvus corax)*, Raccoons (*Procyon lotor)*, Striped Skunks (*Mephitis mephitis*), Red Foxes (*Vulpes vulpes*), Mink (*Mustela vison*), Northern Harriers (*Circus cyaneus*), and Great Horned Owls (*Bubo virginianus)* (Schmidt 1973*; Genter 1985; Armbruster 1987).

I found between three (1997) and five (1995) territories occupied by cranes on Rokeby Marsh. Historical records indicate that in 1901-1964 and 1993, Rokeby Marsh has supported one to six nesting pairs of Sandhill Cranes annually (Houston 1949; Reed 1903; D. Hjertaas, Saskatchewan Environment and Resource Management, personal communication). This evidence suggests inter-year variation in carrying capacity. Climatic conditions, water levels, vegetative structure, and the size or characteristics of uplands within territories vary irregularly over time and alter habitat conditions, resulting in a fluctuating number of crane pairs on the marsh within any given year. Variation in nesting conditions and short breeding season length combine to limit habitat carrying capacity.

Historical records indicate that although Sandhill Cranes have occurred in the Yorkton region for over 120 years, the number of resident breeding pairs has declined sharply. During the late 1880s – 1890s, Sandhill Cranes were recorded as regular and common breeders around Rokeby Marsh, Good Spirit Lake, and Crescent Lake but by 1949, cranes were listed as only rare summer residents in the Yorkton area (Houston

1949). Loss and degradation of wetland and wildlife habitat, drought, and sport and subsistence hunting likely impacted these historic resident crane populations (Schmidt 1973*, Johnson 1976; Turner et al. 1987).

We found low annual productivity and concurrent low recruitment rates (percentage of juveniles within the population) on Rokeby Marsh and the YWC. This may explain why previously occupied territories are vacant in some years. Offspring return to their natal area as subadults and, as adults, eventually select mates and either colonize new territories in the area or replace absent pairs (Drewien 1973; Duan et al. 1997). Vacant territories may be a consequence of low recruitment and survival rates as there are limited numbers of resident adults available to fill vacant yet suitable territories. Low annual recruitment rates limit the ability of Sandhill Cranes to recover from population declines (Tacha et al. 1992).

Hunting mortality may also limit the growth of the resident crane population. Resident cranes are exposed to hunting along their entire migratory route. Timing of their departure from the study area and from traditional staging areas may expose this population to greater hunting pressure than on cranes from other breeding populations. To date, no long term data on recruitment or survival rates have been collected for the mid-continental populations, and currently the effects of hunting on specific breeding populations are unknown (Drewien et al. 1995). Banding recoveries indicate that hunting mortality in the mid-continental flock can equal or exceed the species estimated 10% recruitment rate (Johnsgard 1983). A future investigation to determine the effect hunting plays on resident crane populations in southern Saskatchewan is warranted.

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