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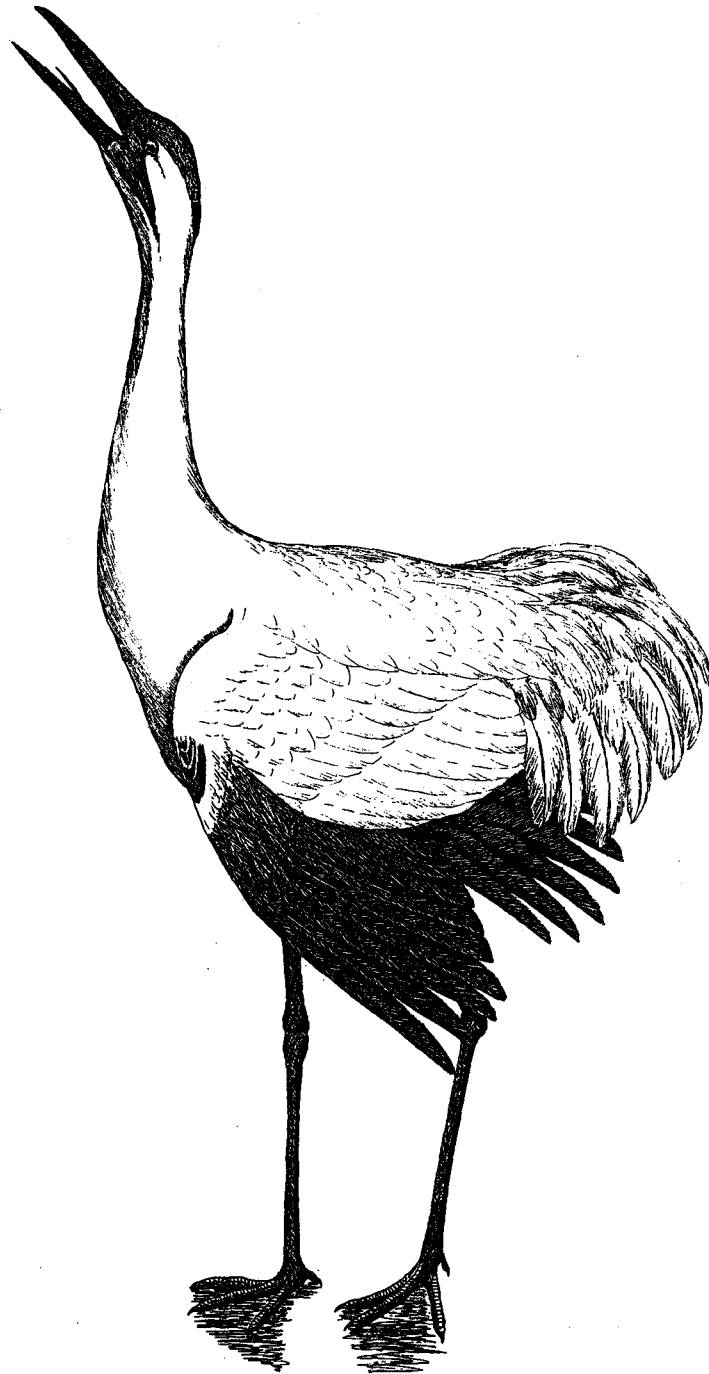
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Cranes of the World in 2008

**A Supplement to *Crane Music* (Paul A. Johnsgard, Smithsonian Institution Press,
Washington DC, 1991 (ISBN 1-56098-051-6)).**

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Time proceeds inexorably onward, and it has been 17 years since the first edition of *Crane Music* was published. During that time more than a billion people have been added to the earth's roles, and global warming has increasingly been recognized as a real threat to our planet's future. Although during that period a small percentage of Americans have become very rich through advances in technology, expanding markets and globalization, wildlife in general has suffered. Continuing population growth and associated economic and ecological pressures have resulted in greatly increased deforestation, wetland drainage, and destruction of natural habitats. Additionally, global climate changes are bringing on unforeseen massive ecological changes that will have serious effects on crane populations, especially in arctic and alpine regions (Harris, 2008).

Downward population trends in wildlife that are associated with these factors are especially apparent among native grassland and wetland-dependent birds; nearly all of North America's grassland-adapted birds are now in serious continental decline, and probably much the same is true elsewhere in the world. Most of the world's cranes are also to a large degree dependent on grasslands and wetlands; those that are generally the rarest and most in danger of extinction are the ones most strongly dependent on extensive wetlands. The whooping, Siberian, white-naped, wattled and Japanese (red-crowned) cranes are all strongly wetland-dependent for breeding, and are now among the world's rarest and most endangered species. On the other hand, some relatively herbivorous and terrestrial species such as the sandhill, Eurasian, demoiselle and blue cranes have learned to take advantage of agricultural technology by incorporating into their diets of native plants various cultivated grains, such as corn and wheat in Europe and rice in Asia. As a result these species have exhibited local, regional or even national population increases. Such foraging practices have often brought cranes into conflict with agricultural interests, resulting in economic conflicts and sometime draconian control measures.

An overview of the current status of the world's cranes is perhaps in order, to bring up to date the accounts given earlier in *Crane Music*, which was written nearly 20 years ago. The accompanying table presents an updated (as of about 2004–2008) summary of world crane distribution and status, which shows some significant differences from the similar table presented in the first edition of that book. Some of these differences are the likely result of more complete and more accurate surveys, such as the substantially increased estimate of the black-necked crane's population, previously thought to number only about 1,600 birds. The same factor may help account for the larger estimates shown for the Siberian crane and blue crane.

According to the criteria of the International Union for Conservation of Nature and Natural Resources (1994), six crane species and five additional subspecies were classified as endangered or critically endangered by Curt Meine and George Archibald (1996). Several other local or regional populations of the blue crane, demoiselle crane, wattled crane and Siberian crane are now also at high risk of disappearing. For example, the tiny central and western populations of the Siberian crane that bred near the Ob Valley of central Siberia and until recently wintered in India is extinct. Surveys in 2008 of this crane on its Yakutia breeding grounds in northeastern Russia found only ten breeding pairs, and only two of these had chicks. The Atlas Mountains population of the demoiselle crane is also extinct, while the Iranian population of the Siberian crane is

A SUMMARY OF THE CRANES OF THE WORLD AND THEIR STATUS

Species and Subspecies	Approximate World Population ¹	Breeding Areas	Population Status & Trend ²
Black Crowned Crane			
W. African race	<i>ca.</i> 11,500–17,500	Gambia to Chad	Endangered, declining
Sudan race	<i>ca.</i> 43,000–53,000	Sudan to Kenya	Vulnerable, uncertain
Gray Crowned Crane			
S. African race	<i>ca.</i> 8,000–12,000	Southern Africa	Endangered, rapid decline
E. African race	<i>ca.</i> 50,000–60,000	Kenya to Malawi	Vulnerable, rapid decline
Siberian Crane	<i>ca.</i> 3,500	Central & E. Russia	Endangered
Wattled Crane	7,000–8,000	Botswana, Zambia	Vulnerable, declining
Blue Crane	23–26,000	South Africa	Vulnerable
Demoiselle Crane	<i>ca.</i> 200,000–300,000	Central Asia	Lower Risk, increasing
Australian Crane	<i>ca.</i> 40,000–50,000	Australia	Lower Risk, stable
Sarus Crane			
Indian race	<i>ca.</i> 8,000–10,000	India & Nepal	Endangered, declining
Eastern race	<i>ca.</i> 1,000	Indochina	Endangered
Australian race	<i>ca.</i> 5,000	Northern Australia	Uncertain
White-naped Crane	<i>ca.</i> 7,000–8,000	Northeast China	Vulnerable, increasing
Whooping Crane³			
Great Plains	267	Canada, Texas	Increasing
Eastern U.S.	71	Wisconsin–Florida	Increasing
Florida (resident)	40	Florida	Decreasing
Sandhill Crane⁴			
Lesser race	<i>ca.</i> 450,000	Siberia, N. America	Lower Risk (declining?)
Greater race	<i>ca.</i> 65,000–75,000	Northern USA	Lower Risk (increasing)
Florida race	<i>ca.</i> 4,000	Florida	Lower Risk (stable)
Mississippi race	130	Mississippi	Critically Endangered
Cuban race	650	Cuba	Critically Endangered
Japanese Crane	2,500–2,700	China, Japan, Russia	Endangered
Hooded Crane	<i>ca.</i> 11,500	Eastern Asia	Vulnerable, stable
Black-necked Crane	<i>ca.</i> 11,000	Tibetan Plateau	Vulnerable, increasing
Eurasian Crane	<i>ca.</i> 450,000	Eurasia	Lower Risk, increasing

¹ Estimates (as of *ca.* 2004–2005) based largely on Von Treuenfels (2006) and Beilfuss, Dodman & Urban (2007), except for North American species

² Status estimates mostly based on Meine & Archibald (1996), trends based largely on Ellis, Gee & Mirande (1996),

³ Population numbers as of early 2008, excluding captive populations

⁴ Population estimates as of 2007; lesser race population includes the questionable Canadian race *rowani*

nearly if not entirely extinct. The world populations of black crowned crane and gray crowned crane are also evidently declining, although the gray crowned crane still is widespread over much of eastern Africa.

Likewise, the Asian mainland population of the Japanese crane is evidently declining. However, the Japanese population on the northern island of Hokaido has been slowly increasing since the early 1970's, as the result of special protection of the birds' limited breeding areas and winter feeding. Under these conditions, their numbers have increased forty-fold, from little more than 50 birds in 1972 to more than 1,240 in 2006. These magnificent birds have attracted a significant audience from tourists and wildlife photographers, adding greatly to the local economy. Like the story of our whooping crane's near brush with extinction, this species' return from near extinction is one of the greatest successes in bird conservation.

The hooded crane of eastern Asia is only somewhat larger than the demoiselle, and its breeding grounds in eastern Siberia still remain to be well documented. Birds that summer north and east of Lake Baikal fly south and winter along the Yangtze River of China. This western population is thought to consist of about 1,000 birds. A larger group, after breeding in far-eastern Russia and northern China migrates south through Korea (where some stop and overwinter) to Japan's southern island of Kyushu. There, in very small protected areas, the population has progressively increased, from about 260 in the mid-1900's to more than 10,000 by 2006. Like the Japanese crane, the birds have responded strongly to wintering-ground protection and artificial feeding where the birds risk increases chances of disease outbreaks and conflicts with local farmers. The world population appears to be stable, if not increasing.

Substantially larger numbers of demoiselle and Eurasian cranes are now known to exist worldwide than had been previously believed. About half the world population of nearly a third of a million demoiselles winters in Gujarat, northern India, after having bred in the central Asian steppes of Kazakhstan, Kirgistan and Uzbekistan. Other demoiselles winter in eastern India, after flying in from distant Mongolian breeding grounds and navigating over the towering Himalayan Mountains. The remoteness of their arid and little-populated breeding grounds offers the best hope for the continued abundance of these elegant cranes.

Likewise, the Eurasian crane's breeding habitats extend from Scandinavia eastward across virtually all of Russia, giving it perhaps the broadest breeding range of all crane species, and making it probably the second-most common of all cranes, at about half a million birds by 2006. In Europe these cranes have recently extended their breeding range south in Germany, where as many as 5,400 were breeding by 2006. Breeding now occurs locally in Great Britain, France, the Netherlands, the Czech Republic and Hungary. By 2005 at least 160,000 cranes were wintering in France, Spain and Portugal, while another 100,000 or more were migrating from the Baltic Sea through central Europe to wintering areas scattered from the Mediterranean coast of Africa south to Ethiopia and Sudan. Wintering areas in Europe have shifted to the north in recent years, with about 70,000 cranes wintering in France during 2000–2001, as compared with only about 100 only two decades previously. Much of this recent range expansion of both breeding and wintering European ranges can be attributed to effective international protection and to increased corn production, which Eurasian cranes have learned to exploit in the same manner as have sandhill cranes in North America.

Population estimates for the Australian crane have varied greatly in the past, and the estimate of 15,000–20,000 given in my earlier summary needs updating. Much of the confusion over the Australian crane's population stems from early and unverified statements to the effect that as many as 100,000 birds might have been present. This estimate has recently been reduced by about 50 percent to 40,000–50,000 birds, most of which are centered in Queensland. Additionally, there is a small group in southern New Guinea, and a declining population of only 500 to 1,000 birds in Victoria. Australian cranes are everywhere dependent on seasonal wetlands for nesting. As noted earlier, they forage broadly on a variety of invertebrates and vegetation, but especially favor the tubers of "bukuru," a native wetland sedge. When natural foods are lacking, such as during droughts, the birds will resort to feeding in agricultural fields, bringing them increasingly into conflict with farmers. Because of widespread destruction of wetlands, reduced natural foods, and competition (as well as hybridization) with the larger sarus crane, the long-term future of the Australian crane is somewhat clouded.

In India, breeding of the native sarus crane is timed to coincide with the monsoonal rains, when days of torrential rain alternate with very hot and humid ones. The largest known breeding populations are centered in northern India, in the boundary area of Etawah and Mainpuri districts of southwestern Uttar Pradesh. During the late 1990s and early 2000's about 250 breeding pairs occurred here, but recent construction, conversion of wetland to farmland, human disturbance and pesticide applications have reduced the breeding population of this single most important wetland for sarus cranes. That any cranes have managed to survive and continue to breed in this densely populated region is certainly to be welcomed, but human population growth throughout the world has resulted in an ever-increasing threat to the long-term survival of all the world's cranes.

The Sandhill Crane

The most common crane in the world at present is the North American sandhill crane. In the first edition of this book its estimated numbers were: lesser sandhill 500,000, Canadian sandhill (now considered as part of the lesser race) a few thousand, greater sandhill 35,000–40,000, Florida sandhill about 4,000, and the Mississippi and Cuban sandhills about 50 birds each. The accompanying table shows that all of these except the lesser race have undergone varying amounts of population increases since the early 1990's, whereas the lesser's numbers have evidently declined somewhat in recent years.

The most numerous of these races, the lesser, has two population components. A relatively small number (perhaps ten percent or less) nest in southern Alaska and winters in the Central Valley of California. The major component consists of the "mid-continent" population that breeds on arctic tundra from the Kolymaskaya Plains of Siberia eastward to coastal Alaska and northern Canada. It winters thousands of miles to the south, in widely spread wetlands of southeastern Arizona, New Mexico, Texas and northern Mexico. However, during the spring flight north nearly the entire mid-continent population concentrates during March in the Platte Valley, where it can be readily counted. The average Fish and Wildlife Service Platte Valley count for 2002–2004 was 375,875 birds, as compared with maximum estimates of 510,000 in 1982 and 515,000

birds in 1985. Counting that many cranes accurately is difficult, but it would appear that this population has been in slight decline since the 1980's or early 1990's.

The cranes are not alone in their spring use of the Platte Valley. Since the 1990's more than a million snow geese have moved from their traditional spring route along the Missouri Valley west into this fertile valley, supplementing the million or more Canada geese, cackling geese and white-fronted geese that have traditionally used the region as a spring staging area. The cold-hardy snow geese typically reach peak numbers nearly three weeks before the cranes attain maximum numbers, getting an early start on consuming the waste corn that has been the crane's primary spring "fuel" ever since the advent of the region's corn-growing culture that developed after World War II.

Corn-based agriculture mushroomed with the development of center pivot irrigation a few decades later, using ever increasing amounts of water diverted directly from the Platte or pumped from its closely associated water table. As a result, groundwater levels declined an average of nearly six feet in the Central Platte Natural Resources District between 1999 and 2006. Not only did groundwater levels decline seriously at this time, but also after an extended drought and increased upstream surface-water diversions, the Platte River proved to be exhaustible. During that period the Platte's largest impoundment, Lake McConaughy, also sank to historic low levels, and for several weeks during the summers of 2002 through 2006 the river completely dried up from Grand Island to Columbus.

As a part of a related and long-negotiated federal relicensing agreement, Lake McConaughy's operators agreed in 1998 to set aside ten percent of the lake's storable inflows as an Environmental Account. This water would be released for maintaining wetland habitats of the central Platte Valley when needed. In essence, the recovery plan, formalized in 1997 by the Department of Interior and the three affected states, would fulfill the basic requirements of the Endangered Species Act; thus protecting the whooping cranes and three other federally listed species. The agreement's primary function would add and restore up to 30,000 acres of wetland habitats in the central Platte Valley. It remains to be seen whether the costly recovery plan will be fully funded and enacted by the participating parties. Nebraska has already failed to live up to its agreements relative to begin, by December of 2008, to make up for water-depletions caused by irrigation wells drilled since the recovery plan was formalized in 1997. If Nebraska or the other parties come up short, the future of the Platte Valley as a primary spring staging area for migrating cranes and waterfowl will be put at great risk.

While center-pivot irrigation in the Platte Valley has produced far more corn than did previous dry-land agriculture, the progressive dewatering of the Platte has had disastrous effects on the ecology of the both river and its associated sub-irrigated wet meadows. Yet, even with the present-day near-monoculture of corn in the Platte Valley, cranes have had increasing difficulties in finding sufficient leftover waste corn each spring for accumulating enough body fat to carry them thousands of miles to their tundra breeding grounds. Harvesting technology has also progressively improved, gradually reducing the amount of corn that remains unharvested. For arctic-bound cranes, the combination of fewer wet meadows (their primary source of invertebrate foods) and diminished supplies of their primary carbohydrate food base means that there will be decreased chances of surviving the spring migration and successfully completing the next breeding season. The gradual increase in spring snow goose populations in the Platte

Valley has added to the other goose populations already present, and has increased the problems of laying down fat during the cranes' stopover period. Late March body weights of both lesser and greater sandhill cranes weighed in 1978 and 1979 were found by Gary Krapu and others to be significantly greater than those weighed in 1996.

Increased stress in finding spring food is not the only danger the cranes now face. "Recreational" crane hunting has become increasingly more popular in the Great Plains since it was initiated as an "experimental" hunting season in Texas and New Mexico during the early 1960's. Legal crane hunting now occurs in Colorado, Kansas, Montana, New Mexico, North Dakota, South Dakota, Texas and Wyoming. The popularity of crane hunting has gradually increased in these states, with Nebraska remaining the only Central Flyway state still lacking an open season. For the 30-year period 1975–2004, the collective crane kill for these states, including those birds killed but unretrieved, averaged 15,719 birds. There has been a gradual increase in kills over this time frame. For example, between 1975 and 1984 the average total kill was 12,010, while between 1995 and 2004 the ten-year average was 19,044 birds, an increase of 58 percent. The total kill for the 2005-06 season was 20,063. During the 2004-05 and 2005-06 seasons Texas hunters generated 64.5 percent of the total kill, and North Dakota accounted for another 23.4 percent.

Sandhill hunting also goes on in Alaska, Canada and Mexico. Available data suggest that kills in these regions are small by comparison. The 1975–2001 average retrieved kill for Alaska was less than 1,000 birds, and that of Canada (Manitoba & Saskatchewan) averaged under 5,000 birds for the same period. However, the average 2000–2002 Canada kill was 8,728 birds, suggesting recent increasing kill rates similar to those in the US. No data are available from Mexico. However, adding in the known Canadian and Alaskan numbers to those for the Central Flyway states, it is likely that at least 30,000 sandhill cranes are now being legally shot in Alaska, Canada and the Central Flyway states.

Assuming that the mid-continent sandhill crane population now has about 375,000 birds in spring, and there is a 9.0 percent recruitment rate, about 34,000 young cranes should enter the population each fall. In that case, nearly 90 percent of the potential annual population increase are being killed by hunters, leaving very few others for basic mortality factors such as predation, disease and accidents. Since unhunted sandhill crane populations, such as the Florida race, have a known mortality rate of at least ten percent, one would expect an additional loss of 37,000 birds from such sources every year. The recent apparent population decline in this population is therefore not so much a biological conundrum as it is a mystery why the Fish & Wildlife Service administrators value the so-called "recreational" killing of sandhill cranes above valuing them for their fundamental aesthetic values, as is generally recognized throughout the civilized world.

The greater sandhill crane had done relatively better than the lesser sandhill crane in recent decades. It consists of four major populations, plus a small one that have only recently been recognized as distinct. Population estimates for these have been provided by Curt Meine and George Archibald, as of the early- to mid-1990's. The eastern (Great Lakes) population probably exceeds 30,000 birds, which migrate to wintering grounds in southern Georgia and Florida. This population has increased greatly in recent decades, and has expanded its range into some parts of its historic range in southern Minnesota,

Iowa, Illinois, Ohio and Pennsylvania, New York and Maine. A nearby population in northwestern Minnesota and adjacent parts of Manitoba and Ontario consists of perhaps 10,000–15,000 birds. Unlike the other Minnesota flocks, these birds migrate directly south to winter on the coast of Texas, where they mingle with smaller cranes from northern Canada, and are exposed to significant sport hunting.

The Rocky Mountain population of greater sandhills was estimated at 20,000–21,500 in the early 1990's by Roderick Drewien, Wendy Brown and William Kendall, and was judged by them to be stable or slightly declining. These birds have a major fall stopover in the San Luis Valley of Colorado, and wintering occurs in western New Mexico and southeastern Arizona. Annual fall recruitment rates over 21 years averaged 8.1 percent, and survival rates ranged from 91–95 percent during that period. Arizona began a hunting season in 1981, and was later successively joined by New Mexico, Utah, Montana and Idaho. In 1995, Drewien, Brown and Kendall concluded from recruitment and mortality data that the Rocky Mountain population could not sustain any increased harvests. The average retrieved kill from 1990 through 1994 was 406 birds. However, by 2002 about 600–800 cranes were annually being killed for sport in these five states, indicating that no efforts at controlling the kill have since been made.

In addition, there is a relatively small (1,400–2,100) population that breeds in northeastern Nevada and southwestern Idaho, and winters along Arizona's lower Colorado River and Gila River, and in California's Imperial Valley. There is also a larger (6,000–6,800) population breeding from southern British Columbia south to northeastern California, and wintering in California's Central and Imperial valleys. At least the latter population might be increasing.

The resident Florida race of the sandhill crane is thought to be a stable population. Since the late 1970's it has numbered about 4,000 birds, all in Florida except for a population in the Okefenokee Swamp, Georgia. Studies by Stephen Nesbitt and others indicate that these birds may attempt to breed when males are as young as two years, and females at three. The modal age for first successful reproduction was five years, and mean individual productivity was 0.35 young per year. There is a long breeding season of up to nine months. As many as three reneesting efforts have been observed, even after chicks have survived as long as 16 days, with an average reneesting interval of 19.5 days. The average clutch size of 210 nests was 1.78 eggs, and the average post-fledging brood size was 1.27 young. These are among the highest brood sizes reported for any sandhill crane population. Yearly percentages of juveniles in the population ranged from 6.7% to 17.8 percent over seven years, averaging 11.9 percent. Adult annual survival was estimated as 86.7 percent. A similar study in Georgia indicated a mean adult survival rate of 89 percent, with females having somewhat better survival rates than males, and adults better than subadults. Bobcats are evidently important predators in this race. All told, these statistics would indicate that this should be an expanding population. However, the Florida population is seemingly limited by habitat fragmentation and loss. It has nonetheless adapted very well to sometimes almost suburban situations.

Both the Mississippi and Cuban races of sandhill cranes may be the last surviving remnants of a single population that once extended from Florida to Cuba and west along the Gulf coast to at least Mississippi. The Mississippi race is now limited to a single national wildlife refuge of 19,400 acres, of which only about 12,500 are suitable for cranes. Probably always small, the total population didn't rise above 100 birds until the

late 1980's. In recent years the population has reached about 130, and been supplemented by captive-bred birds, since the wild stock has been unable to maintain itself. Likewise, the Cuban sandhill crane is a remnant population with limited remaining habitats, and in recent decades its numbers have declined. According to Curt Meine and George Archibald the surviving birds are limited to 13 scattered locations of Cuba, from Pinar Del Rio on the west to the Cauto River delta in the east, as well as the Isle of Pines (=Isla de Juventud) and some small offshore islands. The birds are found in savannas, grasslands, wetlands and swamps. The total population may consist of about 650 birds, and is believed to be increasing as a result of Cuban conservation efforts.

The Whooping Crane

Whooping cranes have undergone several important [population changes since the first edition of this book. The experimental cross-fostered flock of whooping cranes produced by putting their eggs under the care of sandhill cranes at Grays Lake, Idaho, has now disappeared. Following the mid-1980's, the flock underwent a steady decline, and a decision was made in 1989 to terminate the egg-transfer program. The cross-fostered birds evidently failed to learn to identify themselves as whooping cranes, and never attempted to mate with their own kind. Additionally, high mortality rates resulting from power line accidents or avian tuberculosis killed many adults and eventually doomed the project. Of 289 whooping crane eggs transferred to Grays Lake, 209 hatched but only 84 chicks fledged, mostly owing to coyote predation and bad weather during the breeding season. In total, of all the cross-fostered cranes that survived long enough to migrate to Bosque del Apache, the last survivor disappeared in the spring of 2002.

By 1989, the decision to abandon additional egg-transfers at Grays Lake was replaced with a plan to try establish a non-migratory whooping crane flock in central Florida, where wild whooping cranes had existed (as winter migrants, but with no definite evidence of breeding) until the early 1900's. The site chosen was the Kissimmee Prairie, an area of about 800 square miles where Florida sandhill cranes were already thriving. After obtaining approval from state, federal and provincial agencies, the first group of captive-reared cranes was released in Florida early in 1993. The young cranes had been hatched and reared in facilities of the Fish and Wildlife Service, Patuxent Maryland, and the International Crane Foundation, Baraboo, Wisconsin. A total of 14 juveniles were released in 1993, followed by 19 in 1994, 19 more in 1995, and additional birds in later years until a total of more than 300 had been released. Initially the young birds were placed in large well-fenced enclosures that proved not to be predator-proof. During the first two years two-thirds of the released birds were killed by bobcats. Later, by using portable enclosures well away from known bobcat habitats, survival was greatly improved, with 69 percent of the birds surviving their first year. First-year survival has since remained between about 50 and 70 percent, and an 83 percent survival during the second and third years.

By 1996 some of the released birds had been seen forming pair bonds, mating and even building nests, raising hopes for the project's eventual success. During the spring of 2000 three pairs attempted to nest, and one of the four-year-old pairs hatched two chicks successfully, the first wild whooping cranes to be hatched south of Canada in more than a century. In 2002 a pair of four-year-olds hatched and successfully fledged one youngster, its sibling having been snatched from the nest by a bald eagle shortly after

hatching. The surviving chick, named Lucky by the people who had witnessed the eagle attack, lived to see its parents nest again the following year. In 2003 a total of eight nests were built and three chicks were fledged. By that spring there were 106 birds living in the wild, raising hopes that a breeding flock of 23 breeding pairs might be attained by 2020. In the spring of 2005 there were 12 nesting pairs present, producing a total of nine chicks, five of which survived at least to the summer of 2006. By then over 300 birds had been released on the Kissimmee Prairie. However, high mortality among older age-classes and a relatively low fledging success has led to a recent decision to terminate any additional infusion of new birds.

Also in 2006, two whooping crane chicks were hatched for the first time at Necedah National Wildlife Refuge, in central Wisconsin, from a wild but captive-raised pair. Necedah National Wildlife Refuge, located near the crane-rearing facilities of the International Crane Foundation at Baraboo, had been selected as the focal point for the development of a migratory whooping crane flock that might be trained to migrate to Florida wintering grounds. This imaginative project would depend on the skill of aviculturists in rearing cranes that would not imprint on their human caretakers, by using crane-like costumes while rearing the chicks to fledging. Imprinting actually begins before hatching. During the last 24 hours prior to hatching, the eggs are exposed to the sound of an ultralight engine and the voices of the pilot's imitations of parental crane calls. Fledging birds are taught to follow a "trike," (the body of the ultralight without its wings) driven by crane-costumed parent-figure. Success has also relied strongly on the ability of highly skilled ultralight pilots training the newly fledged birds to follow the aircraft in flight over distances of more than a thousand miles, to Florida wintering grounds. Accomplishing that, the ultimate hope was that the birds would survive winter and safely migrate back to Necedah on their own in spring, using their memories of the fall migration as a navigation guide.

This ultra-light-led migration was clearly an audacious and high-risk idea, and was necessarily preceded by several years of working with Canada geese and sandhill cranes, using an ultralight craft serving as a "lead bird." The lead craft must travel at the cranes' typical flapping-flight air speed (about 30 to 40 miles per hour), and cover appropriate daily distances. The pilot also must try to avoid accidental collisions with obstacles such as power lines, attacks by predators such as golden eagles, and somehow keep all the birds together as a single unit. The first motorized migration experiment was done with Canada geese in 1993, and the first motorized sandhill crane migrations were attempted in 1995. Attempts with whooping cranes began in 1997, initially by introducing them into groups of similarly imprinted sandhill cranes.

Beginning in 2000, an intensive effort began to establish a migratory flock of whooping cranes in eastern North America. This ambitious, stranger-than-fiction adventure required the skills and resources of an array of private and governmental organizations that together formed the Whooping Crane Eastern Partnership (WCEP). In 2000, to test the migration route and also performance and coordination during the many complex parts of this effort, a trial migration occurred with sandhill cranes. Each year since, WCEP has successfully reared, trained, and flown a cohort of whooping cranes along a 1,200-mile route from Necedah National Wildlife Refuge in central Wisconsin to Chassahowitzka National Wildlife Refuge on the Gulf Coast of Florida. The non-profit organization Operation Migration is headquartered in Port Perry, Ontario, and oversees

the training of chicks and the ultralight migration. Typically four ultralight aircraft are used, three of them leading chicks while the fourth, a slightly faster ultralight called the “chase plane,” goes after birds that may stray from the flock. A fixed-wing plane flies overhead and moves more swiftly ahead or behind as needed. Ground vehicles follow below. Typically the birds fly at heights of about 350 to 1,000 feet, and in good weather may cover up to a hundred miles or even more in a day. The entire 1,200-mile journey south takes weeks, and often is held up for days or even weeks during periods of inclement weather.

In the spring of 2002 five young whooping cranes that had wintered in Florida made their way back to Necedah in less than ten days. By the spring of 2006 the new migratory flock had grown to 64 birds, to which 24 more were added that fall. In February of 2007, disaster struck, with almost the entire cohort of young birds being killed during a severe storm and tidal surge that swept over the winter release pen at Chassahowtzka. WCEP learned from this loss, and added another cohort of 17 birds to the population in 2007. The reintroduced migratory population in eastern North America numbered 68 adults and 21 juveniles as of late 2008. Although there were 11 nestings in their Wisconsin breeding area, all the clutches were abandoned just prior to hatching.

This reintroduction has included a remarkably intensive monitoring effort led by the Fish and Wildlife Service and ICF. Detailed histories have been collected of the movements and social behavior of each bird throughout the project. From these efforts, several lessons have become clear. One is that cranes return in spring to the general area where they had fledged, not the place where they were hatched and early reared. The birds, after that single ultralight-led migration during their first autumn, are quite capable of retracing the migration on their own back to central Wisconsin. The birds do not follow the precise flight path that they experienced in fall, but the general corridor north – thus, they are not using visual landmarks to find their way.

Weather events as the cranes are migrating north – such as strong west winds that set the birds off course, so that they end up on the wrong (east) side of Lake Michigan – mean that not all birds make it back to release area. And birds that, for one reason or another, have missed legs of the ultralight migration by being transported in a crate, easily become lost if they travel north on their own in spring. WCEP personnel, however, have successfully retrieved some of these birds and moved them back to Wisconsin. At this early stage in the reintroduction, when the flock is still small, it is desirable to concentrate the birds in central Wisconsin to encourage pairing.

The ultralight-led birds learn much from the sandhill cranes that live near them throughout the year, for example, becoming increasingly wary of people in their yearling summer, through association with sandhills. Yet the whooping cranes have readily formed pairs bonds with other whooping cranes. Ultimate success of the project will come when growing numbers of pairs nest and successfully fledge young. WCEP monitoring efforts are now focusing on this crucial spring period in the Necedah area. In addition, ICF and the Fish and Wildlife Service are experimenting with a second method for adding whooping cranes to the migratory flock, rearing chicks that are released directly into the wild flock at Necedah in autumn, without ultralight training. These young birds will learn their migration route from the older cranes.

With all the publicity associated with Operation Migration, the original Wood Buffalo–Aransas migratory flock of whooping cranes has been somewhat neglected, but

it too has made remarkable progress in recent years. Based on winter counts at Aransas, the population has increased from 146 birds in 1992 to 257 in 2008. Between 1992 and 1997 there was a net increase of 14 birds, between 1997 and 2002 a further increase in 14 birds, and between 2002 and 2007 an increase in 63 birds. The 2007 and 2008 seasons added 61 more chicks. In recent years this population has been increasing at a rate of about four percent per year. As of late 2008 there were 385 wild whooping cranes in the Wood Buffalo–Aransas flock, and 151 captives.

According to Ernie Kuyt, since 1983 there has been a significant increase in the number of whooping crane juveniles and subadults, and a corresponding increase in the breeding population. By 1993 several pairs were breeding south of the original nesting zone, in the Alberta portion of Wood Buffalo National Park. By 2005 three pairs were breeding outside the limits of the park, complicating the need for protecting breeding habitats. A study by Brian Johns and others reported that, of 136 banded juveniles, 103 returned to Wood Buffalo Park the following spring, and at least 76 percent of first-time breeders nested within 12 miles (20 kilometers) of their natal sites. This site-fidelity is probably related to learning migration routes from parents or congeners, and is common in migratory species having long-term monogamy.

According to Kuyt, whooping cranes spend about as much time on their breeding grounds (164 days) as on their wintering grounds (154 days). The spring migration period averaged 17 days, and the fall migration 30 days, with the longer fall migration associated with about two weeks spent staging in south-central Saskatchewan. On a normal migration day the birds average 7.5 hours of flight time, covering about 245 miles, and averaging 32 miles per hour, but at times reaching 60 miles per hour when wind-assisted. Favorable winds sometimes result in flights of 9–10 hours, and from 425 to 490 miles covered. Collisions with power lines are apparently the most serious threat to migrating whooping cranes, accounting for two of six deaths that were documented among migrating birds.

For persons old enough to remember when the idea of ever seeing a wild whooping crane seemed little more than a fantasy, the presence of several hundred birds now alive in the wild is almost too good to be true. We owe this good fortune to the work of an untold number of dedicated field biologists, aviculturalists, scientists and even philanthropists who have helped to underwrite the purchase of critical habitats or to fund research needed to make a viable population of whooping cranes a reality. Very few people are lucky enough to feel as if they have helped save a species from extinction; these are among the select few.

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