FINAL REPORT

SECTION 6

ENDANGERED SPECIES ACT

OKLAHOMA
DEPARTMENT OF WILDLIFE CONSERVATION

FEDERAL AID PROJECT E-35-3

Distribution and Ecology of the Swift Fox (*Vulpes velox*)

SEPTEMBER 26, 1994 - SEPTEMBER 29, 1997

FINAL REPORT

STATE: Oklahoma GRANT NUMBER: E-35-3

GRANT TYPE: Research

GRANT TITLE: Distribution and Ecology of the Swift Fox (*Vulpes velox)*

SEGMENT DATES: 26 September 1994 to 29 September, 1997

PROJECT OBJECTIVES:

1) Evaluate the efficacy of various detection techniques including scent post surveys, spotlighting, and infra-red triggered cameras.

2) Determine the current range and population status of the swift fox in Oklahoma.

3) Investigate habitat affinities and potential interspecific associations (e.g., with other canids) of the species and its dependence on particular landscape features such as prairie dog towns.

4) Assess potential threats to existing swift fox populations.

5) Conduct data analysis and write the final report

Abstract

Scent post surveys, conducted using 0.9144 m x 0.9144 m 26 gauge stainless steel tracking plates sprayed with chalk and baited with canned mackerel and meat scraps, proved to be an effective means of detecting the presence of swift fox and other carnivores in this region of Oklahoma. Information obtained from tracking plates located in six counties in northwestern Oklahoma reveal that the swift fox is not randomly distributed across this region. On the contrary, its individuals are concentrating in the

extreme northwestern corner of this region. The geographic bias in distribution of swift fox is highly significant ($P < 0.001$), and significantly different from the other major canid encountered in this study - coyotes ($P < 0.001$). Within Cimarron County, the county with the highest relative abundance (detection rate) of swift fox, this species seems to prefer prairie dog towns, rangelands and pinyon-juniper mesas, and avoids riparian areas. Coyotes, on the other hand, were most frequently detected in riparian areas. The low relative abundance of swift fox in geographic areas (counties) and macrohabitats with high detection rates of coyotes is consistent with the hypothesis that predation by other canids may strongly influence the distribution of swift fox (red fox also frequent riparian habitats in this region, pers. obs.). Along with the threat of predation by other canids, any activities that reduce optimal habitat for swift fox should also be viewed as a significant threat.

PROCEDURES:

The three counties in the Oklahoma panhandle (Cimarron, Texas and Beaver) and three adjacent counties (Harper, Ellis and Woodward) were surveyed for the presence of swift fox and other mammals (Figure 1). The panhandle of Oklahoma consists primarily of shortgrass and mixed grass prairie, rangeland and extensive agricultural habitats. Several riparian corridors cut predominantly west-east through the panhandle, and the northwestern corner of the panhandle is dominated by pinyon-juniper woodlands and mesa habitats.

Presence and distribution of swift fox were determined primarily through the use of baited tracking plates at pre-established tracking stations. The technique required that a 0.9144 m x 0.9144 m 26 gauge stainless steel tracking plate be set down and sprayed with a mixture of isopropyl alcohol and carpenters chalk (G.M. Fellers, National Biological Service, pers. comm.). The alcohol serves as a dispersant and the mixture results in a thick, uniform coating of chalk on the plate after the alcohol evaporates. In our design, each plate has a one inch hole drilled through its center, allowing it to be placed directly over a stake that permanently marks the tracking station. Bait was then placed in the middle of the plate or on the stake. The plate was recovered and checked for tracks after three nights (Egoscue, 1956; Hatcher, 1978; Orloff et al., 1986, 1993; Paveglio and Clifton, 1988; Pocatello Supply Depot progress report, 1981).

Ninety permanent tracking stations were established throughout the panhandle, and 42 were established in adjacent counties according to a stratified design (Figure 1). First, tracking stations were distributed through the panhandle (or portions of adjacent counties) according to their relative size. Next, macrohabitats were identified within counties and the area they covered determined. Tracking stations were assigned to these macrohabitats proportionally. In very small or excessively large macrohabitats, numbers of stations were set to ensure an adequate sample size (i.e., a minimum of no less than 12 stations per macrohabitat). The tracking effort assigned to each county and each habitat within each county is reported in Tables 1 and 2 (see "functional plate nights in those tables). Lastly, the specific locations of the stations were determined according to land accessibility and distance from other established stations. A minimum linear distance of at least three miles was maintained between all tracking stations. Thirty-one tracking stations were established in Cimarron county, 33 stations were established in Texas county, and 26 stations were established in Beaver county. Nineteen stations were established in Ellis County, 18 in Harper County and five in Woodward County.

Results of the tracking studies were reported as detection success, which equaled the number of detections per functional plate-night. Note that this measure adjusts for differences in tracking efforts across counties and across habitats. Functional plate-nights is a measure of actual effort and is calculated as total number of plate nights (number of plates * number days tracking) - number of plate nights that were rained out.

Five broad habitat types, or "macrohabitats", were identified in the Oklahoma panhandle. These were as follows: rangeland (included grazed and ungrazed rangeland), mesa, agricultural land (plowed and planted), riparian areas, and prairie dog towns. The dominant gross habitat feature in the Oklahoma panhandle is rangeland. Thirty tracking stations were placed in this habitat. Eighteen tracking stations were established in agricultural lands of the panhandle, sixteen stations were placed in prairie dog towns, fourteen in riparian areas, and twelve stations were placed in the Black Mesa area (Table 2). In adjacent areas in western Ellis, Harper and Woodward Counties nine sites were established in agricultural lands, five at prairie dog towns, 24 in rangelands and eight in riparian areas. The local land features of this region are generally uniform. Due to this, the designation of the macrohabitat that a station was placed in is usually very clear. The exceptions are agricultural lands and riparian areas. A track station was determined to be in agricultural land if 50% or more of the area at the crossroads where the station was established was active farmland. In riparian areas, tracking stations were placed in the middle of dry river beds or culverts, usually at a bridge. The requirement for an area to be considered riparian was that at some point in the year, it held water when other surrounding areas did not.

As we reported in the FY 1994-1995 annual report, fatty acid scent disks proved less efficient than other attractants. Instead, canned mackerel combined with beef scraps proved an efficient attractant for a diversity of mammals and was used throughout the final two years of this project. The mackerel was placed in the center of each tracking plate and a scrap of beef was placed on top of each stake at the tracking stations.

Infra-red triggered cameras also were used to detect and document the occurrence of swift fox in the study area. The cameras consist of three units, the camera itself, the camera housing containing the automatic shutter trigger, and the infrared sensor. The sensor detects localized thermal changes within 5 to 6 m of the camera and triggers the shutter. The sensor and the camera are set up within fifteen feet of the tracking plate. This technique allows for a visual record of endotherms visiting the tracking station and allows for verification of tracks recorded during the sampling period.

Spotlighting was conducted opportunistically in Cimarron county on July 23 and October 17, 1995. The observer cruised along a section of road, stopping at five points spaced one mile apart, and then used predator calling to attract carnivores and identify them with a spotlight.

RESULTS:

Tracking sessions were conducted during the following periods: In the panhandle during July, 1995; October 1995; March 1996; July 1996; February 1997; in adjacent counties during October 1996. After adjusting for periods when tracking plates were rained out, this effort totaled to 1038 functional plate nights. Twelve different species of mammals were detected (Tables 1 and 2). Overall, mammals were detected 141 times over 1038 functional plate nights (detection success = 13.6%). Detection success for swift fox was 3.3% (34 detections out of 1038 plate nights).

As Figures 1 and 2 illustrate, swift fox activity (as inferred from detection success) was not randomly distributed across the geographic region sampled. Swift fox detections were more than twice as frequent in Cimarron County than any other county and the geographic bias was highly significant ($P < 0.001$; Chi-square goodness of fit test = 23.48, 3 df, data for counties in the body of the state were pooled because of relatively low expected frequencies). On the other hand, the distributions of other mammals (Figure 3) and coyotes in particular (Figure 4) were quite different, being highest in counties of the body of the state and low in the panhandle (especially Cimarron County). The geographic biases exhibited by these other mammals is significant (Chi-square = 13.59 and 8.32 for all mammals (excluding swift fox) and for coyotes, respectively; $P < 0.005$ and $P < 0.05$; 3 df, data for counties in the body of the state were pooled because of relatively low expected frequencies). A test of independence revealed that swift fox and coyote distributions differed significantly across this region (Figure 4; $P < 0.001$, Chi-square = 19.15, 2 df, data for Beaver, Harper, Ellis and western Woodward Counties were pooled because of relatively low expected frequencies).

Figure 1 depicts the distribution of swift fox across the panhandle. Particularly interesting are the apparent "hot spots" of activity and detections in the extreme northwestern corner of the panhandle. Principal among these is the Black Mesa Region and adjacent prairie dog towns. The population in this area and to the west and northwest may be serving as a source population for swift fox throughout the panhandle.

In a similar fashion, mammal detections were not randomly distributed among macrohabitats (Figures 5 and 6). Within Cimarron County, where most swift fox detections occurred, this species appeared to favor prairie dog towns (especially those within or adjacent to the Black Mesa Region) and avoided riparian sites (detection success was too sparse to allow statistical tests of the pattern illustrated in Figures 5 and 6).

In addition to information from tracking studies, we recorded a number of incidental observations of mammals (Table 3). During spotlighting activities, one bobcat was detected at a prairie dog town on October 17, 1995, and another was detected in mesa habitat on July 23, 1995. A bobcat was also photographed with an infra-red triggered camera in the Mesa Region on March 25, 1996. Coyotes were detected with spotlighting five times in mesa habitats on July 23, 1995, and one was observed at a prairie dog town on July 29, 1996. Swift fox also were detected incidental to other activities in Cimarron County once on July 22, 1995, and once on October 14, 1995. One swift fox was also observed in agricultural land of Texas County on November 19, 1996. Finally, infra-red triggered cameras recorded swift fox in agricultural land of Beaver County on March 27, 1996, and in Mesa habitats of Cimarron County on July 29, 1996.

DISCUSSION:

Objective 1: Evaluate the efficacy of various detection techniques including scent post surveys, spotlighting, and infrared triggered cameras.

As reported in our first annual report, we feel that the most effective technique used to assess swift fox presence and distribution in the Oklahoma panhandle has been the tracking station (i.e., scent post surveys). Tracking stations performed well in effectively detecting swift foxes. In dry weather, they provide clear, easily readable tracks. Additionally, the information gathered at tracking stations is not restricted to just foxes, but includes a variety of other vertebrates. There were several stations that recorded swift fox tracks plus the tracks of other carnivores. The ability to record multiple station visits makes the tracking stations even more valuable. We strongly recommend that the use of tracking stations be continued and emphasized as the principal method of swift fox detection. In addition we recommend that, when possible, tracking surveys be complemented with the use of infra-red triggered cameras.

Cameras can be set up at tracking plates known to detect swift fox and, thus, can serve to verify identifications based on tracks.

Objective 2: Determine the current range and population status of the swift fox in Oklahoma.

As discussed above and illustrated in Figures 1 and 2, swift fox activity was substantially and significantly higher in Cimarron County than in any other county we studied. Again, it appears that the population in the Black Mesa and adjacent regions to the west and north may represent a source population, while Texas, Beaver and counties to the east may represent population sinks (i.e., those maintained largely by emigration of individuals from population "sources").

Objectives 3: Investigate habitat affinities and potential interspecific associations (e.g., with other canids) of the species and its dependence on particular landscape features such as prairie dog towns.

As discussed above and illustrated in Figure 5, mammal activity does not appear to be randomly distributed across macrohabitats of the Panhandle. Mammal activity, in general tended to be highest at prairie dog towns and riparian sites. Detections of swift fox, however, tended to be highest in the Black Mesa Region and adjacent prairie dog towns of Cimarron County (Figure 1). We hypothesize that the distributions of swift fox may be strongly influenced, not just by distributions of macrohabitats, but also by the distributions of other carnivores (especially coyotes) that may prey heavily on swift fox. Consistent with this hypothesis, swift fox and coyotes were segregated both geographically and ecologically (i.e., by macrohabitats; Figure 4 thru 6). Although not detected during these studies, red fox tend to exhibit a distribution pattern similar to that of coyotes. That is, they tend to be more common in the body of the state and they tend to frequent riparian habitats (see Caire et al., 1989).

Objective 4: Assess the potential threats to any existing populations.

Predation from other canids may be a serious threat to swift fox in this region. Coyote populations were historically low until the eradication of wolves. In addition to coyotes, red fox may be posing an increasing threat to swift fox as the former species continues to extend its range westward across Oklahoma into the panhandle region. Any activities that favor these larger canids or that reduces the coverage of swift fox habitat may seriously threaten this species.

Objective 5: Conduct data analysis and write the final report.

This report completes this objective.

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Table 1. Number of detections of mammal species across the five counties surveyed. Functional plate nights (tracking effort) is also reported.

Count of Detection Results		Detection Results			
Region	County	*Canis familiaris*	*Canis latrans*	*idelphis virginianu*	*Erithizon dorsatum*
Body of the State	Ellis		2		
	Harper		3		
	Woodward		1	1	
Body of the State Total			6	1	
Panhandle	Beaver	1	2		
	Cimarron	1	7		1
	Texas	1	17		
Panhandle Total		3	26		1
Grand Total		3	32	1	1

Felis domesticus	*Lynx rufus*	*Mephitis mephitis*	*docoileus hemionu*	*Procyon lotor*	*Spilogale putorius*
3		3			2
		5			1
		3			1
3		11			4
2	1	3		1	6
1	3	3			11
	3	4	1		4
3	7	10	1	1	21
6	7	21	1	1	25

All Species

Taxidea taxus	Vulpes velox	Grand Total	Functional Plate Nights
		10	57
1	1	11	60
		6	21
1	1	27	138
2	6	24	179
4	24	55	312
2	3	35	309
8	33	114	900
9	34	141	1038

Table 2. Tracking results as a function of local habitat conditions.

Count of Detection Results			Detection Results					
Region	County	Habitat	*Canis familiaris*	*Canis latrans*	*idelphis virginianu*	*Erithizon dorsatum*	*Felis domesticus*	*Lynx rufus*
Body of th	Ellis	Agricultural land					2	
		Prairie Dog Town		1				
		Range					1	
		Riparian		1				
	Ellis Total			2			3	
	Harper	Agricultural land						
		Prairie Dog Town						
		Range		1				
		Riparian		2				
	Harper Total			3				
	Woodwar	Agricultural land						
		Range		1				
		Riparian			1			
	Woodward Total			1	1			
Body of the State Total				6	1		3	
Panhandle	Beaver	Agricultural land		2			1	
		Prairie Dog Town						
		Range	1				1	
		Riparian						1
	Beaver Total		1	2			2	1
	Cimarron	Mesa		1		1		1
		Prairie Dog Town		2				
		Range	1	1				1
		Riparian		3			1	1
	Cimarron Total		1	7		1	1	3
	Texas	Agricultural land		10				1
		Prairie Dog Tow	1	5				
		Range		1				1
		Riparian		1				1
	Texas Total		1	17				3
Panhandle Total			3	26		1	3	7
Grand Total			3	32	1	1	6	7

						All Species	
							Functional
Mephitis mephitis	*Odocoileus hemionus*	*Procyon lotor*	*Spilogale putorius*	*Taxidea taxus*	*Vulpes velox*	*Grand Total*	*Plate Nights*
						2	12
						1	9
3						4	27
			2			3	9
3			2			10	57
2						2	9
				1		1	6
1			1		1	4	33
2						4	12
5			1	1	1	11	60
1			1			2	6
2						3	12
						1	3
3			1			6	21
11			4	1	1	27	138
1		1	3	1	3	12	86
			1			1	50
			1		2	5	97
2			1	1	1	6	46
3		1	6	2	6	24	279
2					7	12	111
			3	2	6	13	51
			4	1	10	18	102
1			4	1	1	12	48
3			11	4	24	55	312
1				2	1	15	108
	1		2			9	60
1			2		2	7	90
2						4	51
4	1		4	2	3	35	309
10	1	1	21	8	33	114	900
21	1	1	25	9	34	141	1038

Table 3. Information on incidental detections of carnivores.

County	Date	Species	Township, Range, Section	Detection Method	Macrohabitat
Cimarron	22-Jul-95	*Vulpes velox*	T1N, R9E, Sec 30/19	Incidental	Agricultural land
Cimarron	23-Jul-95	*Canis latrans*	T6N, R2E, Sec 27	Spotlighting	Mesa
Cimarron	23-Jul-95	*Canis latrans*	T6N, R2E, Sec 27	Spotlighting	Mesa
Cimarron	23-Jul-95	*Canis latrans*	T6N, R2E, Sec 25	Spotlighting	Mesa
Cimarron	23-Jul-95	*Canis latrans*	T6N, R3E, Sec 19	Spotlighting	Mesa
Cimarron	23-Jul-95	*Canis latrans*	T6N, R3E, Sec 19	Spotlighting	Mesa
Cimarron	23-Jul-95	*Lynx rufus*	T6N, R2E, Sec 25	Spotlighting	Mesa
Cimarron	14-Oct-95	*Vulpes velox*	T4N, R2E, Sec16	Incidental	Mesa
Cimarron	17-Oct-95	*Lynx rufus*	T6N, R3E, Sec 13	Spotlighting	Prairie Dog Town
Cimarron	25-Mar-96	*Lynx rufus*	T5N, R1E, Sec 18	Infrared Camera	Mesa
Cimarron	29-Jul-96	*Canis latrans*	T4N, R2E, Sec 19	Visual/Incidental	Prairie Dog Town
Cimarron	29-Jul-96	*Vulpes velox*	T4N, R2E, Sec 27	Infrared Camera	Mesa
Texas	10-Nov-96	*Vulpes velox*	T2N, R19E, Sec 28	Visual Sighting	Agricultural land
Beaver	27-Mar-96	*Vulpes velox*	T1N, R22E, Sec 25	Infrared camera	Agricultural land
Beaver	27-Mar-96	*Canis familiaris*	T1N, R21E, Sec 33/34	Infrared camera	Range

Figure 1-a. Locations of sites surveyed during this study.

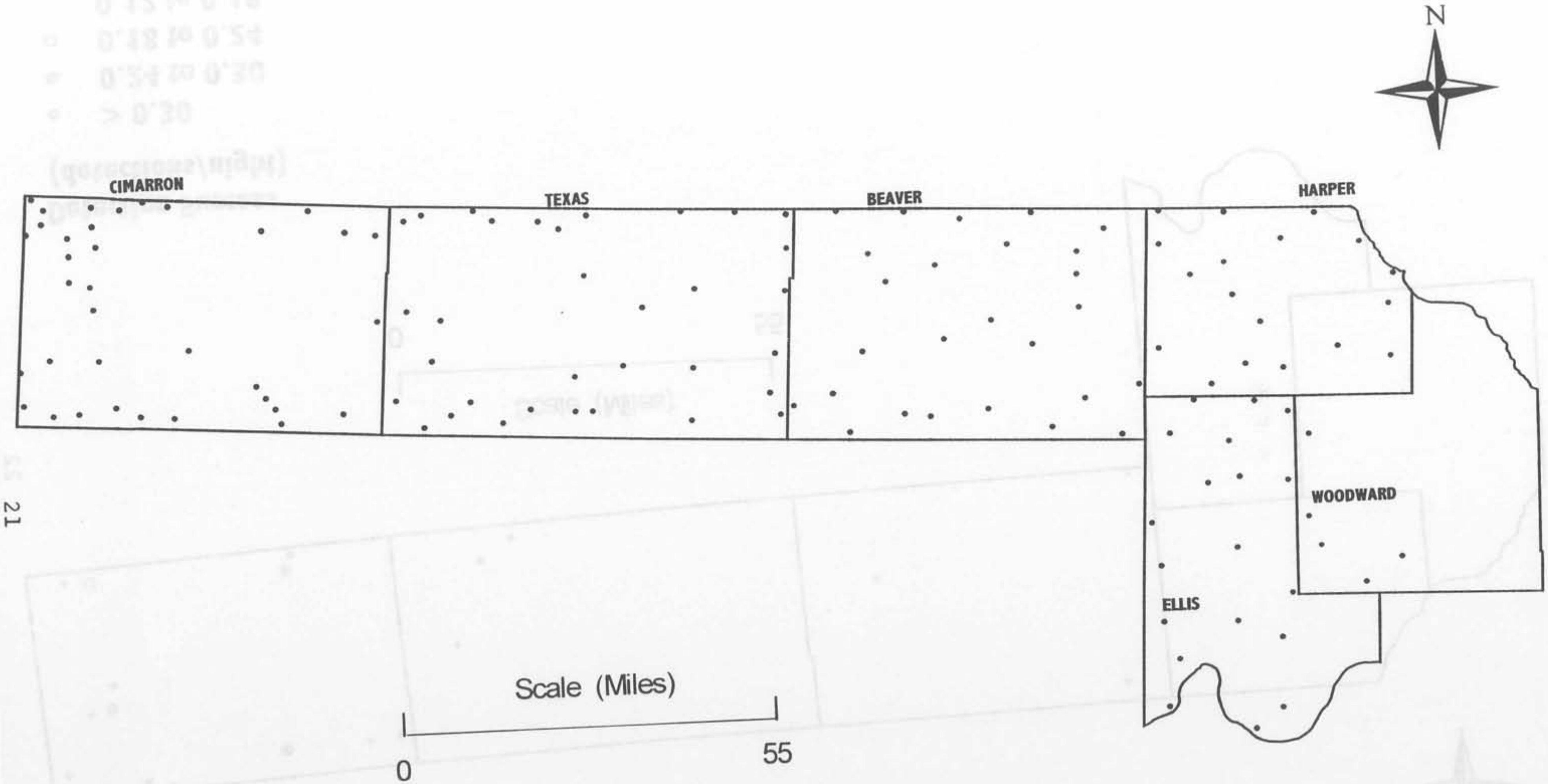
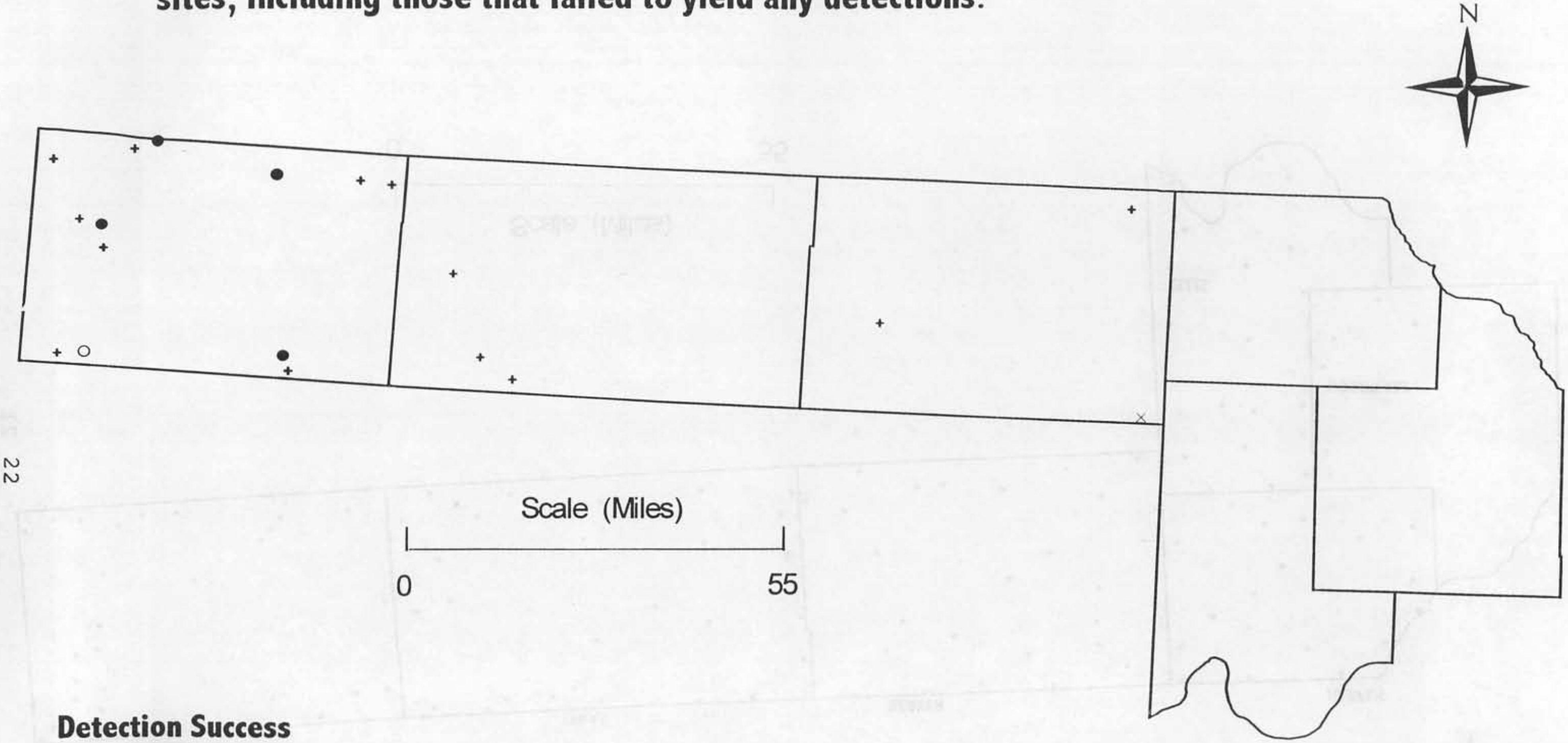


Figure 1-b. Sites where swift fox were detected during these studies (symbols indicate relative densities, or detection success; see legend). See Figure 1-a for locations of all sites, including those that failed to yield any detections.



Detection Success (detections/night)

- ● > 0.30
- • 0.24 to 0.30
- ○ 0.18 to 0.24
- 0.12 to 0.18
- + 0.06 to 0.12
- × > 0.00 to 0.06

Figure 2. Distribution of swift fox across counties of north-western Oklahoma.

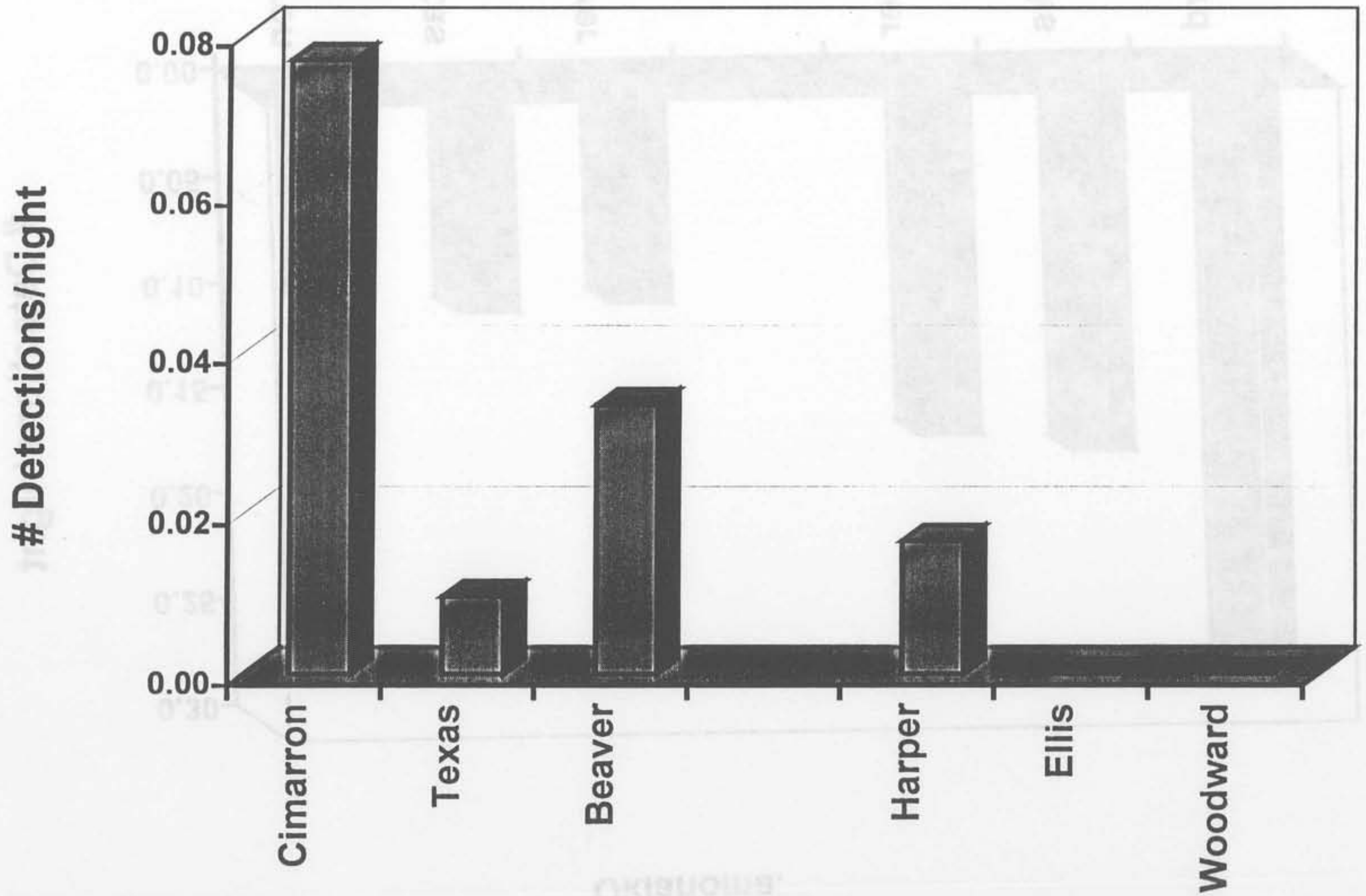


Figure 3. Distribution of mammals (excluding swift fox) across counties of north-western Oklahoma.

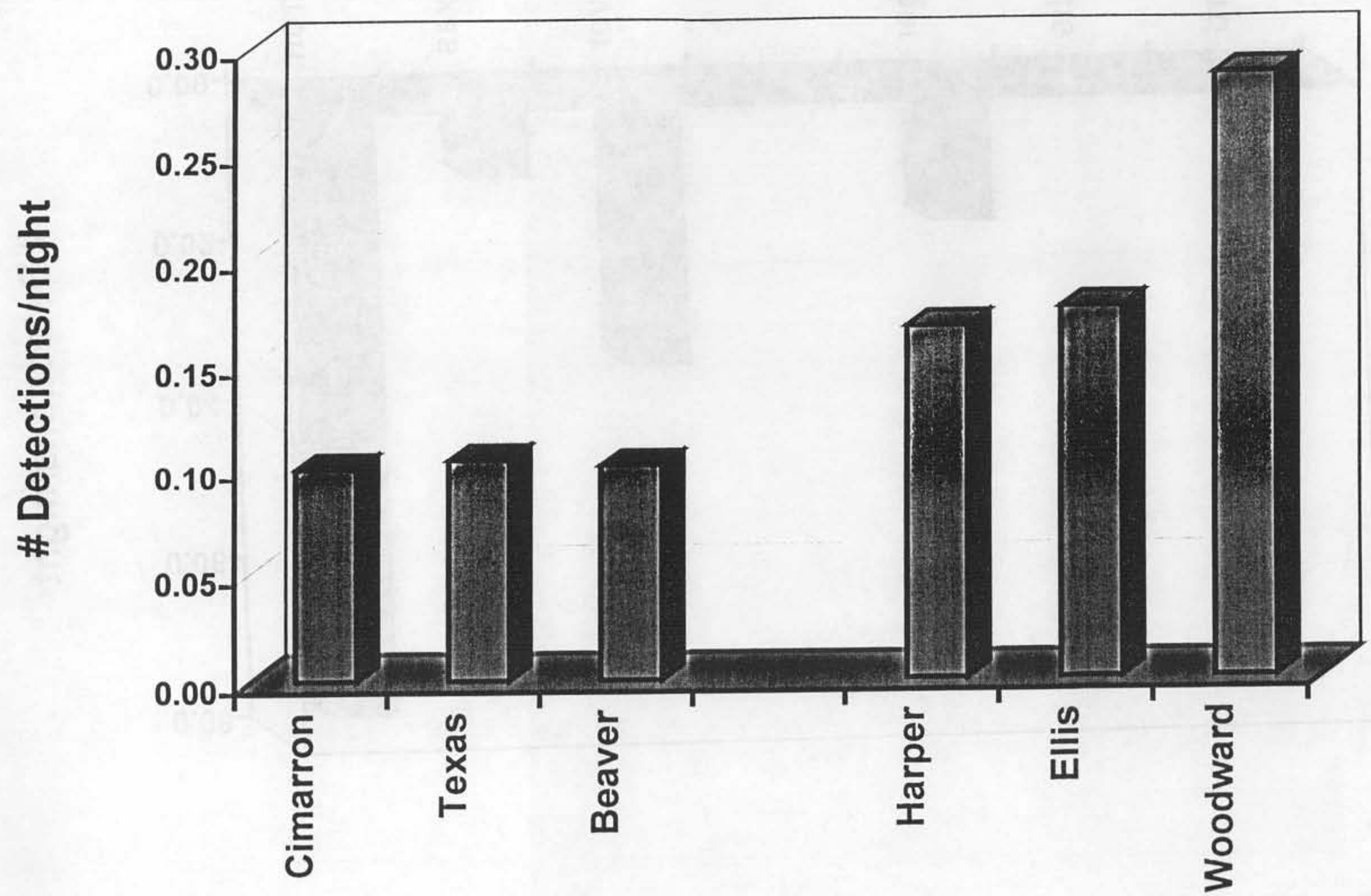


Figure 4. Distribution of coyotes across counties of north-western Oklahoma.

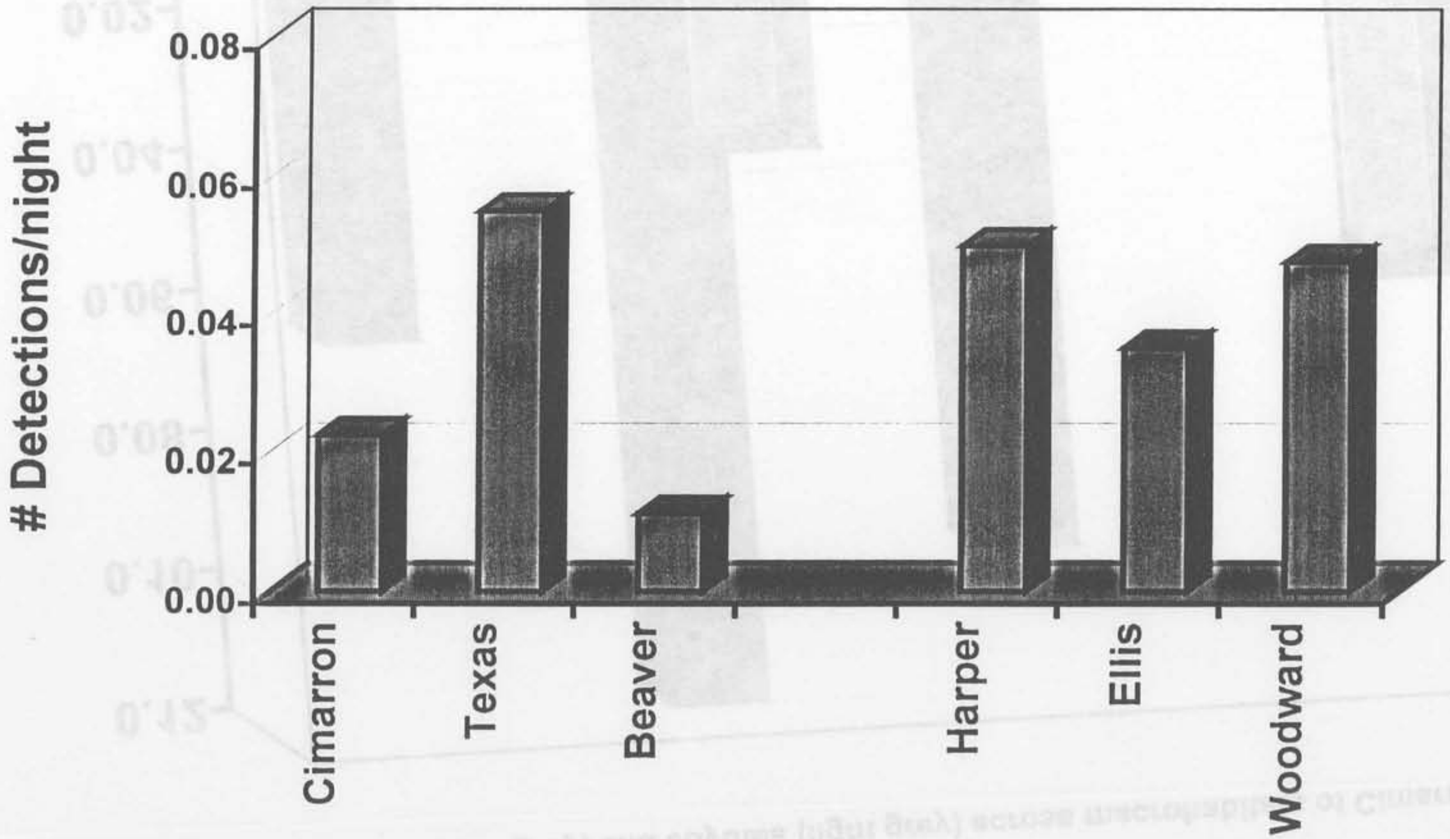


Figure 5. Distributions of swift fox (dark grey) and coyotes (light grey) across macrohabitats of Cimarron County.

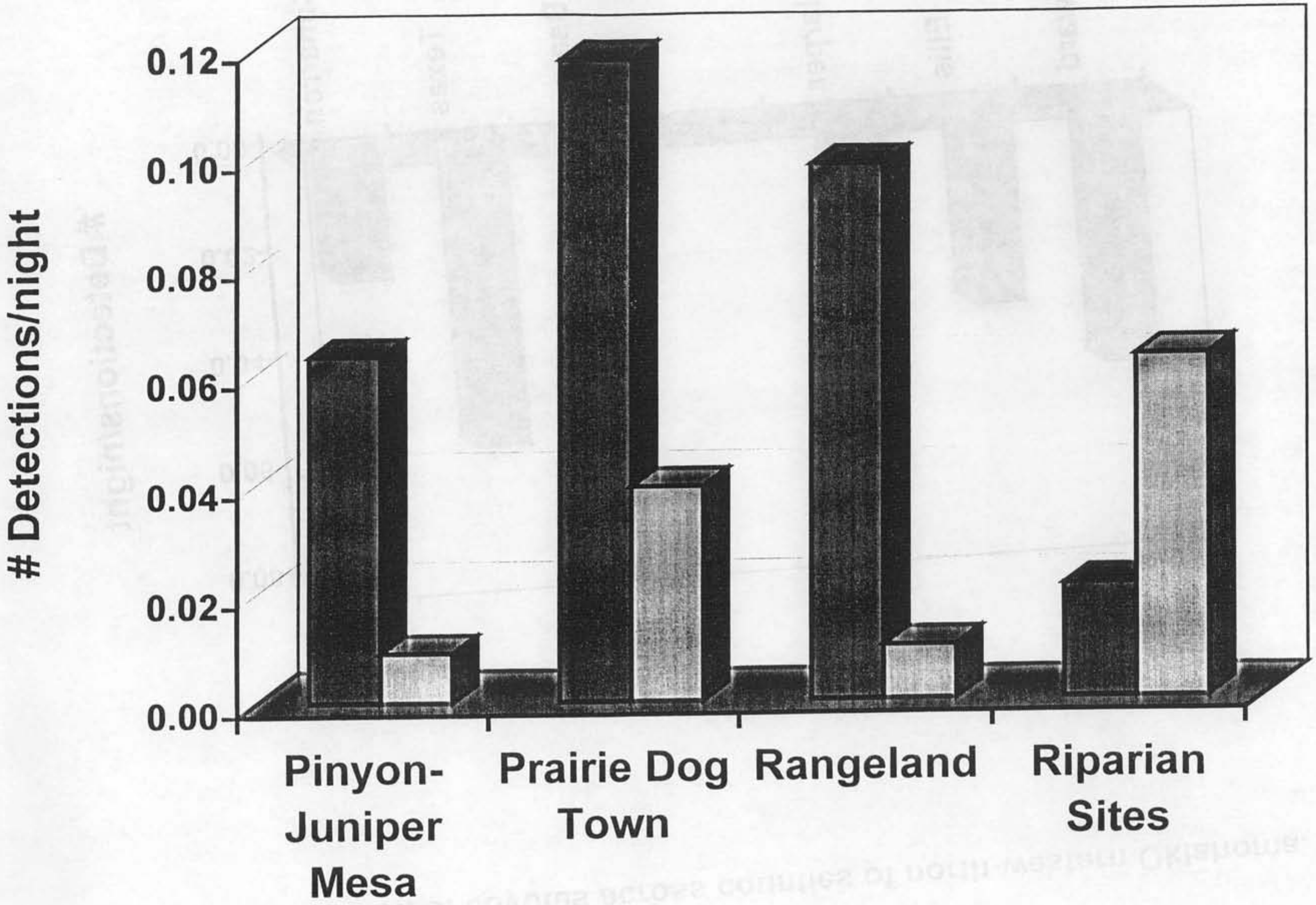


Figure 6. Distributions of swift fox (dark grey) and coyotes (light grey) across macrohabitats (all counties).