

From the Field: The relationship of Rio Grande wild turkey distributions to roads



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Distance sampling from roads is a common population estimation technique used for many wildlife species (Brennan and Block 1986, DeYoung and Priebe 1987, Borralho et al. 1996, Dahlheim et al. 2000). A critical assumption of the distance sampling technique is that the distribution of animals is not influenced by the transect, but this assumption may be violated if the transect is a road (Burnham et al. 1980, Buckland et al. 2001, Williams et al. 2001). Attraction of target animals to the transect will result in inflated population estimates, and withdrawal from the transect will bias the estimates low (Verner 1985, Thompson et al. 1998, Buckland et al. 2001).

Many authors have suggested line transects should not be positioned along roadways unless individuals are randomly distributed across the landscape (Burnham et al. 1980, Buckland et al. 2001, Williams et al. 2001). Male Rio Grande wild turkeys (*Meleagris gallopavo intermedia*) likely use roads as display sites in south Texas; thus, population surveys using roads should be conducted outside of the breeding season to reduce the probability of wild turkeys being attracted to roads (DeYoung and Priebe 1987). Eastern wild turkeys (*M. g. silvestris*) in Virginia used areas >450 m from roads more than expected and areas <150 m from roads in proportion to availability (McDougal et al. 1990). In Arizona, male Merriam's wild turkeys (*M. g. merriami*) used areas <200 m from roads less

than expected (Rogers et al. 1999). However, none of those studies examined the relationship of roads to wild turkey distributions during specific seasons and time periods. Our objectives were to quantify the association of male and female Rio Grande wild turkeys to roads according to season and time of day, and examine the potential biases of using roads as transects for distance sampling. We conducted this research in order to help develop appropriate protocols for distance sampling of Rio Grande wild turkeys from roads.

Study area

Research was conducted at 3 study sites in Texas and 1 site in Kansas. The Texas study sites were centered on the Matador Wildlife Management Area (WMA) (352.4 km²), located northwest of Paducah in Cottle County along the confluence of the Middle and South Pease Rivers; the Gene Howe WMA (347.5 km²), located northeast of Canadian in Hemphill County along the Canadian River; and private ranches surrounding the Salt Fork of the Red River (721.7 km²) north of Hedley in eastern Donley and western Collinsworth counties. The Kansas study site was centered on the Cimarron National Grasslands (264.5 km²) north of Elkhart in Morton and Stevens counties, Kansas, and Baca County, Colorado along the Cimarron River. The riparian areas of the 4 study sites were dominated by cottonwood

(*Populus deltoides*), western soapberry (*Sapindus drummondii*), hackberry (*Celtis occidentalis*), honey locust (*Gleditsia triacanthos*), black locust (*Robinia pseudoacacia*), tamarisk (*Tamarix chinensis*), and sand plum (*Prunus angustifolia*) (Spears 2002, Spears et al. 2002, Holdstock 2003). The upland areas were dominated by mesquite (*Prosopis glandulosa*), sand sagebrush (*Artemisia filifolia*), redberry juniper (*Juniperus pinchotti*), shinnery oak (*Quercus havardii*), sand plum (*Prunus angustifolia*), and acacia (*Acacia* spp.) rangelands. Primary land uses at the study sites were cattle ranching interspersed with center-pivot agriculture and oil and gas development. Road density averaged 12.1 ± 0.4 m/ha (mean \pm SE). More detailed descriptions of the study sites were provided by Spears (2002), Spears et al. (2002), Holdstock (2003), and Phillips (2004).

Methods

As part of a larger study (e.g., Spears 2002, Barnett 2003, Holdstock 2003, Phillips 2004), Rio Grande wild turkeys were captured using drop-nets (Glazener et al. 1964), rocket nets (Bailey et al. 1980), and walk-in traps (Davis 1994). We outfitted approximately 75 wild turkeys at each study site/year with an 8-hour mortality switch, 95-g, backpack-style radiotransmitter (Model #A1155, Advanced Telemetry Systems, Isanti, Minn., USA) and triangulated locations 1 to 3 times/week from January 2000 through December 2003 using the techniques of Holdstock (2003) and Phillips (2004). We triangulated locations using a null-peak receiver system (Advanced Telemetry Systems, Isanti, Minn., USA) and a vehicle-mounted dual 4-element yagi antenna (Balkenbush and Hallett 1988, Samuel and Fuller 1994). Telemetry locations for individual wild turkeys were separated by ≥ 1 day. The observation period was divided into seasons (winter=01 December through 28 February, spring=01 March through 31 May, summer=01 June through 31 August, and autumn = 01 September through 31 November) and time of day (AM=first third of day light hours, midday=middle third of day light hours, and PM=last third of day light hours). Telemetry locations with error polygons > 1 km² were removed prior to analyses.

Distances from roads to telemetry locations were measured with the Nearest Neighbor 3.5 extension for ArcView[®] 3.2 GIS (Weigel 2004). Dense vegetation at our study sites made detection unlikely for

wild turkeys > 100 m from roads. Thus, we measured the percent availability of area < 100 m and ≥ 100 m from roads at each study site with a buffer tool in ArcView[®] GIS 3.2. We used χ^2 goodness-of-fit tests (Conover 1999) to determine whether wild turkeys used road buffers in proportion to availability. If a difference was found between the distributions of use and availability, we used Goodman's simultaneous confidence intervals for multinomial proportions (Goodman's confidence intervals) with a continuity correction factor of 0.5 to determine if the distance intervals were used more, less, or in proportion to availability (Goodman 1965, Cherry 1996).

Results

We obtained 16,766 locations of Rio Grande wild turkeys (female=11,214, male=5,552). We located wild turkeys 2,234 times during autumn, 6,093 in spring, 6,885 in summer, and 1,554 in winter. Telemetry location error polygons averaged 0.179 ± 0.002 km² (mean \pm SE). Distance of wild turkey locations from roads averaged 280.1 ± 1.7 m. Across the study sites, $22.4 \pm 0.5\%$ of the available area was within 100 m of roads; $77.6 \pm 0.5\%$ of the available area was ≥ 100 m of roads. Thus, we used 22.4% to reflect the availability of the area within 100 m of roads for all study sites.

Female Rio Grande wild turkeys used the area within 100 m of roads in proportion to availability during autumn midday, spring midday and PM, and winter AM and midday (Table 1). Male use did not differ from availability during autumn AM, midday, and PM, spring AM, summer AM, and winter AM and PM (Table 1). The area < 100 m from roads was used in proportion to availability by both sexes during 2 season and time of day combinations: autumn midday and winter AM.

Discussion

Our results suggest that distance sampling from roads during autumn midday and winter AM would result in unbiased estimates of Rio Grande wild turkeys. However, other time periods might result in biased estimates. For example, expect an inflated population estimate from distance sampling along roads for both male and female wild turkeys during the summer midday period because wild turkeys of both sexes used areas < 100 m of roads more than expected (Table 1). Also, expect an

Table 1. Rio Grande wild turkey use of areas within 100 m of roads by season, time of day, and sex in the Texas Panhandle and southwestern Kansas, 2000–2003.

Season	Time	Sex	n ^b	χ^2	df	P	Goodman's confidence interval (<100 m) ^a			use ^c
							lower bound %	% observed	upper bound %	
Autumn	AM	F	350	15.431	1	≤0.001	25.76	31.14	36.78	+
		M	292	0.037	1	0.847	16.84	21.92	27.61	o
	Midday	F	515	2.095	1	0.148	20.93	25.05	29.45	o
		M	340	0.800	1	0.371	19.45	24.41	29.83	o
	PM	F	428	18.578	1	≤0.001	26.19	31.07	36.16	+
M		309	0.148	1	0.701	18.22	23.30	28.92	o	
Spring	AM	F	1,216	8.858	1	0.003	16.41	18.83	21.43	-
		M	464	0.297	1	0.586	17.29	21.34	25.78	o
	Midday	F	1,848	0.774	1	0.379	19.45	21.54	23.73	o
		M	645	5.840	1	0.016	22.59	26.36	30.34	+
	PM	F	1,370	0.579	1	0.447	19.12	21.53	24.09	o
M		550	8.288	1	0.004	13.88	17.27	21.08	-	
Summer	AM	F	1,336	15.440	1	≤0.001	24.21	26.87	29.63	+
		M	726	0.330	1	0.566	19.89	23.28	26.90	o
	Midday	F	1,630	13.156	1	≤0.001	23.74	26.13	28.61	+
		M	897	17.456	1	≤0.001	24.91	28.21	31.63	+
Summer	PM	F	1,458	33.811	1	≤0.001	26.12	28.74	31.43	+
		M	838	7.648	1	0.006	23.05	26.37	29.86	+
Winter	AM	F	296	0.765	1	0.382	15.40	20.27	25.80	o
		M	137	3.931	1	0.047	9.38	15.33	23.03	o
	Midday	F	393	0.365	1	0.546	16.77	21.12	25.95	o
		M	190	12.678	1	≤0.001	25.78	33.16	40.89	+
	PM	F	374	9.057	1	0.003	23.81	28.88	34.24	+
M		164	4.465	1	0.035	21.74	29.27	37.43	o	

^a Goodman's simultaneous confidence intervals for multinomial proportions were used to compare use of areas <100 m from roads to availability. The area <100 m from roads was used in proportion to availability if the Goodman's interval included 22.4% (percent availability of the area <100 m from roads) (Goodman 1965, Cherry 1996).

^b Total number of Rio Grande wild turkey locations.

^c Symbols indicate areas <100 m from roads were used more (+), less (-), or in proportion to availability (o).

under estimate during those seasons and time periods in which turkeys used areas within 100 m less than their availability (e.g., females during spring AM) (Table 1). Thus, autumn midday and winter AM are probably the best times in the Texas Panhandle and southwestern Kansas to conduct distance sampling from roads based on wild turkey distributional patterns. However, other factors such as flocking behavior and visual obstruction need further consideration because they may influence distance sampling as well. Future research should also focus on the degree of bias resulting from the distributional patterns of Rio Grande wild turkeys around roads in particular seasons and time periods.

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