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DO ARCTIC-NESTING GEESE COMPETE WITH SANDHILL CRANES FOR WASTE CORN IN THE CENTRAL PLATTE RIVER VALLEY, NEBRASKA?

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Abstract: Numbers of arctic-nesting goose staging in spring in the Central Platte River Valley (CPRV) of southcentral Nebraska increased dramatically from the 1970s to the 1990s, raising concerns that geese may be competing with the mid-continental population of sandhill cranes (Grus canadensis) for waste corn. From late February to mid-April 1998-2001, we measured temporal patterns of cropland use, evaluated habitat preferences, and compared numbers of goose using the primary crane-occupied parts of the CPRV area with numbers of sandhill cranes. Numbers of Canada goose (Branta canadensis), lesser snow goose (Chen caerulescens), Ross’ goose (Chen rossii), and greater white-fronted goose (Anser albifrons) peaked an average of 2.3, 2.8, and 1.5 weeks before sandhill cranes, with 90% of goose numbers occurring by 21, 15, and 21 March when averaged over the 4-year period. Numbers of sandhill cranes, on average, were highest on 26 March. All bird groups used corn habitats in greater proportion than expected based on their availability (land area) and used soybean habitats less than expected. Across years, 37.5, 82.5, 53.7, and 44.3% of Canada goose, lesser snow goose/Ross’ goose, greater white-fronted goose, and sandhill cranes, respectively, occurred in quadrants where > 90% of the annually planted cropland was in soybeans. Overall, estimated numbers of goose annually averaged 66, 46, 39, and 62% of estimated numbers of cranes in the CPRV. When viewed in the context that arctic-nesting geese rely primarily on waste corn to meet their energy needs in Nebraska and crane capacity to store fat has declined over the past 20 years, these relationships suggest geese were important competitors of sandhill cranes for waste corn in the CPRV area during 1998-2001.

Key words: Anser albifrons, Branta canadensis, Chen caerulescens, Chen rossii, competition, corn, greater white-fronted goose, Grus canadensis, habitat use, lesser snow goose, Platte River, Ross’ goose, sandhill crane, soybeans, transects

Approximately one-half million sandhill cranes (Grus canadensis) representing about 80% of the continental population stop in spring in the Central Platte River Valley (CPRV) and North Platte River Valley of Nebraska (Krapu et al. 1984) where they acquire fat reserves in preparation for migration and reproduction (Krapu et al. 1985). Sandhill cranes obtain nearly all their energy and fat reserves from waste corn while in Nebraska (Reinecke and Krapu 1986). By the late 1980s and 1990s, the midcontinental population (MCP) of lesser snow geese (hereafter snow geese) had increased from an estimated 750,000 geese in 1979 to 6 million in 1997 (Abraham et al. 1997). Although snow geese were uncommon in spring in the CPRV as late as 1980 (U.S. Fish and Wildlife Service 1981), the Rainwater Basin Area (RBA), which lies adjacent to the CPRV on the south, became the principal spring staging area for snow geese by 1990, and flocks containing tens of thousands of snow geese/Ross’ geese had become common within the CPRV by the mid-1990s. The MCPs of Canada goose and greater white-fronted geese (hereafter Canada goose and white-fronted geese) also had increased markedly from 2 decades earlier (U.S. Fish and Wildlife Service 2001). In addition, while most cropland in the CPRV had been irrigated and in corn production for several decades (Krapu et al. 1984), soybeans became an important crop during the 1990s but with unknown significance to the spring staging population of sandhill cranes. These changes combined with evidence that sandhill cranes may be acquiring less fat in the CPRV than in the 1970s (Krapu et al. 2005) led to concern among crane managers that the 4 species of geese may have become major competitors with cranes for waste corn during late winter and early spring. These circumstances prompted us to evaluate whether arctic-nesting geese had become significant competitors for waste corn in the primary sandhill crane-occupied parts of the CPRV. Specifically, we: (1) determined temporal patterns of use of the CPRV by arctic-nesting Canada goose, snow geese/Ross’ geese, and white-fronted geese and compared to sandhill cranes; (2) compared magnitude of use of corn and soybean fields by arctic-nesting geese and sandhill

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cranes and evaluated preference/avoidance for these crops, and (3) estimated magnitude of use of the CPRV by arctic-nesting geese relative to level of use by sandhill cranes.

STUDY AREA

The study area encompassed that portion of the CPRV extending from south of Grand Island to the Overton area in Nebraska. Land use in this section of the CPRV was devoted principally to agricultural production, but extensive areas near the river were managed primarily for sandhill cranes and other wildlife. More detailed descriptions of land use and other characteristics of the CPRV are presented in U.S. Fish and Wildlife Service 1981, Currier et al. 1985, Krapu et al. 1986, and Sidle et al. 1989. Platte River channels were braided and contained numerous sandbars and vegetated islands of widely varying area (Williams 1978). Extensive lands formerly within parts of active channels were covered with woody vegetation (U.S. Fish and Wildlife Service 1981, Sidle et al. 1989). Native grassland and wet meadows adjoined present and former channels on parts of the study area. Throughout most of the CPRV, aside from land lying within the channels and an associated corridor of woodlands and grassland, most of the landscape was in cropland and planted to corn or soybeans.

Sandhill cranes roosted in shallow waters of inundated sandbars of Platte River channels primarily in areas where channels remained > 50 m wide (Krapu et al. 1984). Geese roosted in excavated ponds created by sand and gravel mining and in barrow pits left following construction of nearby Interstate 80. Geese also roosted in Platte River channels when low river stage exposed extensive sandbar habitat. Agricultural lands adjacent to the river served as the primary foraging sites of both geese and cranes staging in the CPRV.

METHODS

We established 8 transects where sandhill cranes were concentrated in the CPRV (Fig. 1) to estimate temporal use of the CPRV by geese and cranes and evaluate whether a preference existed for corn or soybeans. Each transect was divided into 80 quadrants each one-half mile (880 m) by one-quarter mile (440 m) on either side of maintained roads. Each transect was 32.2 km long and extended 16.1 km north and 16.1 km south from the main channel of the Platte River. Habitat types and post-harvest land use within quadrants were estimated from the ground in advance of the start of surveys. Canada goose, snow goose/Ross’ goose, greater white-fronted goose, and sandhill cranes were surveyed in each quadrant by driving the survey route, starting at 0800 CST, and stopping as needed to conduct counts. Survey data for snow goose and Ross’ goose were combined because field conditions prevented us from distinguishing between individuals of these closely related species. Surveys were conducted each week on Tuesdays, weather conditions permitting, beginning in the third week of February and continuing through the second week of April 1998-2001. In 1998, only 7 surveys were conducted with the last during the first week of April.

Statistical Analyses

Numbers of geese and cranes were tallied in each quadrant, but not by land use within quadrants. To estimate actual use of corn and soybean habitats, we allocated numbers of geese and cranes observed in each quadrant in direct proportion to the respective estimated acreage of corn, soybeans, and other habitats within quadrants. We estimated expected use of habitats (assumed no preference for specific habitats) by allocating numbers of geese and cranes to habitat types observed on each transect each year in direct proportion to the respective acreage of corn, soybeans, and other habitats in each transect (i.e., across quadrants). We compared actual use of corn and soybean habitats to expected use using chi-square tests (PROC FREQ; SAS Institute 1988), with separate tests for each bird group (Canada goose, snow goose/Ross’ goose, white-fronted goose, and sandhill cranes) and year (1998B2001). We used Mantel-Haenszel tests (PROC FREQ; SAS Institute 1988) to compare actual and expected use of corn and soybean habitats for each bird group across years while controlling for annual variation.

RESULTS

Migration Chronology

Numbers of all species of geese peaked by mid-March (median survey date 75) in all years and declined rapidly thereafter whereas numbers of sandhill cranes peaked in late March and remained high into the first week of April (median date 96) (Fig. 2). Numbers of cranes present before mid-March varied widely among years (Fig. 2) apparently influenced by weather conditions during late winter in the Central Plains. In 1998, unusually warm temperatures in February led to an exceptionally early arrival of large numbers of both cranes and geese (Fig. 2). Numbers of Canada goose, snow goose/Ross’ goose, and white-fronted goose, on average, respectively peaked 2.3, 2.8, and 1.5 weeks earlier than sandhill cranes with 90% of goose numbers occurring by 21, 15, and 21 March when averaged across years. Crane numbers averaged highest on 26 March during 1998-2001.

Habitat Preference and Use

Fifteen of 16 yearly comparisons indicated preference for corn and avoidance of soybeans (Table 1). Controlling for annual variation, all bird groups showed preference for corn habitats and avoidance of soybean habitats over the 4-year period (Table 1). Across years, 37.5, 82.5, 53.7, and 44.3% of use
Fig. 1. Locations of 8 transects used to estimate numbers of Canada geese, lesser snow geese/Ross geese, greater white-fronted geese, and sandhill cranes in the Central Platte River Valley of southeast Nebraska during late February to mid April 1998-2001.
Fig. 2. Relative abundance of Canada geese, lesser snow geese/Ross’s geese, greater white-fronted geese, and sandhill cranes (A-D) in the Central Platte River Valley of southcentral Nebraska during late winter and early spring of 1998-2001. Surveys were conducted weekly beginning during the third week of February (median date 54) and ending during the second week of April (median date 102).
Table 1. Percent actual and expected use of corn and soybean habitats on 8 transects in the Central Platte River Valley by sandhill cranes (SACR), lesser snow geese/Ross’s geese (SG/RG), Canada geese (CAGO), and greater white-fronted geese (GWFG) during 1998-2001. P-values test null hypothesis of no difference in actual versus expected use of habitats for individual years based on chi-square test, and no difference in actual versus expected use of habitats overall, controlling for year, based on Mantel-Haenszel test.

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<th>Species</th>
<th>Year</th>
<th>Corn Actual</th>
<th>Corn Expected</th>
<th>Soybeans Actual</th>
<th>Soybeans Expected</th>
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<td>10.4</td>
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by Canada geese, snow geese/Ross’ geese, white-fronted geese, and sandhill cranes occurred in quadrants where cornfields of various post-harvest treatments constituted > 90% of annually planted cropland. Across years, 0.1, 0, 0, and 2.5% of use by Canada geese, snow geese/Ross’ geese, white-fronted geese, and sandhill cranes occurred in quadrants where > 90% of the annually planted cropland was in harvested soybean fields.

Overall, estimated goose numbers within the primary crane-occupied parts of the CPRV averaged 66, 46, 39, and 62% of sandhill crane numbers during spring 1998-2001.

**DISCUSSION**

In order for competition for food to occur among species, one species must successfully out-compete another species thereby limiting the latter species ability to meet its nutrient requirements (Cockburn 1991). Corn is a preferred food of snow geese/Ross’ geese and white-fronted geese in southcentral Nebraska during spring migration (R. Cox, Jr., unpubl. data, Krapu et al. 1995) and apparently also of Canada geese based on the preference shown for corn during this study. Reliance of geese and cranes on corn to meet energy and fat storage needs combined with knowledge that the capacity of sandhill cranes to store fat has declined over the past 20 years (Krapu et al. 2005) suggests geese are important competitors of sandhill cranes for waste corn. The fact that numbers of geese peaked 1.5-2.5 weeks before sandhill cranes allowed time for a major part of waste corn to potentially be removed by geese prior to when most crane foraging occurred. With less corn available due to goose foraging, cranes presumably must spend more time searching for food, thereby increasing their maintenance energy costs when compared to the 1970s, a period when goose numbers were much lower and waste corn was present in excess of needs (Reinecke and Krapu 1986).

Level of competition between geese and cranes for waste corn can be expected to vary among years depending on when geese and cranes arrive, how long they stay, and on annual variation in amounts of waste corn. In years such as 1998 when large numbers of geese and cranes arrive early, the potential exists for exceptional levels of competition. In 1998, despite high use of the CPRV by geese and cranes in February and early March, major competition between geese and cranes likely was avoided because a severe storm in October 1997, early in the corn harvest, caused extensive lodging and breakage of ears from standing stalks. As a result, much higher amounts of waste corn were available in spring 1998 than during other springs (Krapu et al. 2004) compensating for extensive early goose and crane use of the CPRV (Fig. 2). High early use of the CPRV by geese in 1998 may have resulted, in part, because food was exceptionally abundant.

Limited quantitative information exists on numbers of spring staging geese staging during spring in the CPRV during the 1970s (U.S. Fish and Wildlife Service 1981). However, we conducted waterfowl surveys in the RBA during spring 1980 which indicated snow geese/Ross’ geese accounted for < 2% of spring goose use on surveyed wetlands and surrounding agricultural lands (G. Krapu, unpubl. data) and snow geese rarely were seen in the CPRV during 1978-80 (U.S. Fish and Wildlife Service 1981). Ross’ geese were rare in both the CPRV and RBA during the 1970s so it is probable that few, if any, of either species would have been present had surveys been conducted in 1978-80 along the transect routes used in our surveys. Snow geese/Ross’ geese accounted for about 42% of all geese in crane-occupied areas during in 1998-2001 reflecting the massive scale of increase of these species during spring in the CPRV over the 20-year period.

Growing competition from arctic-nesting geese for waste corn is but one of several factors responsible for less waste corn being available in the CPRV for cranes than in the past. Corn harvest efficiency increased by an estimated 55% in the CPRV from 1978 to 1998 (Krapu et al. 2004), reducing waste corn post-harvest by about 47% after accounting for increases in corn yield. Soybeans accounted for < 1% of the annually planted cropland in the CPRV in the 1970s (Krapu et al. 1984) but by 2000 accounted for an estimated 18% (G. Krapu, unpubl. data). Given avoidance of soybean fields by geese and cranes in the CPRV (this study) and lack of ingestion of waste soybeans by both geese and cranes (Krapu et al. 2004), increased soybean production also has increased competition for food between geese and cranes in the CPRV. Moreover, the relative difference between actual and expected use of corn and soybeans in our study (Table 1) likely underestimate actual differences because we proportionately allocated birds to habitat types within quadrants.

Whether competition for waste corn between arctic-nesting geese and sandhill cranes will continue to increase, stabilize, or decline, will depend, in part, on population trends of arctic-nesting geese and sandhill cranes. Over time, independent of level of competition from arctic-nesting goose populations, density of waste corn in the CPRV in early spring is likely to continue to decline due to ongoing efforts to increase harvest efficiency and the likelihood that production of soybeans and possibly other crops poorly suited for meeting energy needs of cranes and waterfowl will continue to increase. Therefore, we recommend that managers responsible for ensuring adequate resources remain available for spring-staging crane and waterfowl populations in Nebraska work with landowners to develop economically sound farming practices that will maintain sufficient high-energy food in fields during early spring to meet needs of sandhill cranes and arctic-nesting geese. Also, in sections of the CPRV where cranes are most concentrated because of limited suitable nocturnal roosting habitat (Krapu et al. 1982), cropland may need to be acquired and managed specifically to supplement high-energy food resources available on privately owned cropland managed for production of farm commodities.
ACKNOWLEDGMENTS

We thank Steve Anschutz of the Ecological Services Office of the U.S. Fish and Wildlife Service at Grand Island, Nebraska, and Daylon Figgs of the Kearney Office of the Nebraska Game and Parks Commission for making available time for their staffs to participate in waterfowl/crane surveys. We are particularly grateful to T. Buhl, D. Carlson, B. Hanson, W. Jobman, R. Meduna, and E. Wilson for assisting in this study. We thank D. H. Johnson for constructive comments on earlier drafts of this manuscript.

LITERATURE CITED


