

BELOW AVERAGE WHOOPING CRANE PRODUCTION IN WOOD BUFFALO NATIONAL PARK DURING DROUGHT YEARS 1990 AND 1991

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The production of juvenile Whooping Cranes on their breeding range in Wood Buffalo National Park (WBNP) in the period from 1984-1989 was unsurpassed by any previous period of six consecutive years. Between 15 and 25 juveniles annually reached the winter range at the Aransas National Wildlife Refuge (ANWR) in Texas during that time, averaging a production of 19.3 wintering young per year.

Each year, during the late May removal of surplus eggs from the Whooping Crane breeding range in and near WBNP, we measure the water depths of nesting ponds at 1-m distance from the nest edge. Mean annual water depths recorded since 1976 (Table 1) indicated two periods of high water levels (1976-1979 and 1982-1989) and two periods of low water levels (1980-1981 and 1990-1991). Tests showed that water depths in the two high water periods did not differ nor did those between low water level periods. Water depth in both high water level periods was significantly different ($p < 0.001$) than that in both low water periods.

Average pond depths from 1976-1991 varied from 14.3 - 27.8 cm. During this period, production of juveniles (i.e., birds arriving at ANWR) varied from 0.12 - 0.78 juveniles per

breeding pair (Table 1). Annual production of juveniles was significantly correlated ($R^2 = 0.446$; $p < 0.05$) with yearly mean water depths at nest sites. This relationship is described by the linear regression: productivity = $-0.206 + (0.032 \times \text{mean water depth})$. In the more recent high water level period (1982-1989) there was a steady increase in production of juveniles until 1987 when the all-time record of 25 juveniles was established.

There appears to be a one-year lag in the decline in production in response to lowered water levels, somewhat similar to the effect of a decline in water levels from 1979 to 1980. This two-year period exceeded the 1981 production of two juveniles (17 breeding pairs), the lowest production (equalling that of 1973 and 1974 for which no water level data are available) since 1967 when the Canadian Wildlife Service (CWS) began expanding management and research of Whooping Cranes on the breeding range.

The one-year lag in response to changes in nest pond water depths also occurred when water depths increased (1978-1979; 1980-1981) but productivity declined. Perhaps pond water depth (and thus productivity) in part is correlated with the previous year's soil moisture reserves. Unless

Table 1: RELATION BETWEEN ANNUAL NEST POND WATER DEPTHS AND PRODUCTION OF JUVENILE WHOOPING CRANES, 1974 - 1991

Year	Mean water depths (1m from nest)	Nest ponds sampled	Production*	Breeding pairs	Young per pair
1966-73	no data	—	—	—	—
1974	52.5	1	2	15	0.13
1975	31.0**	12	8	16	0.50
1976	27.8	15	12	16	0.75
1977	22.2	17	10	17	0.59
1978	21.1	12	7	15	0.47
1979	24.9	18	6	19	0.32
1980	14.3	12	6	19	0.32
1981	16.2	13	2	17	0.12
1982	21.5	16	6	17	0.35
1983	20.5	18	7	24	0.29
1984	24.3	16	15	29	0.52
1985	25.3	27	16	28	0.55
1986	26.1	27	21	29	0.72
1987	22.6	25	25	32	0.78
1988	22.1	28	19	31	0.61
1989	23.4	25	20	31	0.65
1990	15.3	18	13	32	0.41
1991	14.7	17	8	33	0.24

* juveniles arriving at ANWR

** measured at 30 cm from nest, excluded from analysis

the mean 1992 nest pond water depth increases to about 20 cm or higher, it is unlikely that the 1992 production of juveniles will increase significantly above 0.24 juveniles per breeding pair (Table 1).

Satisfactory water depths in the breeding range are of critical importance. Whooping Cranes select shallow ponds, islands and marshes as nesting areas and use emergent wetland vegetation such as bulrush, sedge and cattail as nest material. During spring and summer, the cranes forage almost exclusively in wetlands, particularly along the margins of shallow ponds, where larval and nymphal forms of insects may occur, as well as leeches, snails, small fish and frogs. With lowering water levels, pond margins become exposed, revealing foraging cranes and their flightless chicks; the birds' feeding opportunities decline, frequently forcing them to travel overland to the next pond and exposing

themselves to terrestrial predators. These predators, such as the Gray Wolf, find it easier to travel in drying areas and, when wolves encounter crane chicks, the deaths of the flightless cranes are inevitable. Wolf predation of Whooping Crane chicks was first documented in 1979 and recorded again in 1982 and 1983.²⁴

By the end of February 1990, about 76 cm of snow covered the ground in Fort Smith, Northwest Territories, the weather station nearest the Whooping Crane breeding range. This amount of snow was greater than for any of the previous six years. Although cold weather in April and May maintained relatively stable water levels in the region, it may have delayed production and maturation of invertebrates. Mosquitoes did not become numerous in the district until about 12 June, and observations of insectivorous birds (i.e.,

Eastern Phoebe) were 11 days later in 1990 than in the previous year. This slow warming trend delayed initiation of nesting and may have discouraged four previously breeding pairs from nesting at all.

Water levels in nest ponds in 1990 were the lowest since 1980 (Table 1). Readings in 1990 of CWS water gauges (located along Highway 5, south of the centre of the crane nesting area) confirmed a continuing decline in water levels throughout the summer, further corroborated by the findings of the National Hydrology Research Institute.⁵

CWS aerial surveys over Whooping Crane breeding range in 1990 were flown between 29 April and 25 May. During the seven surveys we located 30 nests and found two more on 9 June. The total of 32 nests equalled the record established in 1987. After the removal of 12 surplus eggs on 27 May 1990, 47 eggs remained in nests in WBNP. Daily production surveys flown from 6-11 June indicated that at least 29 chicks had hatched between 27 May and 11 June. On 11 June, 22 chicks remained, with eight eggs still unhatched.

The final series of four aerial surveys in 1990 was completed from 29 June to 4 July. At that time, 16 chicks were still alive, including 2 from the 8 late eggs. A month-old dead chick was sighted from the air on 1 July and recovered. A necropsy of the female chick did not show evidence of trauma nor of starvation but there was a possibility of enteritis. The carcass was heavily autolyzed however, and no diagnosis of cause of death could be made (Dr. D.K. Onderka, pers. comm.). Chicks are not capable of sustained flight until about 15 August and evidence of three further losses (probably on the breeding range) became apparent when 13 juvenile cranes were counted at 50(4). December 1992

ANWR in fall 1990 (Tom Stehn, pers. comm.).

The peak 1990-1991 wintering population of 146 birds at Aransas suffered severe losses. Eleven birds including five of the 13 juveniles and at least three adults from different breeding pairs died. Only one carcass was found but it had deteriorated and cause of death would not be established. (The nonbreeding segment [almost half] of the crane population is largely in WBNP with a few birds probably elsewhere in Alberta and Saskatchewan.)

During spring 1991 migration, an adult female Whooping Crane was shot in Texas and the two men responsible for the shooting were convicted and sentenced. An estimated 135 Whooping Cranes completed the northward migration.

Climatic conditions at Fort Smith in spring 1991 were similar to those of the previous year. Spring precipitation was not greater than in 1990. No appreciable precipitation was recorded from March to the end of May (Flight Services, Transport Canada). Whooping Crane nest pond water levels recorded during the 28 May 1991 removal of surplus eggs averaged 14.7 cm, even lower than the previous year's figure and almost identical to that of 1980 (14.3 cm), the lowest level recorded (Table 1).

A dry spring around Fort Smith was followed by one of the wettest Junes on record (rain on 16 days), followed by 15 days of rain in July. June and July precipitation figures were respectively 114.4 and 86.6 mm (Flight Services, Transport Canada). Although WBNP was lush green in the summer of 1991 and provided good cover for young cranes, the rains may have come too late to allow invertebrate food stocks to increase in time. The almost continuous rains for much of June and July may have disrupted crane feeding, thus increasing mortality of small chicks.

Aerial searches for nests in 1991 were carried out from 28 April to 24 May. We located 32 nests and one additional family. These 33 known nestings established an all-time record dating back to at least 1938. Eleven colour-banded (and thus identifiable) birds and three un-banded cranes, comprising seven previously nesting pairs, were found but were not nesting in 1991. Several of the birds had lost mates during the previous winter. Three other banded pairs and a single bird, all expected to nest for the first time in 1991, failed to breed. On the bright side, we found four novice nesting pairs as well as another bird nesting for the first time with a previous breeder. We assume that unfavourable habitat conditions in spring discouraged many experienced and novice breeders from nesting in 1991.

Of the 33 nests accounted for, 28 or 29 contained two eggs each and at least four contained a single egg. Three of eight birds in attendance at one-egg clutches were novice breeders. One nest was abandoned before 28 May and the re-nesting effort also failed. Two nests with two eggs each were found destroyed before the egg pickup (most likely by a Black Bear, who may also have taken the eggs from a nearby Sandhill Crane nest) and a fourth nest (with two eggs) not found until 19 May and not visited during the egg pickup, had been abandoned on 12 or 13 June.

On 28 May we visited 20 nests and collected 16 surplus eggs. Thirteen nests were not visited: eggs in one nest had already hatched, several nests had been destroyed, one nest was too far from the core nesting area, eggs in several late nests were too young and thus not suitable for transport and a few other

nests were skipped as they were too close together and visiting one nest would have disturbed the others as well. We substituted single, live eggs into seven nests and removed five non-viable eggs and two late eggs (from single-egg clutches). Substitutions are made to ensure that the maximum number of nests will have at least one viable egg.

During the annual egg collection, viability of eggs in nests is tested by placing the eggs in a container of 30-35°C water and watching for movements of the egg. In this way, non-viable eggs can be identified and removed from the field. Live eggs are substituted into nests containing non-viable eggs, are sometimes exchanged for eggs of doubtful quality or exchanged with eggs which are too young for meaningful viability tests. A comparison of the hatching success of tested and untested eggs between 1985 and 1988 indicated an increase in hatching success of about 15 percent as a result of these manipulations.¹ Undoubtedly the technique also enhances the production of juvenile Whooping Cranes.

At the completion of the 1991 egg pickup and substitution, 18 nests contained a single egg. Two eggs of unknown quality were in eight other nests. The egg(s) in three nests had already hatched on 28 May, two nests had been destroyed before that date, one nest contained a single egg of unknown quality (a re-nesting effort which later failed) and one nest was not found (although the adults and single chick were later observed). This accounts for all 33 nests known in 1991.

The 16 eggs collected (including the five non-viable ones) were shipped to the Patuxent Wildlife

Research Centre, United States Fish and Wildlife Service (USFWS) near Laurel, Maryland, where six of the 11 viable eggs hatched. Five embryos (an unusually high number) died at various stages of incubation.

During 10-15 June surveys in a USFWS aircraft we observed 21 chicks, six of them from substituted eggs. From the eight two-egg clutches not visited during the egg pickup, five pairs of cranes each had a single chick, one pair had both chicks and the other two pairs had lost both eggs or chicks. By the end of this period, about 16 eggs or chicks had disappeared and, added to the pre-pickup losses of four eggs, 20 (44%) of the 45-46 eggs or chicks had already been lost.

Further losses continued during the summer as evidenced from aerial surveys on 17 and 20 August when Kuyt accounted for nine crane families, each with a single juvenile. Only one family, known to be intact on 15 June could not be found but all other nesting pairs (except one novice breeding pair) were believed to have been located on those two days.

Eight of these nine families made it safely to ANWR as part of a total wintering population of about 132 cranes (T. Stehn, pers. comm.). This is the second consecutive year that Whooping Cranes in the WBNP-ANWR population have not increased; they held their own in 1990, and declined from the preceding year in 1991. These two years of production were preceded by seven consecutive years (1983-1989) of numerical increases in the population. The loss of one or two year's production is largely due to unfavourable habitat conditions in WBNP. Of far greater significance, particularly in the long term, is the continuing satisfactory survival of subadults (nonbreeding) and the concomitant increase in the number of proven and

potential breeding adults. With 33 observed nests or family groups and ten pairs not nesting in 1991 but expected to have done so (seven previously breeding pairs; three novice pairs), there was a potential of 43 breeding pairs in 1992.³ Studying winter distribution of Whooping Cranes, Tom Stehn found that as many as 46 winter territories were occupied by known breeding pairs or families and by pairs with a high degree of frequency of association.⁶ The latter pairs generally form breeding pairs. To reach a record number of breeding pairs in the next few years, Whooping Cranes must be exposed to no more than marginal mortality during the rest of the 1991-1992 winter and must have acceptable spring and summer habitat conditions in WBNP in 1992.

1. KUYT, E. 1992. Case study: Whooping Crane. Chapter 4 - Reproductive manipulation *In* The management of populations of endangered bird species. Technical publication, International Council for Bird Preservation, in press.
2. KUYT, E. and J.P. GOOSEN. 1987. Survival, age composition, sex ratio and age at first breeding of Whooping Cranes in Wood Buffalo National Park, Canada. Proc. 1985 Crane Workshop, Grand Island, Nebraska, pp. 230-244.
3. KUYT, E. and B.W. JOHNS. 1991. Location of nonbreeding and novice breeding Whooping Cranes, Wood Buffalo National Park - 1991. Unpublished Canadian Wildlife Service Report. 22 pp.
4. KUYT, E., B.E. JOHNSON and R.C. DREWIEN. 1981. A wolf kills a juvenile Whooping Crane. *Blue Jay* 39:116-119.
5. MCNAUGHTON, D. 1991. Hydrological investigations Wood Buffalo National Park 1985 to 1990. Report prepared for Canadian Parks Service, Fort Smith, NWT. 15 pp., figures and appendices.
6. STEHN, TOM. W. Whooping Cranes during the 1990-1991 winter. Unpublished United States Fish and Wildlife Service Report. 103 pp.