An Unexpected Journey: Greater Prairie-chicken Travels Nearly 4000 km after Translocation to Iowa

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Abstract.—After translocation a female greater prairie-chicken (*Tympanuchus cupido pinnatus*) traveled over 3988 km between 5 April 2013 and 20 June 2014. The bird traveled a mean distance of 21.5 km per day during the spring (median distance per day 22.2 km; range 0–115 km per day) moving through portions of four states. Nine other marked birds traveled a mean distance of 336 km and a mean distance per day of 7.5 km during the spring (median distance per day 4.6 km; range 0–92 km per day). This is the first record of movements of this magnitude by a greater prairie-chicken. This report highlights the use of recent advances in satellite/GPS telemetry methods for advancing our knowledge of wildlife movements.

Introduction

The greater prairie-chicken (*Tympanuchus cupido pinnatus*) was once common throughout the Midwestern United States and in the grasslands of Iowa. As native grasslands in Iowa and the Midwest were converted to intensive agriculture after European settlement, the amount of habitat available for grassland species decreased. This habitat loss, combined with over-harvesting, led to a dramatic decline and eventual extirpation of prairie-chickens from Iowa (Stempel and Rodgers, 1961).

Re- introduction efforts by the Iowa Department of Natural Resources (IDNR) in the late 1980s and early 1990s established a small population of greater prairie-chickens in southern Iowa, but the future of the population is uncertain (Shepherd, 2011). In order to prevent the extirpation of the remaining re- introduced prairie-chicken population from the state, the IDNR implemented a plan to translocate greater prairie-chickens from Nebraska to Iowa (Iowa Greater Prairie-chicken Management Committee, 2013).

Greater prairie-chickens are a resident species with limited evidence of long distance movements (Niemuth, 2011). Historically, greater prairie-chickens may have exhibited seasonal movements related to food availability (Scmidt, 1936; Hamerstrom and Hamerstrom, 1949; Schroeder and Braun, 1993). For resident greater prairie-chickens, most individuals remain in a small area throughout their lives (Hamerstrom and Hamerstrom, 1951).

Recent developments in radio-tracking technology have enabled the production of satellite/Global Positioning System (GPS) transmitters small enough to be used on animals the size of greater prairie-chickens. Available models include solar powered units with up to 3 y of operating time. Using GPS transmitters allows for the location of animals without the physical presence and intrusion of a researcher. This lessened disturbance may allow the animal to behave more naturally, resulting in less biased location data (Mech and Barber, 2002). GPS transmitters also allow year-round data collection with multiple locations per day recorded for each animal.

We present movement data for 10 translocated female greater prairie-chickens and highlight the first documented case of extremely long-distance movements made by a translocated greater prairie-chicken. We also highlight the utility of satellite/GPS transmitters to advance our knowledge of wildlife movements.

Methods

Our study area included the capture location in southwestern Nebraska and the release area in southern Iowa. The capture location in Chase County, Nebraska (40°31′6″N, 101°38′33″W) is an agricultural area consisting primarily of native grass rangeland on the slopes of the sandhills. Level or gently sloping areas are planted to row crop, including corn (*Zea mays*) and winter wheat (*Triticum* sp.). The release site in Ringgold County, Iowa (40°41′37″N, 94°5′13″W) is an agricultural area consisting of cattle pasture planted to cool-season, nonnative grasses including smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), and tall fescue (*Schedonorus phoenix*), and row crops, primarily corn and soybeans (*Glycine max*). The release area also includes extensive wildlife conservation areas with native grasslands. The distance between the capture and release areas was 715 km.

FIG. 1.—Female greater prairie-chicken wearing an ARGOS satellite/GPS transmitter attached via rump mounted figure-8 harness. Photo by Pete Hildreth, Iowa DNR

The Iowa Department of Natural Resources trapped and translocated 73 greater prairie-chickens from southwestern Nebraska to southern Iowa and northern Missouri in April, 2013. Birds were captured on lek sites in Nebraska using walk-in traps. We weighed, measured, and banded each bird with a numbered aluminum band. Birds were processed and transported to Iowa within 12 h of capture.

Prior to release we placed solar Argos satellite/GPS transmitters (model PTT-100 22 g, Microwave Telemetry, Inc., Columbia, Maryland) equipped with mortality switches on 10 adult female prairie-chickens via rump mounted figure-8 harnesses (modeled after Bedrosian and Craighead, 2007; Fig. 1). Using a rump mount harness places the solar panel of the GPS transmitter dorsally, allowing maximum solar exposure and battery life. All 10 birds wearing satellite GPS transmitters were released at known lek sites in the Grand River Grasslands area of southern Iowa. We handled birds in accordance with the guidelines set by Iowa State University's Institutional Animal Care and Use Committee (permit # 4-12-7337-Q).

Transmitters were programmed to obtain locations six times per day from 15 March to 15 October and three times per day from 15 October to 15 March. We reduced the number of locations per day during the colder months due to the effects of shorter day lengths and colder temperatures on battery performance of the transmitters. Location data were downloaded weekly using the Argos Web service (CLS America, Lanham, Maryland). Data were parsed and decoded using MTI Argos-GPS Parser software (MTI, 2011) and imported and mapped in ArcMap 10.1 (ESRI, 2011). Travel paths and distances traveled were calculated using the Animal Movements feature in Hawth's Tools for ArcGIS (Beyer, 2004). Mean daily distances for each time period were calculated by dividing the distance traveled during that time period by the number of days in the time period. In cases where mortalities occurred during a particular time period, we truncated the time period for that individual and divided by the number of days for which location data were collected. We calculated mean daily distances and we report median distances for Spring (21 March–20 June), Summer (21 June–22 September), Fall (23 September–20 December), and Winter (21 December–20 March).

RESULTS

The mean distance travelled over the course of the year for the majority of the birds was 336 km. However, one of the 10 birds (band #112) traveled over 10 times that distance, totaling 3988 km between 5 April 2013 and 20 June 2014. Bird 112 moved a mean distance of 9 km per day, with her longest travel distances occurring in the spring season (Table 1). The maximum daily distance recorded for bird 112 was 115 km made on 9 May 2014. Bird 112s path initially spiraled out from the release site in Ringgold County, Iowa and eventually led back to south-central Iowa (Fig. 2). The bird arrived in south-central Iowa on 27 July 2013 and remained there throughout the summer and fall of 2013 and winter of 2014. During this period bird 112 had lower mean daily movement distances compared to spring movements (Table 1). On 21 March 2014 bird 112 started moving extensively again. Her path took her east into Illinois and west to the Missouri/Kansas border.

Transmitter loads (weight of transmitter plus harness divided by the weight of the bird) for all birds were below the accepted limits for wild birds in research (Fair *et al.*, 2010). Bird 112s weight was 4.6% lower than the mean weight of all birds, and as a result, her transmitter load (3.15%) was slightly higher than average (3.02%) but was still below accepted limits.

Discussion

Prairie grouse from the genus *Tympanuchus* are thought to have poor dispersal abilities (Braun *et al.*, 1994). However, seasonal movements have been reported. In a Colorado population of greater prairie-chickens, seasonal movements ranged from 2.9 km to 10.6 km (Schroeder and Braun, 1993). Resident greater prairie-chickens are reported to remain within 8 km of lek sites, and in cases where moderate movements have been recorded, individuals end up within a few kilometers of their lek sites (Svedarsky and Van Amburg, 1996). The longest movement distances reported in the literature for prairie grouse range from 5.8 km to 160 km (Table 2). Maximum values reported for mean daily distances moved range from 0.15 km per day to 1.23 km per day (Table 2). Previously reported movement distances for prairie grouse are lower than those we observed for all birds in our study and, in particular, for bird 112 (Table 1). One possible reason for differences between our study and others may be the methods used. For example our satellite/GPS transmitters provide multiple locations of an individual each day, whereas a VHF transmitter may only yield one to a few locations per week.

Translocated prairie grouse tend to move more than resident birds (Hamerstrom and Hamerstrom, 1949; Toepfer, 1988; Kemink and Kesler, 2013). This phenomenon is common for translocated animals, and in particular for translocated birds (Toepfer, 1976; Armstrong *et al.*, 1999; Coates *et al.*, 2006). Translocated greater prairie-chickens make more frequent movements immediately after release, while also traveling longer distances during these movements than resident birds (Toepfer, 1976). In addition, translocated individuals have lower survival rates than residents. For example, translocated greater prairie-chickens in Missouri had lower survival rates than resident birds in the same area (Carrlson *et al.*, 2014). Lower survival rates among translocated birds may be related to the longer and more frequent movements made after release (Yoder *et al.*, 2004).

Several studies have found daily movements of prairie-chickens are lowest in the summer (Hamerstrom and Hamerstrom, 1949; Robel *et al.*, 1970; Toepfer, 1988) and highest early in the breeding season (Robel *et al.*, 1970; Gratson, 1983). There are many possibilities for differential movement by season. Seasonal differences in movement rates may be due to seasonal changes in the availability of food and cover (Robel *et al.*, 1970). Movements exhibited by prairie-chickens after translocation do not appear to be associated with homing or orientation back to capture locations, but are more likely searching behavior or exploratory movements (Kemink and Kesler, 2013).

Movement rates for female grouse are highest when they are visiting lek sites in search of mates early in the breeding season (Robel *et al.*, 1970; Gratson, 1983). Hens may look for suitable nest locations during this time, therefore increasing their movement rates (Gratson, 1983). Movement rates for females may decrease later in the summer due to nesting and brood rearing behavior. In addition, molting of the flight feathers in late summer reduces movement in greater prairie-chickens (Schroeder and Braun, 1992). Since bird 112 did not attempt to nest during 2013, feather molting may help explain why bird 112s movements were greatly reduced later in the 2013 breeding season.

Social interaction may also influence how far an individual prairie-chicken moves (Kemink and Kelser, 2013). There is a social dominance order among groups of female greater prairie-chickens during lek attendance (Robel, 1970; Robel and Ballard, 1974). This social dominance can influence nest survival by making it more difficult for less dominant females to mate. This behavior may lead to delayed breeding and nesting which may result in lower nest survival (Robel, 1970) and fewer offspring being produced (Robel and Ballard, 1974). In addition aggressive behavior among females at lek sites

TABLE 1.—Distance traveled per day for 10 adult female translocated greater prairie-chickens. Values are given in kilometers for mean distance traveled per day, range, and median (Med) distance traveled per day. Weight in grams is given for each bird. Values are given for Spring (21 March–20 June), Summer (21 June–22 September), Fall (23 September–20 December), and Winter (21 December–20 March)

		Spring 2013			Summer 2013		
Band #	Weight(g)	Mean	Range	Med	Mean	Range	Med
112	810	21.5	0.2−58.2	22.2	2.8	0.1–13.5	1.1
51	830	0.1	0.0−0.3	0.1	_		
52	760	2.9	0.2−12.5	0.5	_		
53	900	16.9	0.2−45.1	16.8	_		
63	840	13.4	0.1−91.6	7.7	_		
111	930	8.7	0.0−34.9	4.9	1.5	0.0–5.1	1.2
113	830	13.1	0.1−33.6	8.0	_		
114	910	1.5	0.0−2.7	1.5	_		
125	800	2.2	0.2−7.5	1.3	_		
131	840	9.1	0.0−39.0	4.6	0.2	0.0–1.1	0.1

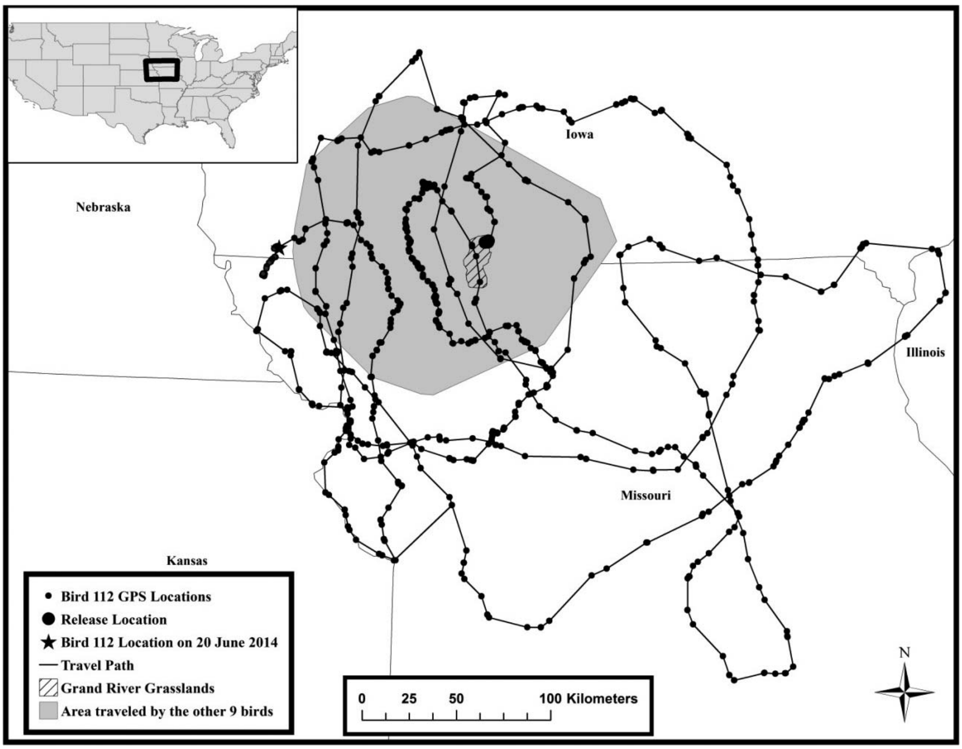

FIG. 2.—Travel path of translocated female greater prairie-chicken (bird 112) between 5 April 2013 and 20 June 2014. The total distance traveled during the study period was 3988 km. The shaded polygon indicates the area traveled by all nine of the other birds wearing transmitters

Table 1.—Extended

Fall 2013			Winter 2013			Spring 2014		
Mean	Range	Med	Mean	Range	Med	Mean	Range	Med
0.5	0.0–3.5	0.4	0.7	0.0–9.0	0.2	21.5	0.2–114.7	20.0
–			–			–		
–			–			–		
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may be associated with extensive movements by less dominant females as they travel to visit other lek sites (Robel, 1970). Larger movements of translocated birds may be the result of these social interactions when new individuals are introduced into existing lek social dynamics (Kemink and Kelser, 2013). Social dynamics may have played a role in the extensive movements we observed in bird 112. Because few active leks remained in the release area, bird 112 may have been looking for other lek sites where the social structure may have been more favorable.

The satellite/GPS transmitters used in this study enabled us to continue to track bird 112 long after she left the release area. With a traditional VHF transmitter, even using aircraft flyovers, it would likely have been impossible to locate bird 112 during much of the study period. The extended battery life of the transmitter not only allowed us to continue to collect location data on bird 112 through the fall and winter but also through the breeding season in 2014.

Table 2.—Maximum reported distances traveled by prairie grouse from the literature. Reports were taken from published data and include the species, location (U.S. States), Sex (Unknown, Male, Female), Age (Juvenile or Adult), maximum linear distance reported in study (km), mean distance traveled per day (km), and whether the population studied was resident (R) or translocated (T)

Species or subspecies	Location	Citation	Sex	Age	Max	Daily	Pop
T. c. pinnatus	Iowa	Moe (1999)	U	Adult	80.5	–	T
T. c. pinnatus	Kansas	Bowman and Robel (1977)	U,M	Juv.	10.8	0.94	R
T. c. pinnatus	Oklahoma	Patten *et al.* (2011)	F	Adult	15+	0.15	R
T. c. pinnatus	Wisconsin	Hamerstrom and Hamerstrom (1973)	F	Adult	48.3	–	R
T. c. pinnatus	Wisconsin	Hamerstrom and Hamerstrom (1949)	U	Adult	46.7	–	R
T. c. pinnatus	Wisconsin	Toepfer (1988)	F	Adult	103	1.26	T
T. c. pinnatus	Kansas	Robel *et al.* (1970)	M	Juv.	10.8	0.93	R
T. c. pinnatus	Wisconsin	Scmidt (1936)	F	Adult	160	–	R
T. c. pinnatus	Colorado	Schroder and Braun (1993)	F	Adult	40	–	R
T. c. pinnatus	Minnesota	Svedarsky and Van Amburg (1996)	U	U	48	–	R
T. pallidicinctus	Texas	Taylor and Guthery (1980)	M,F	Juv.	12.8	1.23	R
T. pallidicinctus	Kansas	Jamison (2000)	M	Adult	44	1.00	R
T. phasianellus	Wisconsin	Gratson (1983)	F	Juv.	5.8	0.87	R

The success of a translocation project is dependent on the translocated individuals remaining in the release area to reproduce. Bird 112 did not remain in the release area and reproduce, but she did provide alternative information that increased our understanding of the potential for dispersal in greater prairie-chickens. Our data show translocated greater prairie-chickens are capable of traveling distances vastly farther than previously known. Understanding the potential movement of individuals post-release may increase the chance of successfully establishing new populations in the future. This report also highlights the utility of recent advances in lightweight satellite/GPS transmitters and advanced telemetry monitoring methods for advancing our knowledge of wildlife movements.

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