MAMMAL CAMERA TRAPPING SUCCESS IN A FRAGMENTED SUBURBAN LANDSCAPE

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Introduction

Camera traps are commonly used for mammal surveys and many recent studies have published variable trap success rates (Kelly & Holub 2008, O'Connell et al. 2011). Trap success rates may not be appropriate for comparisons among studies in different areas because there are many assumptions for trap success rates and detection probabilities to be constant across study sites. Most published reports have focused survey efforts in protected areas or large contiguous forests and the capture rates from these studies may vary compared to rates within highly altered landscapes.

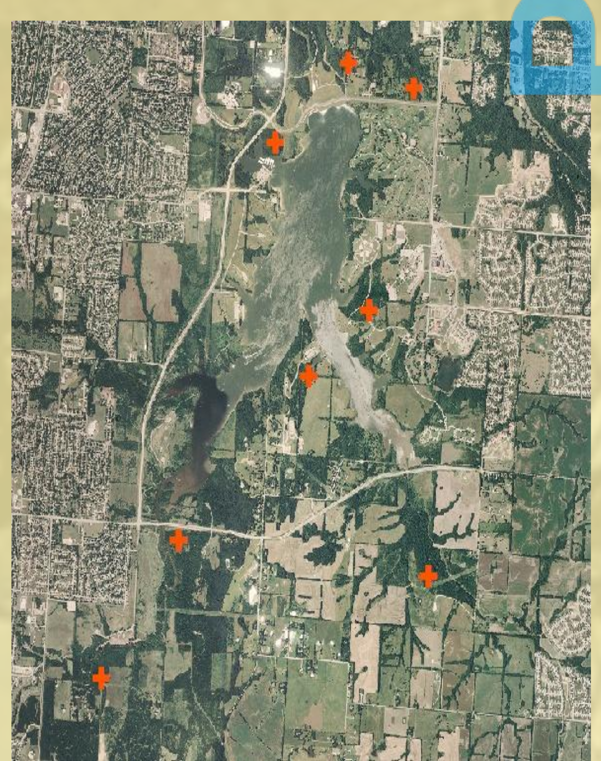
We aimed to compare trap success rates from our study with a similar study in Virginia (Kelly & Holub 2008). We also attempted to examine the influences of habitat parameters on detectability of several mesopredators in our study area using the occupancy analyses recently developed by MacKenzie et al. (2006).

Research Hypothesis

Mammals occurring in fragmented systems are more easily detected by camera traps due to concentrated foraging activities in small fragments.

Study Areas

Twenty-two sites in two rapidly developing suburban areas at Longview Lake, Lee's Summit, Missouri and Warrensburg, Missouri



Longview Lake, Lee's Summit, Missouri

Warrensburg, Missouri

Methods

Field Work

- October 2009 to May 2010
- Reconyx TM RM45 IR Game Camera (pictured)
- Moultrie Game Spy 4.0
- Set >500 m apart
- Baited with 1-3 kg deer meat or butcher scraps
- Surveyed each site for 10-18 days

Acknowledgments

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Methods continued

Analysis

- Detection histories for each mammal species detected
- Latency to initial detection, trap success, and naïve occupancy
- Occupancy analyses for habitat-specific effects on detection

Results

Over total of 308 trapnights (TN) of effort, we detected 11 native mammal species and 2 domesticated mammals (Table 1). Forest cover had a negative influence on our ability to detect coyotes and increasing urbanization positively influenced our ability to detect red foxes (Table 2). Raccoon and opossum detections were not influenced by habitat variables.

Table 1.−Selected estimates of latency to initial detection (LTD) with associated standard errors in parentheses, trap success (detections/100 TN), naïve occupancy (percentage of sites species detected), and total number of independent detections from mammal camera trap surveys in the suburban Midwest, conducted October 2009-May 2010.

Species	LTD (in TN)	Trap success	Naïve Ψ	Independent detections
Raccoon (*Procyon lotor* – pictured below)	2.42 (0.39)	38.96	0.86	120
Opossum (*Didelphis virginianus*)	3.84 (0.95)	37.34	0.86	115
White-tailed deer (*Odocoileus virginianus*)	3.55 (0.50)	27.92	1.00	86
Squirrel (*Sciurus niger* & *S. carolinensis*)	4.62 (0.98)	19.48	0.59	60
Red fox (*Vulpes vulpes*)	3.11 (0.98)	8.77	0.45	27
Coyote (*Canis latrans*)	4.90 (1.15)	7.79	0.45	24
Domestic cat (*Felis cattus*)	2.83 (1.25)	6.82	0.27	21
Domestic dog (*Canis familiaris*)	5.25 (1.51)	4.55	0.36	14
Cottontail rabbit (*Sylvilagus floridanus*)	5.75 (0.94)	3.90	0.18	12
Gray fox (*Urocyon cinereoargenteus*)	2.00[a]	2.92	0.05	9
Bobcat (*Lynx rufus* – pictured below)	5.25 (1.80)	1.95	0.18	6
Striped skunk (*Mephitis mephitis*)	6.5 (1.50)	1.62	0.09	5

[a]No standard error reported because gray fox was only detected at one site.

Table 2.−Selected top models, untransformed coefficients, and model-averaged effects of habitat variables and trophic interactions on detection probability ($\hat{p}$) for coyote and red fox from mammal camera trap surveys in the suburban Midwest, conducted October 2009-May 2010 (excerpted from Cove et al., 2012a).

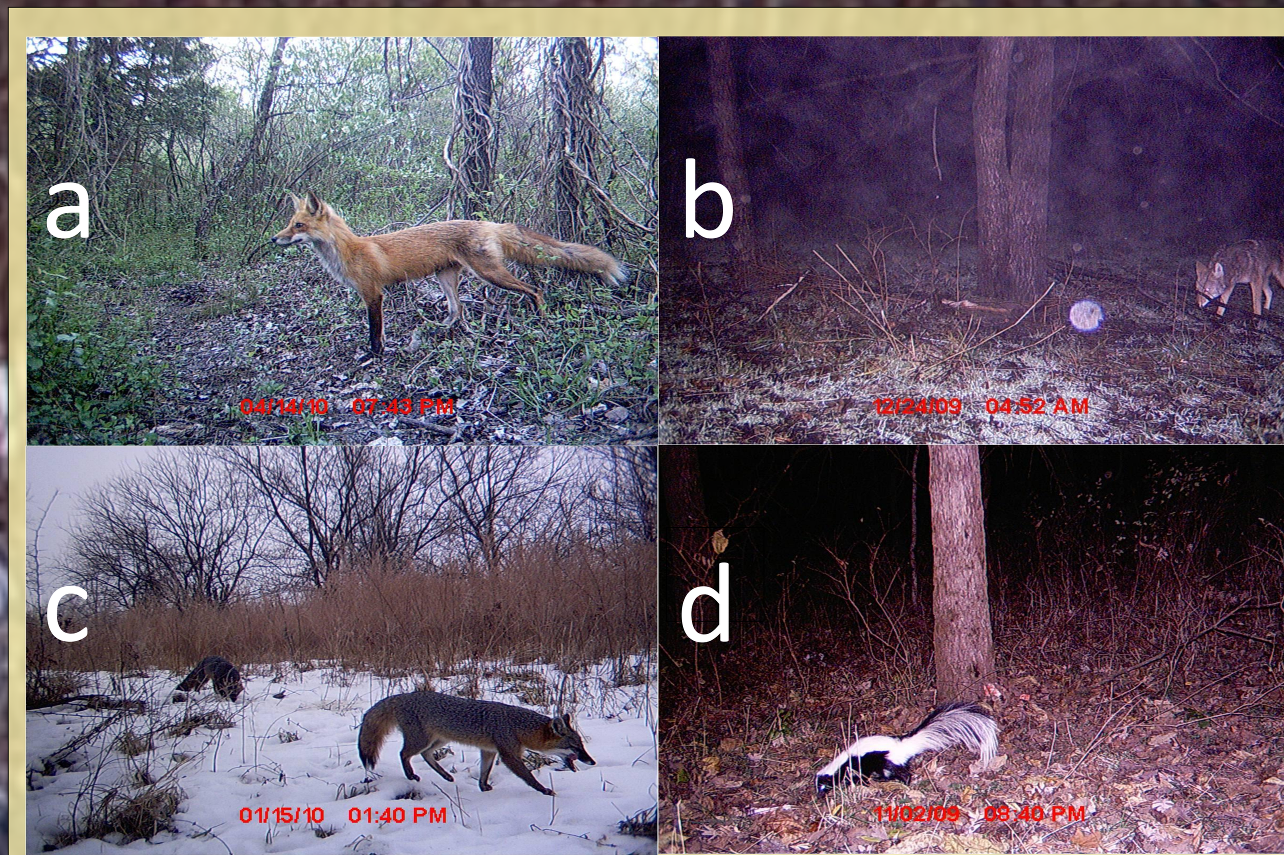
Species / Model	Δ_i	w_i	K	Untransformed coefficients of covariates (SE): Intercept	Forest	Urban	Area	Coyote
Coyote[1]								
p(forest + area)	0.00	0.330	4	0.263 (0.609)	−1.376 (0.574)	–	−1.459 (0.874)	–
p(forest)	0.07	0.319	3	−0.554 (0.371)	−0.950 (0.470)	–	–	–
p(.)	1.28	0.174	2	−0.461 (0.377)	–	–	–	–
p(global)	3.40	0.060	5	0.250 (0.637)	−1.370 (.578)	−0.028 (0.424)	−1.451 (0.879)	–
p(area)	3.54	0.056	3	−0.184 (0.542)	–	–	−0.491 (0.728)	–
Model-Averaged				−0.223 (0.563)	−0.822 (0.682)	−0.001 (0.079)	−0.543 (0.837)	–
Red fox								
p(urban)	0.00	0.227	3	−1.308 (0.456)	–	0.783 (0.319)	–	–
p(coyote)	0.35	0.191	3	−1.209 (0.468)	–	–	–	1.465 (0.680)
p(global)	0.63	0.166	5	−1.912 (0.596)	0.768 (0.422)	1.191 (0.429)	–	0.340 (0.712)
p(urban + coyote)	1.10	0.131	4	−1.514 (0.503)	–	0.616 (0.394)	–	1.034 (0.762)
p(area)	1.28	0.120	3	−0.578 (0.369)	–	–	−1.937 (0.874)	–
p(.)	2.26	0.073	2	−0.599 (0.359)	–	–	–	–
Model-Averaged				−1.273 (0.642)	0.140 (0.347)	0.502 (0.543)	−0.256 (0.727)	0.519 (0.793)

Models presented make up the 95% confidence set, where Δ_i is AIC_c difference ($\Delta_i QAIC_c$ where indicated by [1]), w_i is the Akaike weight, and K is the number of model parameters. Models are only presented for species that did not exhibit the p(.) as the top ranking model.

Covariates: forest and urban are the standardized values for the total coverage (ha) of forest and suburban/urban habitats within site buffers; area is the binomial term to differentiate between Warrensburg and Longview Lake, Missouri study areas; coyote is the trophic interaction term for coyote site use.

Discussion

- Our capture rate results are higher than other published findings with approximately 1/3 of the survey effort (Kelly & Holub 2008). We used 1-3 kg of deer meat as bait at each camera station and we believe this increased our trap success of mesopredators (medium-sized carnivores and opossums) versus the study in Virginia that used no bait. However, our trap success for deer, squirrels, and rabbits were also higher than those published and these species were not attracted to bait.
- Our increased trap success most likely reflects:
- (1) a true state of increased mesopredator and herbivore abundance due to increased human-derived resources in the suburbs, and
- (2) concentrated activity of mammals in small fragmented forest patches versus the expansive forest tracts in other studies (e.g. Cove et al., 2012b).



Photos of two commonly detected canids, (a) red fox and (b) coyote, uncommonly detected canid (c) grey fox and uncommonly detected mephitid (d) striped skunk

Management Implications

- Capture rates with camera traps are not always an appropriate index to compare across studies.
- Studies will benefit from employing occupancy analysis and comparing detection probabilities and occupancy estimates across studies.

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