PAIR FORMATION BY COLOR-MARKED WHOOPING CRANES ON THE WINTERING GROUNDS

Thomas V. Stehn
U. S. Fish and Wildlife Service

Follow this and additional works at: http://digitalcommons.unl.edu/nacwgproc

Part of the Behavior and Ethology Commons, Biodiversity Commons, Ornithology Commons, Population Biology Commons, and the Terrestrial and Aquatic Ecology Commons

http://digitalcommons.unl.edu/nacwgproc/237

This Article is brought to you for free and open access by the North American Crane Working Group at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in North American Crane Workshop Proceedings by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.
PAIR FORMATION BY COLOR-MARKED WHOOPING CRANES ON THE WINTERING GROUNDS

THOMAS V. STEHN, U.S. Fish and Wildlife Service, Aransas National Wildlife Refuge, P.O. Box 100, Austwell, TX 77950, USA

Abstract: Observations were made of color-marked whooping cranes (Grus americana) at Aransas during the 1977–94 winters. Subadult cranes wintered near their juvenile home ranges in flocks averaging 3.12 birds. One and 2 winters prior to nesting, subadults at Aransas tended to form duos apart from other subadults. Frequencies of association 1 year prior to nesting averaged 65.4%. However, 27.7% of pair bonds (n = 18) formed during spring migration or on the breeding grounds without any observed prior association at Aransas. Sixty-eight banded cranes formed pairs. Pair members averaged 1.06 years difference in age. Winter territories of adults tended to be established near the juvenile home range of the male. Information on typical subadult behavior and pair formation at Aransas can be used to compare with pairing behavior in newly established whooping crane flocks.

PROC. NORTH AM. CRANE WORKSHOP 7:24-28

Key words: Aransas, associations, behavior, Grus americana, pair formation, subadult, territory establishment, whooping crane.

The only remaining natural flock of whooping cranes is still very much endangered. This Aransas-Wood Buffalo flock has recovered from a low of 15 birds in 1941 (U.S. Fish and Wildlife Service 1994) to reach 133 birds in the spring of 1995 (T. Stehn, unpubl. data). Efforts to establish a second flock of whooping cranes at Grays Lake National Wildlife Refuge in Idaho by using sandhill cranes as foster parents failed when no adult birds formed breeding pairs (U.S. Fish and Wildlife Service 1994). Efforts to establish a non-migratory flock in Florida by using captive-raised whooping cranes soft-released into the wild began in 1993. Pair formation in Florida occurred in 1995 when 2 3-year-olds built a nest (Nesbitt et al. 1997). It is, however, too early to evaluate the success of pair formation and breeding within this experimental flock. Quantification of pair formation behaviors in the natural Aransas-Wood Buffalo flock could be used to ascertain if behavior is normal in any newly established flock.

The formation of subadult flocks at Aransas National Wildlife Refuge (ANWR) is believed to provide conditions under which potential mates meet and select a suitable partner. Frequent associations of subadults observed over 1–3 winter seasons resulted in 6 pair bonds (Bishop 1984). Blankinship (1976) and Stehn (1992a,b) have observed widowed whooping cranes pairing with new mates at Aransas. This paper describes typical subadult behavior, pair formation, and territory establishment on the wintering grounds for birds color-banded during 1977–88.

I thank ANWR managers J. B. Giezentanner and the late E. F. Johnson for supporting this research. Excellent piloting by J. Kosler, J. Miller, G. Shore, T. Taylor, J. Winship, and the late R. Tanner have enabled much of these data to be collected. I am very appreciative of Canadian Wildlife Service (CWS) biologists J. P. Goossen, B. W. Johns, and E. Kuyt for color-marking cranes and sharing their observations to better understand the Aransas-Wood Buffalo population. I thank R. A. Stehn for statistical analysis, and D. H. Johnson and R. A. Stehn for editing the manuscript.

STUDY AREA

The whooping crane winter range is situated in 8,175 ha of salt marsh on the Texas coast northeast of Rockport (Stehn and Johnson 1987). During the 1994–95 winter, cranes wintered on ANWR (n = 48), West St. Charles Bay (8), San Jose Island (25), Matagorda Island (37), and Welder Flats (14) (T. Stehn, unpubl. data). The entire crane wintering area is commonly referred to as Aransas. Wintering whooping cranes primarily use salt marsh and open bay habitats but sometimes fly to adjacent upland habitat for food and fresh water (U.S. Fish and Wildlife Service 1994).

METHODS

One hundred thirty-five whooping cranes were color-banded from 1977 to 1988 as pre-fledged chicks in Wood Buffalo National Park (WBNP) (Kuyt 1979; Kuyt and Goossen 1987; E. Kuyt, CWS, Edmonton, Alta., unpubl. data). Nomenclature of banded birds follows that of Stehn and Johnson (1987).

Bishop (1984) studied color-marked cranes during the winters of 1980–81 through 1982–83 by using extensive ground observations. Color-marked birds were recorded during weekly aerial census flights during the winters 1977–78 to 1981–82 by S. E. Labuda and 1982–83 to 1994–95 by T. V. Stehn (U.S. Fish and Wildlife Service, Austwell, Tex., unpubl. data). From 1986–87 through 1994–95, I attempted to locate and identify bands on most birds encountered during aerial counts. Bands were identified by flying at 80 knots past the cranes at an altitude of approximately 20 m. I also observed color-banded cranes from boats and vehicles from 1982–83 through 1994–95.
Data collected for each color-banded bird sighting included date, location, and identification of associated cranes. The sex of most marked whooping cranes was determined by behavioral observations (Bishop 1984; T. Stehn, unpubl. data), chromosome analysis of blood components (Kuyt and Goossen 1987), vocalizations (Carlson 1991), and comparison of weights and measurements of pre­fledged chicks during banding operations (B. W. Johns, CWS, Saskatoon, Sask., pers. commun.). Cranes were designated as adults after having made a nesting attempt at WBNP (B. W. Johns and E. Kuyt, CWS, unpubl. data).

Distances from the center of juvenile home ranges to the center of adult territories were measured on a U.S. Geological Survey 1:100,000-scale metric topographic map of San Antonio Bay, Texas. Adult winter territories were also classified as being or not being in the same general area as their juvenile home ranges. General areas were categorized as San Jose Island, Welder Flats, north and south halves of ANWR, and north and south halves of Matagorda Island. For example, a juvenile from the north end of the refuge that established an adult territory on the south end of the refuge (up to 16 km and 8+ territories away), was not considered in the same general area even though it was still on the refuge.

Frequencies of association (FOA) (Hawkins and Klimstra 1970) were calculated each winter between a particular crane and its future mate:

\[
FOA = \frac{C}{A + B - C} \times 100\%
\]

where A = total number of sightings of Bird A, B = total number of sightings of Bird B, and C = total number of times birds A and B were sighted together.

For each color-banded bird, I recorded the sex, age at first nesting, winter territory, winter juvenile home range, winter subadult home range prior to nesting, FOA's with its future mate, and average subadult group size in marsh and bay habitats. Flock size data on uplands (areas that were usually prescribed burns) were excluded since subadults often join adult pairs or families in these areas. Average flock size was also calculated the first winter after nesting to determine if new pairs had established winter territories. I excluded data on 6 widowed birds that had re-paired, 1 pair of birds that wintered apart between their first and second nesting attempts, and 2 marked cranes of unknown identity that had lost their color bands and had only aluminum bands remaining. All comparisons of sample means were made with a standard t-test statistic with a pooled variance estimate and 2-tailed probability set at \(P < 0.05\).

**RESULTS**

**Banded Cranes**

Of the 135 chicks banded in WBNP, 119 survived their first fall migration. Sixty-eight color-marked cranes formed pairs and nested in or near WBNP; 33 (48.5%) were males and 35 (51.5%) were females. The approximately equal sex ratio supports Kuyt and Goossen (1987), who found an even sex ratio in 22 pre-flight chicks. Forty-two banded cranes paired with banded mates (21 pairs), and 26 paired with unbanded mates. Thirty-five of the 68 cranes were alive in November 1995. Pair members averaged 1.06 years apart in age (\(n = 17\), SE = 0.22, range 0–3), with no noticeable trend for either males or females to be older.

One other crane (GwG-BwB, 1988) may have nested in 1992, but it was not positively identified. This crane failed to arrive at Aransas in the fall of 1992 and was excluded from data analysis. As of November 1995, crane r-r (1988) was the only banded crane not yet known to have bred, although this 7-year-old male had an FOA of 100% with an unbanded crane during the 1994–95 winter (\(n = 17\) observations) and was presumably paired.

Six cranes re-paired with subadults after the loss of a mate. In December 1990, 1 widowed male crane re-paired with a younger adult female who had nested once unsuccess­fully. The first mate of that female re-paired with a subadult. This is the only known case of a whooping crane pair breaking up after 1 nesting attempt.

**Group Size**

The average size of subadult flocks containing at least 1 color-banded crane was 3.12 birds (\(n = 189\), SE = 0.09). Each individual sample unit represented average flock size for all sightings of 1 color-banded bird during 1 winter. Flock sizes of marked subadult males (\(\bar{x} = 3.01, n = 80\), SE = 0.14) and marked subadult females (\(\bar{x} = 3.20, n = 109\), SE = 0.12) were not significantly different (\(t = 1.055, df = 187, P = 0.29\)).

Flock size was smaller for cranes during the winters 1 and 2 years prior to nesting. Each sample size represented average flock size for all sightings of 1 color-banded bird during 1 winter. Group size for winters 1 and 2 were not significantly different (\(t = 0.68, df = 103, P = 0.50\)). Average group sizes for the winters 3–6 years prior to nesting were 3.39 (\(n = 42\), SE = 0.21), 3.70 (\(n = 24\), SE = 0.29), 3.14 (\(n = 15\), SE = 0.23), and 3.81 (\(n = 3\), SE = 1.04), respectively. There was a highly significant difference (\(t = 3.30, df = 187, P = 0.001\)) between average group size for winters 1 and 2 (\(\bar{x} = 2.86, n = 105\), SE = 0.11) versus winters 3–6 (\(\bar{x} = 3.45, 0.17\)).
Subadult flocks were largest on ANWR ($\bar{x} = 3.50$, $n = 102$, SE = 0.12), next largest on Matagorda Island ($\bar{x} = 2.40$, $n = 32$, SE = 0.10), and smallest on San Jose ($\bar{x} = 2.04$, $n = 11$, SE = 0.20) and Welder Flats ($\bar{x} = 2.27$, $n = 15$, SE = 0.14). Refuge flocks were significantly larger ($t = 6.76$, df = 158, $P < 0.001$) than those on the other wintering areas. Flock size on Matagorda Island did not differ significantly from the combined values for San Jose and Welder Flats ($t = 1.35$, df = 56, $P = 0.183$).

One-year-old birds were found in flocks averaging 3.26 birds ($n = 48$, SE = 0.18, range 1.00-7.12). There was no significant difference between flock size for 1-year-old versus all older subadults ($t = 0.871$, df = 187, $P = 0.385$), or between 1-year-old males and females ($t = -0.682$, df = 46, $P = 0.498$).

Adult pairs their first winter after nesting were sometimes found with subadult cranes. Group size the first winter after nesting averaged 2.32 ($n = 51$, SE = 0.09) compared with average subadult flock size prior to nesting of 3.12. The flock size the first post-breeding winter was significantly smaller ($t = -4.397$, df = 238, $P < 0.001$) than average subadult flock size prior to nesting of 3.12 for all subadults, and from the flock size of 2.87 ($n = 56$, SE = 0.17) for the first winter prior to nesting ($t = -2.853$, df = 105, $P = 0.005$).

**Frequencies of Association**

FOA’s were calculated for 18 pairs with both birds color-banded. Five additional pairs formed that included widowed birds. Since widowed birds can re-pair quickly (Stehn 1992a), and a long association prior to re-pairing may not occur, data for these pairs were excluded. In no instances did siblings (juveniles from different years raised by the same parents) pair. There were no “twin” chicks brought to Aransas during the years cranes were color-marked, partly because of the removal of 1 egg from most of the nests for management purposes.

FOA’s 1 year prior to nesting averaged 65.4% ($n = 18$, SE = 10.77). Ten pairs (55.6%) had FOA’s of 100% ($\bar{x} = 22$ observations per pair, range 8-34) throughout the winter prior to nesting and were presumably paired. Some of these pairs exhibited territorial behavior at Aransas the winter, or part of the winter, prior to nesting (Bishop 1984). Five pairs were not observed in association with their future mates in subadult flocks at Aransas at any time prior to nesting, although in 2 cases associations may have occurred due to proximity of subadult winter ranges. Based on groupings observed prior to the spring migration immediately prior to their first nesting attempt, pair formation for all 5 pairs must have occurred in migration or on the nesting grounds.

During the winter 2 years prior to nesting, FOA’s averaged 40.2% ($n = 16$, SE = 11.37), with members within 3 pairs associating 100% of the time and members of 9 pairs that were never observed together. FOA’s were only 15.6% 3 winters prior to nesting ($n = 15$, SE = 8.52), 17.7% ($n = 7$, SE = 13.23) 4 winters prior to nesting, and only 4.2% ($n = 6$, SE = 4.17) 5 winters prior to nesting.

Three pairs associated as subadults every year prior to pair formation. Pair G-YbY and YbY-YbY were the same age and had juvenile winter home ranges on adjacent ANWR territories.

**Distances**

Adult males established winter territories an average of 5.6 km from their juvenile winter home range ($n = 33$, SE = 1.08), whereas adult females averaged a distance of 11.9 km ($n = 35$, SE = 1.74). Distances for males were significantly less ($t = -3.04$, df = 66, $P = 0.003$) than female distances.

Adult winter territories were located within the same general area of juvenile home ranges for 25 of the 33 (75.8%) banded males. For those 25 males, 2 of the adult territories were established on the juvenile home range, 18 were on adjacent areas, 3 were 1-2 territories away, and 2 were 3+ territories away. For females, 10 of 35 (28.6%) adult females established territories in the general area of juvenile home ranges. However, for 6 of the 10 females, the male juvenile territory was also located nearby and presumably influenced territory selection. Thus, there were only 4 cases (11.4%) where the adult territory was established in the general area of the female juvenile home range but not in the general area of the male juvenile home range.

Distance between juvenile home ranges of color-marked cranes and their future mates averaged 12.0 km ($n = 17$, SE = 2.35). For 11 of 16 (68.8%) pairs, juvenile home ranges were from different areas. None of these pairs associated together at all the third winter prior to nesting, and only 3 associated the second winter prior to nesting. In 4 of 16 pairs (25.0%), juvenile home ranges were from the same general area and long associations occurred for at least 3 winters prior to nesting. Third winter associations averaged 58.4% ($n = 4$). One pair had juvenile home ranges from the same general area but only associated together for 2 winters prior to nesting, with no association the third winter prior to nesting.

**DISCUSSION**

**Group Size**

Subadults wintered in flocks averaging 3.12 birds during
1978–94. Bishop and Blankinship (1982) documented larger winter flocks during 1978–80 that averaged between 4.4 and 5.6 cranes forming on the Aransas NWR to exploit unusual food concentrations. They suggested that fluctuations in flock size appeared to be influenced by seasonal availability of food in the marsh.

Subadult flock size was usually larger in areas with a greater number of adult territories. During 1994–95, Aransas NWR had 17 adult territories, St. Charles Bay 4, Matagorda Island 14, San Jose Island 8, and Welder Flats 3. During the past 10 years, 51.1% of winter territories have been at Aransas/ St. Charles (T. Stehn, unpubl. data). Subadult flocks were significantly larger on the refuge (3.50), than on Matagorda Island (2.40), San Jose Island (2.04), and Welder Flats (2.27), where only 26.7%, 14.0% and 8.3% of the adult winter territories have been located, respectively, over the past 10 years.

Subadults usually winter in the general area of their juvenile home range (Bishop 1984; T. Stehn, unpubl. data). Thus, the number of juveniles successfully raised in a wintering area will strongly influence how many subadults subsequently winter in that area. This in turn appears to influence subadult flock size, with larger subadult flocks forming when more subadults are in an area. Thus, subadult flocks were largest on the Aransas NWR compared with other wintering areas with fewer winter territories.

Some subadults spend large portions of a particular winter(s) as singles. I postulated that 1-year-old subadults might return to their juvenile home range and winter in the marsh adjacent to their parent’s territory rather than join nearby subadult flocks. One-year-olds, especially females, would be expected to be at the bottom of the social structure in subadult flocks and thus might choose to be solitary. This turned out not to be true. One-year-olds actually tended to winter in slightly larger subadult groups (3.26 cranes) than subadults of all ages (3.12). Thus, subadults that are solitary may be choosing to winter in a particular area whether or not other subadults are wintering nearby.

Flock size was smaller for cranes both the first (2.87) and second (2.84) winters prior to nesting. This occurred because strong associations began to form as birds approached breeding age. I found that duos occasionally established winter territories prior to nesting and would not tolerate the presence of subadult flocks, substantiating observations previously made by Bishop (1984). Bishop and Blankinship (1982) also noted that pair bonding influenced subadult flock size.

Flock size was significantly smaller (2.33) the first winter after nesting compared with the winter prior to nesting (2.87). As territories became more firmly established, adult pairs rarely joined subadult flocks in marsh and bay habitats. However, some new pairs continued to tolerate the presence of subadults at Aransas even after nesting. For example, crane pair RwR-O and BwB-r/w took 3–4 winters to establish a territory on the refuge (T. Stehn, unpubl. data). The first winter after nesting, the pair remained in 1 area on ANWR, sometimes with subadults (2.65 group size), and were chased by neighboring pairs. The second and third winters after nesting, they occasionally spent time with subadults, but were never observed defending the marsh they frequented (group sizes 2.19 and 2.24, respectively). Finally, in their fourth winter after first nesting (group size 2.0), they vigorously defended a territory in the same area. They did not successfully bring a juvenile to Aransas until their fifth year nesting.

**Frequencies of Association**

Although the majority of subadults formed strong associations at least 1 winter prior to nesting, some did not. Five of 18 pairs (27.8%) with both adults color-banded appeared to form pair bonds in a short period of time during the spring migration and/or in WBNP. These 5 pairs were never observed associating at Aransas prior to nesting. This is contrary to pairing behavior described by Bishop (1984), in which she observed formation of pair bonds after long periods of association.

In a majority of cases (68.8%), color-marked cranes selected a mate that did not have a juvenile home range nearby and usually had little association with its future mate 2–3 winters prior to nesting. Pairs were never observed between siblings, but I do not know if there is a behavioral mechanism to prevent such pairing.

**Distances**

Most adult territories established by color-marked males were close to their juvenile home ranges. This supports the hypothesis that an adult territory is normally established as close as possible to the male’s juvenile home range (Stehn and Johnson 1987).

**MANAGEMENT IMPLICATIONS**

Current management efforts to recover the whooping crane include establishing a non-migratory flock in Florida. Chicks are hatched in captivity where they associate with other juveniles, then small groups of juveniles or subadults are soft-released in pens in Florida (Nesbit et al. 1997). Some aspects of behavioral development set in these soft-release pen groups may be analogous to effects associated with juvenile home ranges at Aransas. Since pair bonds at
ANWR generally form after long associations within subadult flocks, it seems important that released cranes be provided conditions under which subadult flocks can form and the normal composition of social groups is represented.

Effects of releasing same age cohorts on future mate selection are not known. Nesbitt and Carpenter (1993) did not find any sandhill crane (Grus canadensis) pairs formed between members of release cohorts. The first nesting attempt by whooping cranes in Florida was by 2 3-year-olds from different release cohorts, but 2 other potential pairs may have formed between birds from the same release cohort (Nesbitt et al. 1997). Since siblings have never been known to pair at Aransas, this could imply that same-age cohorts socialized together in new flocks will not form pair bonds. It is probable that adults will establish territories in Florida near the release pens, so release pens should be near suitable nesting habitat. Nesbitt et al. (1997) suggested that releasing several small groups of birds each year rather than a single large group may foster pair formation between birds released in that year. Additional release pens, such as the satellite pens used by Nesbitt et al. (1997), should be added to help establish nesting areas throughout the available habitat.

LITERATURE CITED


