

# HOURLY DISTANCES AND ALTITUDES OF A RECENTLY-FLEDGED TURKEY VULTURE ON ITS FIRST SOUTHBOUND MIGRATION \*

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## Introduction

In 2004, we fitted a nestling Turkey Vulture with a satellite transmitter, and subsequently documented its first fall migration from Saskatchewan to Costa Rica and its return the following spring as far as Nebraska.<sup>5</sup> In 2007, we fitted another nestling at the same nest with a transmitter that yielded more accurate and frequent locations, and followed its migration southward. Here we report on the results of this recent migration, compare it with the previously monitored one, and provide estimates of migration speed and elevation.

## Methods

On August 5 2004, a Turkey Vulture nestling was fitted with a 35g solar-assisted satellite platform terminal transmitter (PTT) and patagial tag H25. The nest was in a long-deserted farm house west of Ranger, SK (53.6249 N, 107.7620 W), where Ken McDaid, the neighboring farmer, had observed a nesting vulture each summer since 2002. The PTT averaged five irregular Doppler transmissions per day, with accuracy varying between 150 m and

10 km.<sup>1</sup> The four highest accuracy ratings provided 346 locations during its 67-day migration to its wintering grounds in the mountains south of San Jose, Costa Rica.<sup>5</sup>

On August 5, 2007, a second Turkey Vulture nestling from the same nest site west of Ranger was fitted with an improved PTT that was capable of hourly reporting with a global positioning system (GPS). The 70 g solar-powered PTT-100 transmitter #65543 (manufactured and refurbished by Microwave Telemetry, Inc., Columbia, Maryland)<sup>8</sup> was attached to the bird's back and contained sensors for temperature, battery voltage, transmission counts and activity counts. The PTT transmitted hourly at a frequency of 401.650 MHz  $\pm$  36 kHz, giving spatial readings within  $\pm$  15 m and altitude readings accurate to  $\pm$  22 m. A patagial tag, number A33, was placed on the right wing at the same time and here we refer to this individual Turkey Vulture by this tag number. Techniques for application of the backpack transmitter and the approval of the Animal Care Committee, University of Saskatchewan, were as described previously.<sup>5</sup>

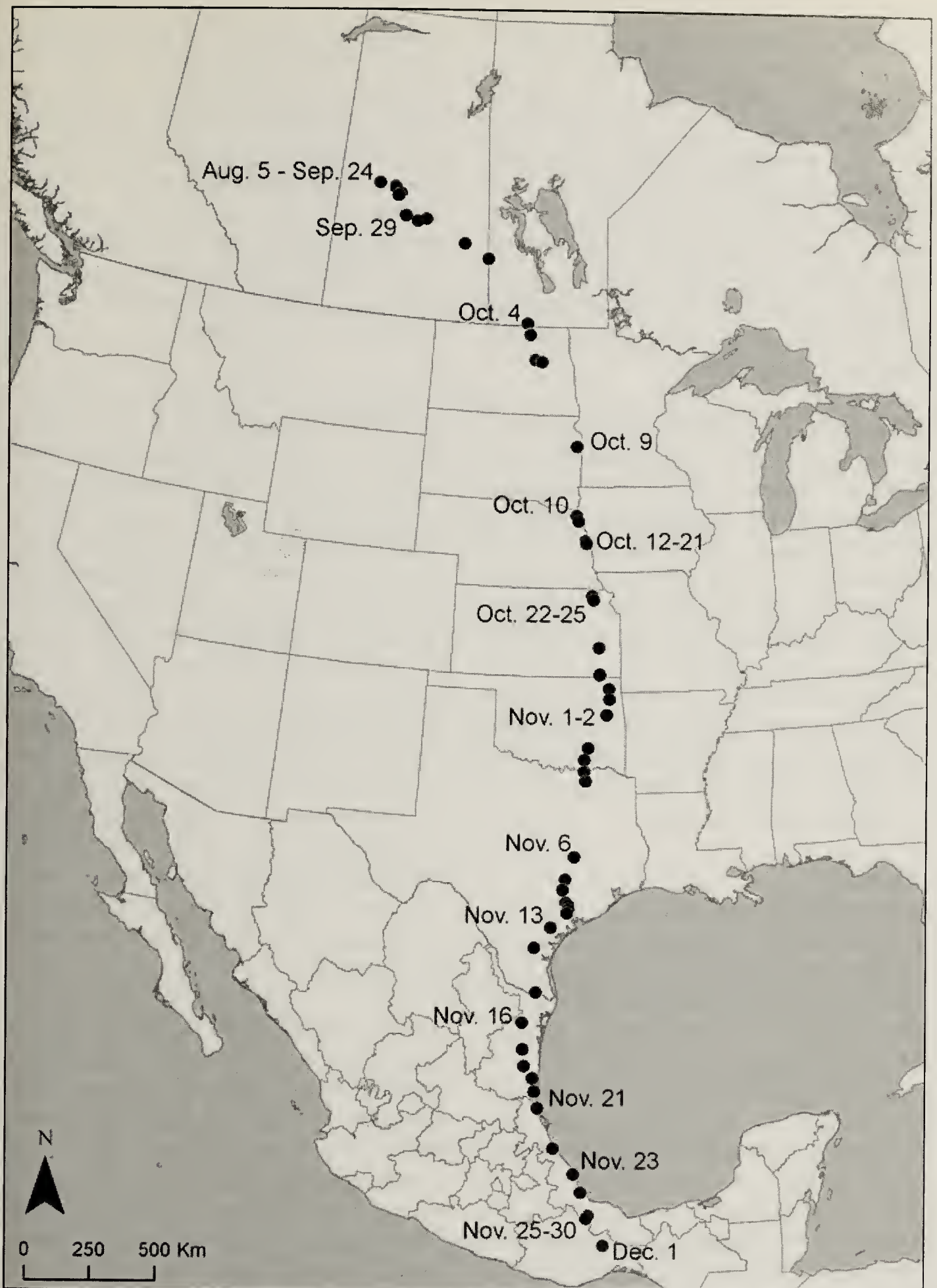


Figure 1. Each dot represents the bird's position at the beginning of a "travel day".  
Map by David R. Barber

Hourly distances and daily total distances were calculated using Greenwich. Days with all hourly distances less than 5.4 km, assumed to be consistent with feeding movements rather than migration, are referred to here as 'rest days'; those with at least one hourly distance greater than 5.4 km are called 'travel days'. Distances are rounded to the nearest km and time is given in Central Standard Time (CST).

To get a rough estimate of how high above the ground A33 was flying, we took the altitude of the night-time roost to represent the average ground level of the terrain it was flying over during the day. Each flight altitude was the number of meters above the night-time roost. Using the night-time roost to approximate ground level for the previous day's travel seemed justified because A33 traveled across the relatively flat terrain of the Great Plains in Canada and the United States, and along the coast in Mexico.

## Results

Transmitter readings indicated that the vulture first moved out of the farm house at 1000h on August 13; it roosted outside the house that night and for the 10 subsequent nights. Morning flights of 130, 150, 270 and then 330 meters began on August 14. On August 28, the vulture was back beside the house. A flight of 610 m was made in the evening of September 4. Its first flight of more than 1 km occurred on September 10, and the first over 2 km on September 19, the day that Ken McDaid phoned to tell CSH he saw the tagged nestling flying at a distance from the house. On each of these flights and many shorter ones, the bird returned promptly to near where it began.

At 1000h CST on September 24, 2007, the bird traveled 19 km south in

3 hours but returned to its nest site 2 hours later. The next day its southbound migration began at 1100h. It traveled or rested for 69 days in a gentle arc through Manitoba, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma and Texas, and along the gulf through Tamaulipas and most of Vera Cruz. It then veered inland to Oaxaca, Mexico on November 30 and December 1 (Figure 1).

Location data for A33 were received every hour for all 24 hours on 45 of the 69 days (Tables 1a-1d). In all, 1565 signals (94.5%) were received from a potential total of 1656 hours, as the vulture traveled 5014 km in 69 days. The number of hours of data received on the remaining 24 days ranged from 16 to 23. Three travel days, two of them in important locations, one at the Nebraska-Kansas boundary and the other during the final day in Oaxaca when the vulture presumably died, had an inadequate number of signals to determine hourly distances (7 signals on October 7, 16 on November 19, and 11 on the final day, December 1, each marked by "?" in Table 1). Only the total daily distance was known for those three days.

We designated 49 of the 69 days as travel days, i.e. days in which the vulture traveled more than 5.4 km in one hour. On 2 travel days A33 flew 1 hour, on 6 days it flew 2 hours, and on 4, 8, 9, 6, 8 and 2 days it flew for 3, 4, 5, 6, 7 and 8 hours, respectively. On seven of these travel days, interruptions midway during that day's travel occurred for one ( $n = 5$ ) or two ( $n = 2$ ) hours. On average, A33 flew 4.3 hours during each travel day, or just over 3 hours per 24 hour period for the 69 days elapsed time, including the 20 rest days.

On five days (October 4, 9, 10 and 21, and November 6), the vulture traveled more than 200 km. Only five

Table 1a. Daily speeds and altitudes of vulture A33 in 2007, Saskatchewan to Manitoba

Transmitter 65543		A33 Patagial tag right wing										approx		av km/ av max		
DATE	hrs of data	start hour	finish hour	hrs >5.4km	hrs no movt	daily distance (km)	max hourly distance (km)	L	highest altitude ASL (m)	hr of highest altitude	lowest altitude at night (m)	height above ground (m)	# days rest	# days travel	total 69days (km)	day height above ground
24/9	24	1000	1500	3	2	43	17		1056	1400	590	466				
25/9	24	1100	1600	5		66	27		879	1300	534	345				
26/9	24			0		8	5	L	590		527	63				
27/9	24	1100	1300	2		28	7	L	612	1300	528	84				
28/9	24			0		19	5	L	548	1000	508	40				
29/9	24	900	1100	2		87	50	L	557	1000	485	72				
30/9	24	1200	1600	4		50	17		985	1300	588	397				
1/10	23	1200	1400	2		46	20	L	603		545	58				
2/10	24	1100	1700	6		178	33		1327	1300	532	795				
3/10	24	1100	1700	6		115	29	L	618		527	91				
4/10	24	900	1700	8		293	49		1395	1400	459	936				
Canada				38		933						3347	2	9	85	304

Table 1b. Daily speeds and altitudes of vulture A33 in 2007, North Dakota to Nebraska

Transmitter 65543		A33 Patagial tag right wing										approx		av km/ av max			
DATE	hrs of data	start hour	finish hour	hrs >5.4km	hrs no movt	hrs no distance	daily distance (km)	max hourly distance (km)	L	highest altitude ASL (m)	hr of highest altitude	lowest altitude at night (m)	height above ground (m)	# days rest	# days travel	total days	height above ground (km)
5/10	24	1000	1300	3		46	46	15	L	500		461	39				
6/10	24			0		2	2	1	L	474		455	19				
7/10	21	900	1400	5		103	103	32		788		460	328				
8/10	24	1300	1500	2		28	28	14	L	480		375	105				
9/0	24	900	1700	7	1	354	354	67		848	1500	524	324				
10/0	21	1000	1700	7		268	268	48		1041	1300	405	636				
11/10	24	1400	1500	1		26	26	6		554		366	188				
12/10	23	1000	1600	5	1	86	86	10		912	1300	307	605				
13/10	22			0		11	11	4	L	364		289	75				
14/10	18			0		5	5	2	L	360		320	40				
15/10	22			0		0	0	0	L	317		298	19				
16/10	21			0		1	1	0	L	335		297	38				
17/10	22			0		1	1	0	L	355		245	110				
18/10	22			0		1	1	0	L	342		315	27				
19/10	24			0		5	5	2	L	364		353	11				
20/10	21			0		16	16	5	L	408		302	106				
21/10	7			?		201	201	?	?	337		323	14				
North Dakota - Nebraska				30		1154	1154					2684	7	9	72	168	

Table 1c. Daily speeds and altitudes of vulture A33 in 2007, Kansas to Texas

22/10	16		0	1	0	L	403	367	36				
23/10	24		0	1	0	L	395	384	11				
24/10	24		0	2	0	L	413	370	43				
25/10	24		0	2	0	L	407	391	16				
26/10	24	1300	2	19	10		720	537	183				
27/10	23	800	8	187	38		1033	290	743				
28/10	24	1000	6	107	24		903	213	690				
29/10	24	900	7	82	16		629	193	436				
30/10	24	1100	4	46	17		625	261	364				
31/10	24	1200	4	65	16		732	137	595				
1/11	24	800	6	152	33		406	172	234				
2/11	24		0	2	0	L	225	152	73				
3/11	24	1300	3	60	22		890	164	726				
4/11	24	1100	4	48	11		774	135	639				
5/11	24	1100	4	42	12		788	179	609				
6/11	24	900	7	305	57		870	113	757				
7/11	21	900	6	94	26		443	99	344				
8/11	24	1200	3	46	13		792	66	726				
9/11	24	1000	5	56	16		825	32	793				
10/11	22	1000	1	15	6		326	49	277				
11/11	17	1000	1	13	8		753	20	733				
12/11	24	1000	2	26	11		707	9	698				
13/11	24	1100	5	88	25		600	16	584				
14/11	24	1000	7	108	20		654	45	609				
15/11	24	1200	5	186	50		639	24	615				
Oklahoma - Texas			90	1753					11534	7	19	67	444

Table 1d. Daily speeds and altitudes of vulture A33 in 2007, Tamaulipas to Oaxaca

Transmitter 65543		A33 Patagial tag right wing				approx		av km/ av max								
DATE	hrs of data	start hour	finish hour	hrs >5.4km	hrs no movt	hrs daily	max hourly distance (km)	L	highest altitude ASL (m)	hr of highest altitude	lowest altitude at night (m)	height above ground (m)	# days rest	# days travel	total days	height above ground (km)
16/10	24	900	1600	7	7	132	24		463	1200	53	410				
17/10	24	900	1600	7	7	107	19		419	1100	67	352				
18/10	24	1100	1500	4	4	71	25		1003	1400	321	682				
19/10	16		?	?	?	62	?		358	700	102	256				
20/11	24	900	1400	5	5	63	14		517	1000	0	517				
21/11	24	1000	1500	5	5	73	20		483	1200	0	483				
22/11	24	900	1500	6	6	177	57		412	1300	13	399				
23/11	24	1100	1600	5	5	130	33	L	405	1600	309	96				
24/11	22	900	1600	7	7	82	18		558	1500	80	478				
25/11	24	1000	1400	4	4	104	27		501	1300	4	497				
26/11	24			0	0	3	1	L	49	700	0	49				
27/11	23			0	0	3	1	L	57	0	0	57				
28/11	23			0	0	2	0	L	45	0	0	45				
29/11	24			0	0	4	1	L	35	800	0	35				
30/11	23	1100	1400	3	3	35	10		336	1200	0	336				
1/12	11	?	?	?	?	126	?	L	292	2000	289	3				
Mexico				53	53	1174						4695	4	12	73	293
TOTAL				211	211	5014							20	49		

A-33 in 2007, Saskatchewan to Oaxaca. ? represents absent hourly data. L represents a low-altitude travel day within ~120 m of the ground. Hours are given in Central Standard Time, "24-hr clock."

**Table 2 Distances and altitudes of vulture A-33, by region, Saskatchewan to Oaxaca**

Region	Dates	# days rest	# days travel	# days	#	max km/ day	total km	av km day	direct dist km	av direct dist km	height above ground	av max height above ground
SK, MB	24/9 - 4/10	2	9	293	933	85	781	71	304			
ND, SD, NE	5/10 - 20/10	7	9	354	1154	72	864	54	168			
KS, OK, TX	21/10 - 15/11	7	19	305	1753	67	1725	66	444			
Mexico	16/11 - 1/12	4	12	132	1174	73	1032	65	293			
Total		20	49	354	5014	73	4402	64				



of the 1565 recorded hours clocked a speed greater than 50 km/hr, with a maximum of 67 km/hr at 1500h on October 9. Four of these five occasions with higher speed were associated with higher than average elevations.

The highest altitude above sea level (1395 m) and the highest altitude above ground (936 m) occurred near Cartwright, MB on October 4. Later, the vulture traveled in near-continuous thermals along the Caribbean coast of Mexico (KLB). One might have expected it to fly at greater heights farther north, where it would soar and glide between thermals, rather than in the south where thermal streets often form and where there should be less circle soaring and inter-thermal gliding. The northerly location of the highest altitude is the only evidence that tends to support this hypothesis. However, in a further test, the *mean* of single daily *maximum* heights reached above ground, lumping both travel and rest days, was calculated: 304 m in Canada, 168 m over the Dakotas and Nebraska, 444 m over Kansas through Texas, and 293 m over Mexico (Table 2). The only "travel days" (in addition to the "rest days" with regularly low flights) that involved flights entirely below ~ 120 m above ground, were four in Canada and two in North Dakota (L in column 9 in Table 1). Similarly, the average distance per day, based on all 69 days, failed to show any appreciable change between the four regions: 85, 72, 67 and 73 km/day as the vulture moved southward (Table 2).

Direct-line distances, between the first and the final readings of each period (Table 2), were shorter, at 781 km for Canada (mean, 71 km/day), 864 km for North Dakota to Nebraska (54 km/day), 1725 km for Kansas to Texas (66 km/day), and 1032 km for Mexico

(65 km/day), for a total-distance direct-line mean of 64 km/day.

An unexpected event was reported to the banding office by Bob Funke, a conservation officer/ game warden based at Fredonia, Kansas. He was called by farmer Walt Griffith, near Neosho Falls, because Griffith had observed a Red-tailed Hawk harassing a Turkey Vulture, and read its wing tag A33; the vulture then took refuge from the hawk by flying through a large open door into Griffith's machinery shed. Funke, on getting the call, rushed about 36 km to the Griffith farm and found the vulture hiding under a workbench. He extracted the vulture, and noticed to his surprise that the vulture also had a transmitter with antenna attached to its back. As Funke demonstrated the transmitter to the equally amazed farmer, the vulture slid out of his arms, flew out the door and went 16 km more before stopping for that night.

## Discussion

For the first time in North America, we were able to calculate the hourly speed and altitude of a recently-fledged Turkey Vulture during its first southbound migration. As expected for a bird using thermals, almost all the southward travel of vulture A33 occurred during midday, usually between 900h and 1700h, during 49 'travel days.' The remaining 20 days presumably involved resting and eating, without southbound progress.

This vulture started south from the same deserted house as the 2004 vulture, H25. The southward migration path of A33 as far as Oaxaca (Figure 1) was almost identical to that of the 2004 vulture that wintered in Costa Rica. The 2004 vulture, H25, however, began the journey four days earlier, reached Oaxaca 22 days earlier, on 9

November, and covered 5316 km in 72 days (map in Houston et al. 2007). A33 averaged 64 km/day using a direct-line distance from start point to end point as compared to 74 km/day for the direct-line distance of H25 in 2004.

When rest days and travel days are pooled, A33 traveled an average of 73 km per day for 69 days. In spite of prevailing northwesterly winds, it surpassed 50 km/hr only five times, an hourly speed consistent with the soaring speeds of 40 km/hr reported by Coles (a vulture keeping pace with a railway train)<sup>2</sup> and the 55 km/hr reported by Kirk and Mossman.<sup>7</sup>

Another species that most often uses soaring-gliding flight rather than powered flight during migration is the Golden Eagle. The eagle's travels resembled those of vultures in several ways. Juveniles making their first flight south from Alaska reached only a maximum of 261 km/day in 1997, but 472 km/day in 1999, only moderately greater than the 354 and 305 km of the juvenile vulture's longest day's travel. The eagles also took advantage of thermals for midday travel and employed stopovers of from 2 to 19 days.<sup>9</sup>

In contrast, raptors that use flapping flight rather than soaring-gliding flight have the potential to travel faster. A combined, pooled group of individual Saskatchewan Swainson's Hawks with leg bands, each encountered at one terminal site only, together suggest a coverage of over 10,000 km in 54 days, an average of 185 km/day, arriving in northern Argentina as early as November 7.<sup>10</sup> An adult Saskatchewan Swainson's Hawk, fitted with a Doppler transmitter and followed every day or two for the entire journey, required 96 days to reach its

wintering grounds in La Pampa province, Argentina on 30 November, a distance of 10,415 km in 96 days, averaging 108 km/day.<sup>4</sup> An adult Saskatchewan Osprey fitted with a Doppler transmitter covered a remarkable 1145 km in two days, from Rapid City, South Dakota to Matador Texas, and it also averaged a healthy 287 km/day for its 19 days of major southbound travel.<sup>6</sup> However, the next year the same Osprey required 9 days longer to make its trip to Costa Rica (Houston 2004).<sup>3</sup>

### Acknowledgments

Ralph Matzner, the landowner, and Ken McDaid, a neighbor, have kept a watchful eye on the vulture nest site near Ranger each summer since 2002. Myron Barton devoted several days to clearing underbrush to reach the GPS location of the fallen-off transmitter, 65543, which was found, on the third and final search, by Pieter Stoffel on August 2, 2006, and subsequently refurbished by Microwave Telemetry Inc. Michael J. Mossman posed important questions that have improved the value of this paper. Claude Bouchard, Professor Emeritus, Université de Laval, wrote the distance-measuring program Grinwich, adding an extra calculation to provide a daily as well as an hourly distance.

We thank Dr. Paul Howey for valuable information and assistance and for waiving the fee for Groundtrack when his company refurbished the transmitter, which thus became available for re-use in 2007. Sarkis and Bobbye Acopian supported the purchase of the PTT and other Hawk Mountain Sanctuary aspects of the project.

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## EASTERN WOOD-PEWEE NEST IN SOUTHEASTERN SASKATCHEWAN

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On the morning of 21 June 2008, I carefully identified a female Eastern Wood-Pewee building a nest at a former provincial picnic site in the Souris Valley along Highway #9. It was hovering to pick dry tops of brome grass (*Bromus* sp.) and then returned to integrate this material into the rim of the nearly completed nest. The nest was 'saddled' on the larger branch of a large Green Ash (*Fraxinus pensylvanica*) within a mature grove of Box Elder (*Acer negundo*) and American Elm (*Ulmus americanus*) with an open understory. The male called sporadically nearby.

These were two of five Eastern Wood-Pewees recorded that day along the route from Roche Percee to Hwy #9. I saw another pair interact at the former Roche Percee Provincial Recreation Site and a single bird calling 5.5 km to the east at Longney's Crossing.

This species is a resident in smaller numbers in the riparian areas along

the Souris River including the specific area of this nest. Other general areas where I and others have observed this species include Moose Mountain Provincial Park, the eastern Qu'Appelle Valley, Good Spirit Provincial Park and Duck Mountain Provincial Park. There have also been scattered reports from several other locations.

Alan R. Smith describes the Eastern Wood-Pewee as 'a rare but regular summer resident in mature deciduous forests' mainly in the Southeastern area.<sup>2</sup> Although it has long been accepted as a possible/probable breeding species, this is apparently the first nest record of a species that was first observed in Saskatchewan by Ernest Thompson Seton at Runnymede on 14 June 1884.<sup>1</sup>

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