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Abstract: In this study we trapped wintering sandhill cranes (*Grus canadensis*) in Louisiana and fitted them with satellite transmitters to determine their migration routes. Four of the 6 sandhill cranes with validated locations and a terminus point used the Central Flyway for spring migration; 2 of these 4 (the only 2 for which we have data) also used the Central Flyway for fall migration. Two of the 6 birds used the Mississippi Flyway for spring migration. The results of this study suggest that reintroduced whooping cranes (*G. americana*) that intermix and migrate with sandhill cranes that winter in Louisiana may enter the Central Flyway. In addition, the Mississippi Flyway is a viable option to use as a migration route for whooping cranes if they are reintroduced in Louisiana.

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Key words: development, *Grus americana*, territories, whooping crane, winter range.

Louisiana has supported sandhill cranes (*Grus canadensis*) both historically and currently. Louisiana's population of sandhill cranes was extirpated in 1919 (Walkinshaw 1949), but birds began returning in the 1960s. A population of 17-100 birds was found in central Louisiana, near Cheneyville, in 1966 (Smith 1979); 12 birds were found in southwestern Louisiana near Holmwood in 1980 (Dewhurst and Zwank 1987). About 2,200 sandhill cranes, primarily greater sandhill cranes (*G. c. tabida*), currently winter in central and southwestern Louisiana (McGowan 2003). This includes flocks at Holmwood and Cheneyville.

This study focuses on the concern expressed by the International Whooping Crane Recovery Team that reintroduced whooping cranes (*Grus americana*) could intermingle with wintering sandhill cranes in Louisiana and follow them into the Central Flyway. Mixing of an endangered flock of whooping cranes with a non-essential experimental flock could introduce diseases and undesirable behaviors to the wild flock and create legal difficulties (i.e., management of an endangered flock and an experimental, non-essential flock). Both White Lake Wetlands Conservation Area and Marsh Island Refuge have been proposed as possible whooping crane reintroduction sites. Holmwood is 129 km from Cheneyville, 48 km from White Lake, and 121 km from Marsh Island, and Cheneyville is 121 km from White Lake and 161 km from Marsh Island. As such, these sites are in relatively close proximity to the proposed reintroduction sites, and concern over whooping cranes mixing with sandhill cranes seems valid.

Little is known about migration patterns of sandhill cranes wintering in Louisiana, including whether or not the Central or Mississippi Flyways are used. Although it is expected that the Mississippi Flyway is a current migration route of some sandhill cranes, this has not been verified. This information would be useful not only to identify potential mixing conflicts with the wild flock of whooping cranes, but if sandhill cranes do use the Mississippi Flyway, it would identify potential migratory pathways to be used in any reintroduction of migratory whooping cranes to Louisiana. In this study, we determined the migration routes of a sample of sandhill cranes wintering in Louisiana, as well as movements between flocks in Cheneyville and Holmwood, Louisiana.

STUDY AREA

Holmwood (30°7′32.99″N, 93°4′48.68″W) is located in Calcasieu Parish in southwestern Louisiana. About 62,000 ha of this parish are used for pasture and 8,700 ha are for rice cultivation. Cheneyville (31°0′44.35″N, 92°17′38.64″W) is located in Rapides Parish in central Louisiana. Rapides Parish contains

46,600 ha of agricultural lands, including 2,700 ha for corn and 3,000 ha for rice cultivation. In both areas, birds forage in agricultural fields and pastures, and generally roost in flooded rice fields (McGowan 2003).

METHODS

We conducted small-scale trapping of sandhill cranes in southwestern Louisiana during February 2004 and winter 2004-2005. During winters 2005-2006 and 2006-2007, we trapped sandhill cranes in Holmwood and Cheneyville. We captured cranes by placing monofilament snares (Ivey et al. 2005) in foraging fields and roost ponds (ACUC Permit # AE13-04).

All trapped birds were restrained by hand, a sock was placed over their head to minimize visual stimuli, basic morphometric measurements were recorded, and birds were fitted with Platform Transmitting Terminal (PTT) satellite transmitters (95 g; Microwave Telemetry, Columbia, Maryland) and released. In some instances, morphometric measurements were not recorded because of concerns over handling time and potential exertional myopathy. The Argos satellite system (Collecte Localisation Satellites 2008) was utilized to determine locations of PTT-tagged cranes throughout the year. All locations were initially recorded except when location estimates were <30 minutes apart. In these cases, the first location was taken. Locations based on only 1 satellite were discarded. Only location classes 1-3 (<1,000-m accuracy) were used in analyses. All locations meeting these criteria were plotted on aerial photography with GIS; birds were monitored for the life of the transmitter.

RESULTS

We captured 2 birds in January-February 2005 in flooded rice fields near Holmwood. One of the 2 birds was found dead 3 days later, possibly as a result of exertional myopathy. No birds were captured in winter 2005-2006. In winter 2006-2007, we captured 1 bird in Holmwood and 5 birds near Cheneyville.

Interflock Movements

Two birds fitted with transmitters moved between the Holmwood and Cheneyville flocks. Crane 64285 was captured on 16 January 2007. On 26 January it moved to Holmwood, but returned to Cheneyville on 29 January. It moved back to Holmwood on 25 February and left on northward migration on 3 March. Crane 64286 was captured in Cheneyville on 16 February 2007. The bird moved to Holmwood on 6 March and remained there until 16 March before beginning its northward migration on 17 March.

Spring Migration

Sandhill cranes initiated spring migration as early as 21 February and as late as 20 March (Table 1). Four birds used the Central Flyway during spring migration and 2 used the Mississippi Flyway (Fig. 1, Table 1). At least 3 birds stopped at some point along the Platte River.

We estimate that 4 of the 6 sandhill cranes nested. Each remained at a single location for 58-100 days beginning 14 April to 1 May. Two sandhill cranes exhibited extensive movements during the breeding season, though 1 crane may have attempted breeding near Hudson Bay from 13 May to 25 May 2007. The terminus point for at least 4 of the 6 birds was Manitoba or Ontario, Canada. The terminus point for 1 bird was northern Minnesota and 1 was the Upper Peninsula of Michigan. However, transmitter failure for the latter bird makes it impossible to determine whether this was the termination point or simply a stopover point at which the transmitter failed.

Fall Migration

We were able to determine fall migration patterns for only 2 sandhill cranes (Fig. 2) due to transmitter failure. Both birds used the Central Flyway for fall migration. Crane 39888 was captured near Cheneyville on 28 February 2007 and migrated to Canada. In the following fall, it wintered through at least 13 January 2008 (the point of transmitter failure) in Oklahoma. Crane 39889, which was captured in Holmwood in February 2005, returned to Holmwood following a stopover from 27 October to 23 December 2006 near Galveston, Texas.

DISCUSSION

The results of this study indicate that sandhill cranes wintering in central and southwestern Louisiana use both the Central and Mississippi Flyways during spring migration. Four of 6 birds fitted with satellite transmitters used the Central Flyway as a spring migration route. Use

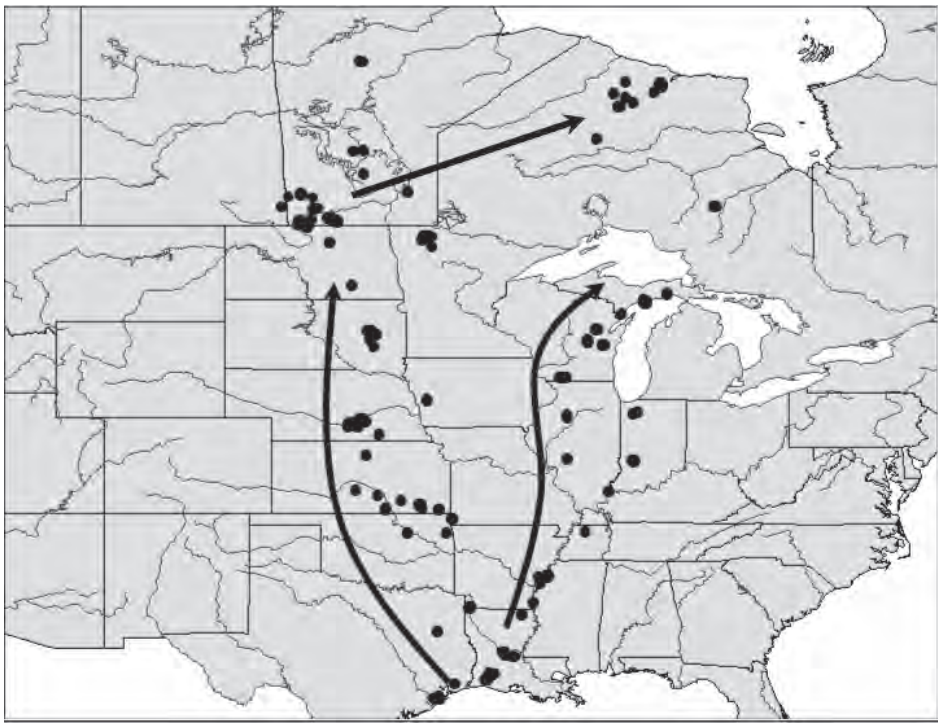

Figure 1. Spring migration routes for 6 sandhill cranes trapped at Holmwood and Cheneyville, Louisiana, 2005-2007, and fitted with satellite transmitters.

of the Central Flyway was also observed among both populations of sandhill cranes. Furthermore, 2 of the 6 birds moved between the Holmwood and Cheneyville flock on at least 1 occasion. McGowan (2003) also documented exchange between these 2 flocks. These results suggest that the flocks are not distinct from each other.

Unfortunately, data are available for only 2 sandhill cranes during fall migration, and both sandhill cranes used the Central Flyway. Krapu and Brandt (2010) indicated that birds captured in the Platte River all used the Central Flyway. Ironically, of 133 birds fitted with satellite transmitters, none migrated to Louisiana.

Louisiana is being considered as a potential reintroduction site for both resident and migratory whooping cranes. White Lake Wetland Conservation Area, near Gueydan, Louisiana, has been proposed as a potential reintroduction site for a resident flock of whooping cranes, and Marsh Island Refuge in Vermillion Bay has been proposed as a potential site for a migrant

Table 1. Spring migration information for 7 cranes captured and fitted with satellite transmitters in Cheneyville and Holmwood, Louisiana, 2005-2007.

Crane ID	Capture location	Interflock movement	Migration start date	Migration end date	Terminus point	Flyway
64285	Cheneyville	N	21 Feb 2007	20 Apr 2007	N. Ontario	Mississippi
64281	Cheneyville	N	2 Mar 2007	13 Apr 2007	Michigan[a]	Mississippi
64278	Holmwood	Y	3 Mar 2007	n/a[b]	N. Minnesota	Central
39889	Holmwood	N	5 Mar 2005	19 Apr 2005	N. Manitoba	Central
64283	Cheneyville	N	10 Mar 2007	1 May 2007	Manitoba	Central
64286	Cheneyville	Y	18 Mar 2007	16 Jun 2007	Manitoba	Central
39888	Cheneyville	N	20 Mar 2007	21 Apr 2007	North Dakota to Ontario	Central

[a] Transmitter failure occurred on 13 April 2007.
[b] Movements continued throughout the summer

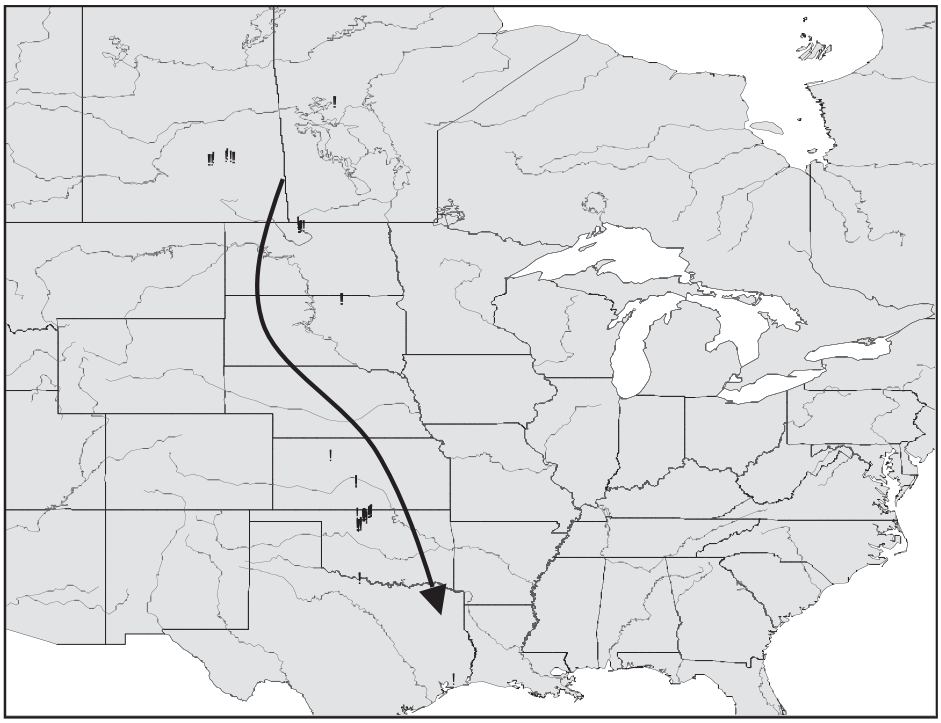

Figure 2. Fall migration routes for 2 sandhill cranes trapped at Holmwood and Cheneyville, Louisiana, 2005-2007, and fitted with satellite transmitters. Transmitters on 4 cranes failed prior to fall migration.

flock. Our study has 2 implications to the potential reintroduction of whooping cranes in Louisiana. First, there is a potential for reintroduced whooping cranes to migrate through the Central Flyway if they mix with wintering sandhill cranes. The risk of mixing may be greater for a reintroduced migratory flock at Marsh Island Refuge, as opposed to a resident flock. Marsh Island Refuge is relatively close to Holmwood and whooping cranes could also easily move into the vast marshes south of Holmwood. Secondly, 2 sandhill cranes captured near Cheneyville used the Mississippi Flyway. We are aware of no other study that has documented the daily migration behavior of sandhill cranes through the Mississippi flyway (i.e., between Louisiana and Wisconsin), although this route has been suspected from resightings of color-marked cranes (International Crane Foundation, unpublished data). Our finding suggests that the Mississippi Flyway could be a potential migration corridor for migratory whooping cranes reintroduced to Louisiana.

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