

Why Do Cranes Sometimes Fly With Their Legs Drawn Up?—During cold weather, various crane species have been observed flying with their legs folded up under their bellies. Bard and Lohrman, and Skinner cited in Nesbitt 1978, Walkinshaw 1953, have reported this posture for the Sandhill Crane (*Grus canadensis*); Epp 1970, for the Whooping Crane (*Grus americana*); and Walkinshaw 1973, for the Common Crane (*Grus grus*) and Japanese Crane (*Grus japonensis*). In this note we analyze the reasons for this behavior.

During a study of winter ecology of Common Cranes in Gallocanta, Spain, 1983–1984, we observed individuals with their legs drawn up only while the birds were leaving the roost early in the morning. Therefore, each morning we recorded (1) the percentage of cranes flying with folded legs, (2) the air temperature at roost departure time, (3) the wind speed and direction, (4) the flight direction of the cranes, and (5) the degree of cloud cover (Table 1). From those variables, the temperature seemed to determine this behavior: at air temperatures below 0° C we observed cranes flying with their legs folded up, while above 0° C cranes did not show this posture. The percentage of birds flying with legs folded up

TABLE 1. Relevant variables for various roosting departure flights. Only 6 days with temperature over 0° C have been included (see text).

Cloud cover (%)	Temperature (°C)	Wind incidence (m/s)	Number of cranes ^a	Percentage with legs drawn up
0	-8	8.3	407	75.18
0	-6	11.3	240	72.08
0	-5.5	8.3	425	58.59
0	-3	12.5	309	52.43
0	-4	8.7	88	44.32
0	-5	10.1	126	43.65
37.5	-7	8.1	391	41.43
0	-4.5	8.3	10	40.00
0	-6	8.3	78	39.74
12.5	-4	10.1	31	38.71
12.5	-5	9.1	424	37.26
0	-8	8.3	84	36.90
0	-7.5	9.3	220	36.82
12.5	-4	6.3	52	30.77
12.5	-5	7.4	70	25.71
100	-5	8.3	1306	21.90
12.5	-6	8.3	332	20.01
100	-1	8.3	20	20.00
0	-0.5	8.3	289	19.03
0	-4	8.3	819	11.72
0	-3	8.3	106	11.32
12.5	-4.5	8.3	555	6.85
0	-2	9.2	93	6.45
0	-4	8.8	24	4.17
0	-4	7.6	146	4.11
0	-4.5	8.3	83	3.61
0	-3	8.2	92	1.09
100	0.5	5.6	10	0.00
100	0.5	11.3	140	0.00
100	0.5	11.9	155	0.00
100	1	18.7	222	0.00
75	1.5	8.3	219	0.00
67.5	2	8.2	564	0.00

^a Sample of cranes whose legs were clearly seen.

was strongly correlated with the temperature below 0° C ($r = 0.523$, $n = 27$, $P < 0.01$). The habit of cranes to roost in areas with shallow water, as they did during this study, suggests that the formation of ice on their feet could be reason for the observed behavior. An ice layer could damage the skin of their feet and the birds may try to avoid ice formation by protecting their legs within the plumage of their bellies. During the rest of the day, when the cranes were standing on dry ground, we observed no birds flying with folded legs, even at temperatures well below 0° C. Moreover, when the cranes leaving the roost had already flown for some time, fewer individuals showed this posture, although this was not quantified.

Wind should also have a chilling effect, since the convective loss of heat is accelerated with air movement (Kendeigh et al. 1977). Although there is no correlation between absolute wind speed and percentage of cranes flying with folded legs ($r = -0.027$, $n = 27$, $P > 0.05$), this is due to the variability of the wind direction in relation to the flight direction of the birds. Indeed, the percentage of cranes with folded legs is significantly correlated with the speed with which the wind really blows on the flying birds ($r = 0.417$, $n = 27$, $P < 0.05$, Table 1). This "wind incidence factor" was calculated adding vectorially both crane and wind velocities and assuming that crane flying speed was 8.3 m/s (our unpublished data). The amount of cloud cover did not affect the posture of the flying cranes ($r = -0.109$, $P > 0.05$).

The behavior we observed seemed to be determined by two variables, freezing temperature and wind incidence. To determine their relative importance, data were subjected to partial correlation analysis. The resultant regression equation was

$$P = -62.06 + 5.91T + 7.45W$$

where P is the percentage of birds flying with folded legs, T is the absolute temperature below 0° C, and W is the wind incidence speed (see Table 1). The multiple correlation coefficient, $R = 0.678$, suggests that 46% of the variance of the observed behavior is explained by these variables. Both partial correlation coefficients are significant ($r = 0.588$, $n = 27$, $P < 0.01$, for temperature; $r = 0.505$, $n = 27$, $P < 0.01$, for the wind incidence), i.e., the effects of both freezing temperature and wind incidence are significant in the absence of a change in the other variable, always for temperature below 0° C.

In conclusion, our data suggest that whenever it is freezing, cranes with their legs and feet wet tend to fly with their legs folded up, and that the frequency of the behavior increases with decreasing temperature below 0° C and with the wind speed to which flying birds are exposed.

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