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POPULATION SIZE AND DISTRIBUTION OF FLORIDA SANDHILL CRANES IN THE OKEFENOKEE SWAMP, GEORGIA

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Abstract.—Florida Sandhill Cranes (*Grus canadensis pratensis*) were surveyed in the Okefenokee Swamp during April 1986. Helicopter surveys were the most effective technique for surveying cranes. Population size was estimated at 403 birds; pairs accounted for 74% of the population. Distribution was not uniform and 65% of the cranes occupied 26% of the available habitat. Crane densities averaged 1.9 birds/km^2, but were highest (up to 6.1 cranes/km^2) in marshes on the south and east regions of the Swamp. Crane densities were positively correlated ($r = 0.93$; $P < 0.001$) with the presence of herbaceous marsh vegetation. The future status of this population is uncertain and may be impacted by human alterations to the natural cycles of drought and fire, which create and perpetuate emergent marsh habitat in the Swamp.

DISTRIBUCIÓN Y TAMAÑO DE LA POBLACIÓN DE *GRUS CANADENSIS PRATENSIS* EN LA CIÉNAGA OKEFENOKEE, GEORGIA

Resumen.—Durante el mes de abril de 1986 se hizo un estimado de las grullas (*Grus canadensis pratensis*) en la ciénaga Okefenokee. El uso de helicópteros resultó ser la herramienta más útil para este tipo de trabajo. Se encontraron 403 aves, lo que representa un 74% de la población total. Un 65% de las grullas ocuparon un 26% del habitat disponible. La densidad promedio de aves resultó ser de 1.9/km^2, pero ésta fue más alta (hasta 6.1 grullas/km^2) en marjales (marshes) en la parte sur y este de la ciénaga. La densidad de grullas se correlacionó positivamente ($r = 0.93$; $P < 0.001$) con la presencia de vegetación herbácea en el marjal. El status de esta población es incierto y podría ser afectado por alteraciones (producidas por el hombre) a ciclos naturales tales como sequías y fuegos que mantienen el habitat y que utilizan estas aves en Okefenokee.

The purpose of this study was to survey the Sandhill Crane population within the Okefenokee Swamp during April and examine crane distribution and density as it relates to wetland vegetation types. The present range of the Florida Sandhill Crane extends from the Okefenokee Swamp (Swamp) in southeastern Georgia to the northern edge of the Everglades on the Florida peninsula (Lewis 1977, Walkinshaw 1973, Williams and Phillips 1972). While no actual census has been conducted, the sandhill crane population in Florida has been estimated at 4000–6000 (Nesbitt 1982, Williams 1978). In Georgia, Sandhill Cranes presently occur only in the Swamp, the northern extreme of their range (Walkinshaw 1973).

Crane hunting occurred in this region until the late 1930s (Hopkins 1947) and may have eliminated cranes from smaller accessible marshes adjacent to the Swamp (Hebard 1941). Wright and Harper (1913) reported that Sandhill Cranes were widely distributed in the Swamp in 1912. Walkinshaw (1949) estimated that the population may have numbered

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100 birds in 1921. In the mid-1970s, J. Eadie (in Patterson 1978:44) estimated the population at 200 birds. However, prior estimates of population size are questionable due to the vastness and inaccessibility of the Swamp.

STUDY AREA AND METHODS

The Okefenokee Swamp is a nationally protected wetland wilderness (National Wildlife Refuge and National Wilderness Area) of 1890 km^2 in southeastern Georgia. The Swamp is a peat-filled depression or bog, and water chemistry and biology are influenced by low pH (Bosserman 1981). Vegetation is characterized as a swamp-marsh complex and is composed of a mosaic of freshwater wetland types including: aquatic macrophyte and emergent marshes, *Sphagnum* beds, shrub swamps, swamp forests, and lakes. Water levels, fire, and underlying stratigraphy determine the spatial distribution of plant communities and pathways of succession (Cohen 1973, Cypert 1972, Rykiel 1977). Most marshes were formed by fires which burned away peat layers and created openings in formerly wooded swampland (Cypert 1961, Hamilton 1982). These shallow marshes are locally called "prairies" (Cypert 1972), and have well defined boundaries and long-established names (Fig. 1). The Swamp exhibits a long hydroperiod (Rykiel 1977) and water depths average 50 cm under normal hydrologic conditions.

All marsh habitat was surveyed for cranes in April. Approximately 65% of the area was surveyed by helicopter and 35% by airboat and skiff. Helicopter surveys were conducted at 35 m elevation and were designed to systematically cover all available habitat (Drewien et al. 1987). An air-ground crane sightability correction factor (1.23) was established by simultaneously surveying areas on the ground and from the air (Conant et al. 1985). This correction factor was used to adjust for cranes that were present, but not sighted from the helicopter. Prior to the helicopter survey, areas were flown in a fixed-wing aircraft to familiarize the pilot and observers with routes and procedures. Airboat and helicopter survey strategies were similar and directed at flushing cranes within sight of observers. When using a manually-propelled skiff, observers slowly traversed the survey area at sunrise while scanning for cranes with binoculars and listening for calls. April was selected as the survey period due to the increased visibility of nesting cranes, absence of leaf cover and new emergent marsh vegetation, and absence of migrant greater sandhill cranes (*G. c. tabida*).

Open marshes within the Swamp were identified and mapped using 1:10,000 and 1:32,000 color infrared aerial photographs. The location and configuration of all marshes 20 ha or larger were transferred to a base map and used for navigation during the surveys. Wetland types were identified through photo-interpretation using techniques described by Gammon and Carter (1979), and classified according to Cowardin et al. (1979). The size of marshes and composition of vegetation cover types was determined according to Golet and Larson (1974).

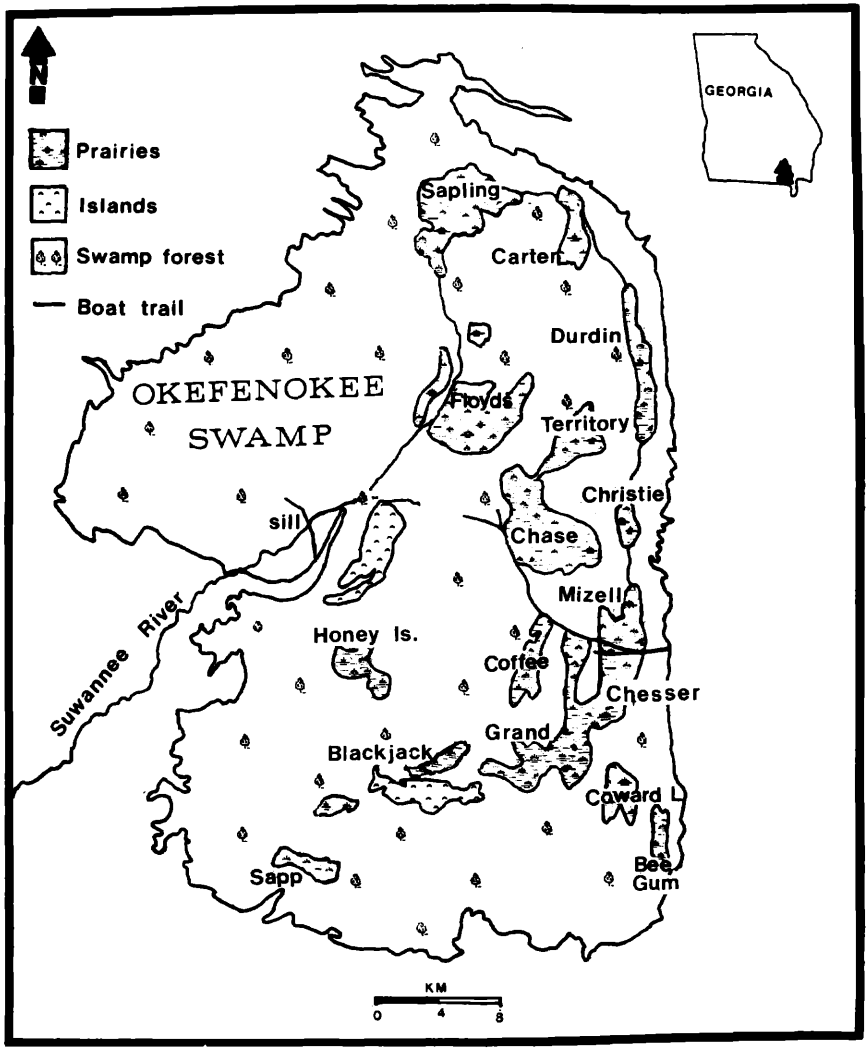

FIGURE 1. Location of marshes (Prairies) >3 km² within the Okefenokee Swamp.

RESULTS

Between 2–14 Apr. 1986, 76 h were expended in surveying cranes, including 13.5 h by helicopter. In the helicopter survey, 182 cranes were sighted, although the count was adjusted to 224 (sightability correction factor 1.23); 179 were recorded during boat surveys, yielding a total population estimate of 403 cranes. Pairs accounted for 266 (74%) of the cranes sighted and the remaining 95 were observed in groups of 3 or more.

Cranes were sighted in all major marshes within the Swamp, however, no cranes were sighted in marshes <10 ha, which were isolated from larger areas by forested vegetation. Densities averaged 1.9 cranes/km^2 of marsh and ranged from 6.1 cranes/km^2 in Grand Prairie to 0.4 cranes/km^2 in Honey Island Prairie (Table 1). The largest number of cranes and highest densities occurred in the southeastern region of the Swamp. This region accounted for only 26% of the total marsh habitat, but supported 65% of the crane population. Lowest crane densities occurred in the largest prairies on the western side of the Swamp, including Chase, Floyds, and Sapling.

Approximately 220 km^2 of open marsh habitat (nonforested emergent wetland) were identified in the Swamp. Marshes were primarily composed of 2 general vegetation cover types: an herbaceous (emergent wetland) cover type dominated by maidencane grass (*Panicum hemitomon*), broom sedge bluestem (*Andropogon virginicus*), and sedge (*Carex* spp.); and a macrophyte (aquatic bed) cover type dominated by water lily (*Nymphaea adorata*), neverwet (*Orontium aquaticum*), and floating heart (*Nymphoides aquatica*). Macrophyte and herbaceous cover types composed 68% and 27% of the marsh habitat, respectively.

Crane density was highly correlated ($r = 0.93$; $P < 0.001$) with the volume of herbaceous cover type within individual marshes (Fig. 2). Marshes with low crane densities, such as Chase, Territory, and Honey Island, contained less than 5% coverage by herbaceous vegetation.

DISCUSSION

Comparison of survey techniques.—Helicopter surveys were the most effective technique for surveying cranes in most regions of the Swamp. Cranes generally flushed at the approach of the helicopter and those that did not fly normally remained visible. Fixed-wing aircraft proved to be unsuitable for surveying cranes in the Swamp. Cranes did not flush at the approach of fixed-wing aircraft and the higher altitude and rate of speed necessary for safe operation made sightings on the ground nearly impossible. Other researchers have also found fixed-wing aircraft to be ineffective for surveying Sandhill Cranes in wooded habitats (Drewien et al. 1987, Valentine and Noble 1970, Williams and Phillips 1972).

Airboat survey results were extremely variable. Cranes were observed to react to the noise of airboats at distances of 3 km or more. Most cranes concealed themselves in dense vegetation and did not flush at the approach of an airboat. The reaction of other cranes was unpredictable and often depended on their distance from wooded cover and their individual tolerance threshold to disturbance. Observations from airboats were also biased with respect to age; flocks of subadults were more inclined to flush than adult pairs. Wooden skiffs, which can be push-poled across the marshes, were the only means of ground transportation that did not flush or disturb cranes beyond the range of view. However, the slow rate of travel limited skiff surveys to small accessible prairies.

Population size/density.—The size of the Sandhill Crane population (403

TABLE 1. Comparison of Sandhill Crane densities within the Okefenokee marshes, April 1986.

Marsh (prairie)	Size (km^2)	No. cranes	Density (cranes/km^2)
Grand-Gannet	12.4	76	6.1
Chesser	11.9	57	4.8
Coward Lake	6.8	28	4.1
Sapp	5.8	23	3.9
Buck-Hitherland	5.9	19	3.2
Bee Gum	2.9	9	3.1
Blackjack	2.9	8	3.0
Coffee Bay	12.8	39	3.0
Mizell	12.9	27	2.1
Durdin	9.2	18	1.9
Sapling	18.5	16	1.0
Floyds	17.3	14	0.8
Chase	26.4	20	0.7
Territory	6.8	5	0.7
Christie	5.7	3	0.5
Honey Island	6.5	2	0.3
Other	55.1	39	0.7
Totals	219.8	403	1.9

birds) in the Swamp was at least twice as large as previously estimated. Despite comprehensive survey coverage, some cranes may have been missed. Visibility of cranes was generally lowest in marshes having a scattered canopy of trees and shrubs. Breeding pair densities (0.7 prs/km^2) in the Swamp were similar to those reported by Walkinshaw (1976) (0.6 prs/km^2) for the Kissimmee Prairie in Florida, but were lower than those reported in Idaho (2.2 prs/km^2) and southern Michigan (3.0 prs/km^2) (Drewien 1973, Hoffman 1983). Crane densities in the Swamp were higher than for phytographically similar bog and muskeg habitat in Ontario (Tebble and Ankney 1982) and Manitoba (Melvin et al., in press). However, crane density is dependent on area coverage and includes many non-habitat variables, which often prevent direct comparisons between study sites.

The association between cranes and herbaceous marsh cover types indicates that the latter influences crane distribution in the Swamp. Plant species that compose the herbaceous cover type are intolerant of extended inundation and are restricted to shallow marshes with relatively short hydroperiods (Duever et al. 1975, Presnell and Brown 1977). Deepwater marshes, which normally support only floating macrophyte cover types, compose approximately 64% of the total marsh habitat. Finn and Rykiel (1979) found that water surface elevations in the Swamp exhibit a gradient that reaches its lowest point in the west-central area at the mouth of the Suwannee River. Water levels decline and the volume of herbaceous emergent vegetation increases to the east and south in relative proportions to the distance from the Suwannee River sill.

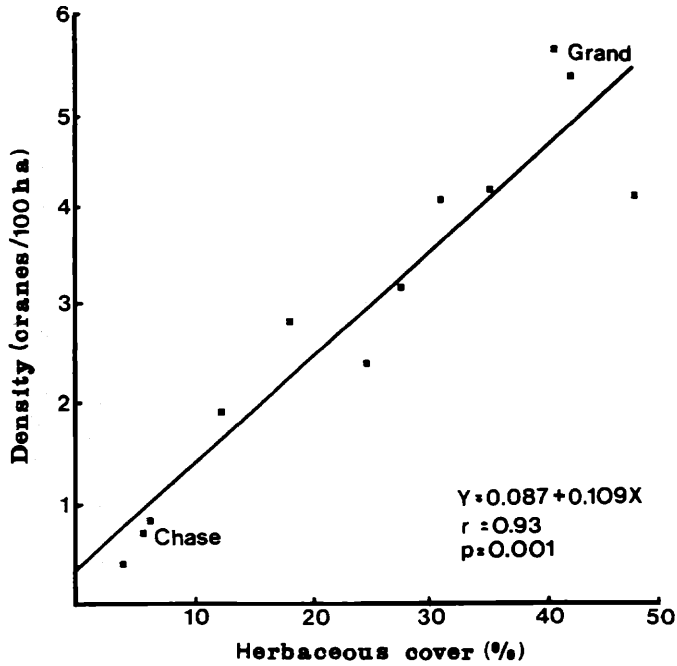

FIGURE 2. Relationship between Sandhill Crane density and presence of herbaceous cover type in the Okefenokee marshes.

Population status.—Crane populations in the Swamp have probably undergone numerous fluctuations during this century in response to natural and human-related events. The construction of the 35 km Suwannee Canal in 1895 and logging of the cypress forests during 1909–1925 (McQueen and Mizell 1926) opened a vast network of trails and provided human access to most marshes. Cranes were often killed by logging crews (McQueen and Mizell 1926) and crane hunting by local residents continued into the late 1930s (Hebard 1941). Hunting eliminated cranes in smaller accessible wetlands in Alabama, Mississippi, and Louisiana during this period (Walkinshaw 1949) and may have had a major impact on crane populations within the Swamp. Establishment of the Okefenokee National Wildlife Refuge in 1937 eventually eliminated crane hunting within the Swamp.

Major fires burned 80% of the Swamp in 1932 and 1954–1955 (Cypert 1972). Whereas drought and fire may have a negative impact on cranes in the short-term (Hebard 1941), fires are essential for the creation and perpetuation of open marsh. In response to the 1955 fire, an earthen dike was built across the Suwanee River on the west side of the Swamp to raise water levels and prevent the occurrence of fires. Known locally as the "sill" this dike has raised water levels by up to 43 cm and reduced natural water level fluctuations by 18–20% (Finn and Rykiel 1979).

Because cranes occupy shallow water (<30 cm) emergent wetland habitats, the dike has reduced the amount of available habitat.

No major fires have occurred since the Suwannee River dike was installed in 1960 (Hamilton 1982). Optimum crane habitat may occur during the first decade following a severe fire. Fire directly improves habitat by promoting growth of emergent herbaceous vegetation and indirectly by eliminating wooded cover that supports mammalian predators of crane eggs and chicks.

The future status of cranes in the Swamp is uncertain. Hydrologic impacts that resulted from efforts to eliminate fires may be accelerating succession of open marsh to swamp forest (Cypert 1972, Finn and Rykiel 1979). Periodic crane surveys are needed to monitor changes that may accompany habitat losses. Helicopter surveys in a stratified sample of high and low density marshes would provide an index to population trends and a data base on which future population estimates can be based. Cranes are often considered an indicator species of changes in the quantity or quality of freshwater marshes (Archibald and Mirande 1985). A decline in sandhill cranes may signal a change in the status of other wading birds and wildlife dependent on the Okefenokee marshes.

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