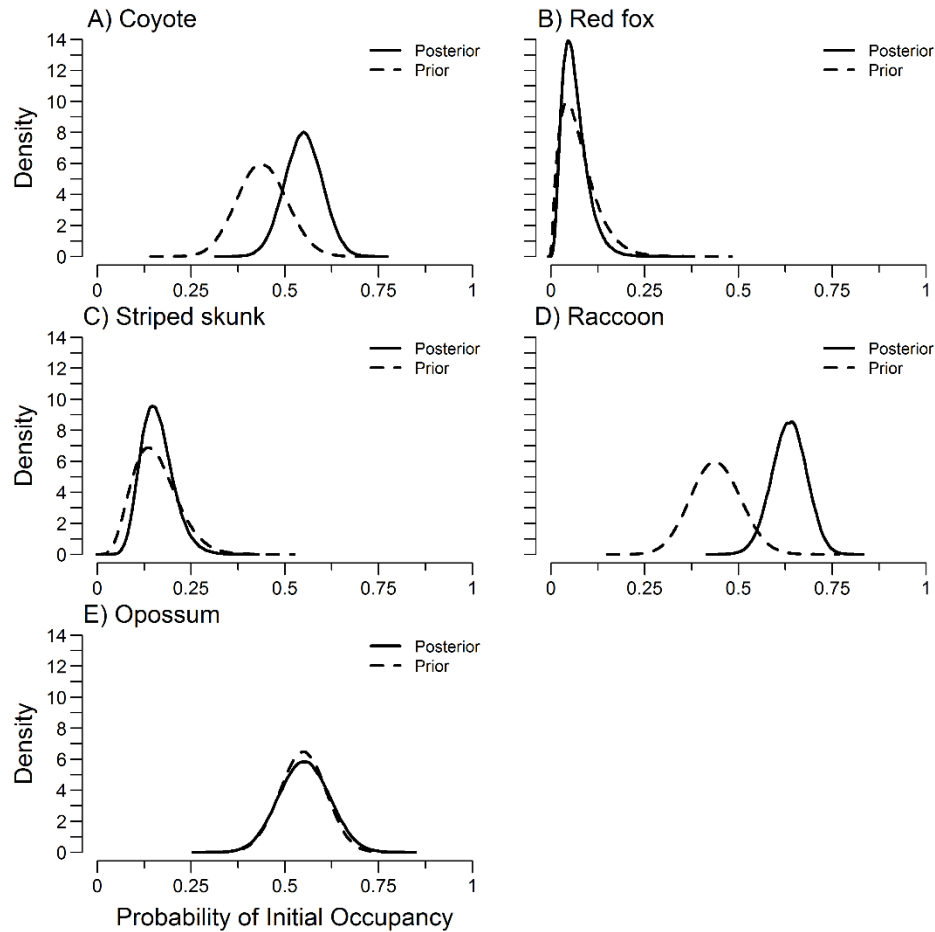


## Appendix S5. Posterior Estimates from Best Fit Models for Each Species

### *Initial occupancy*

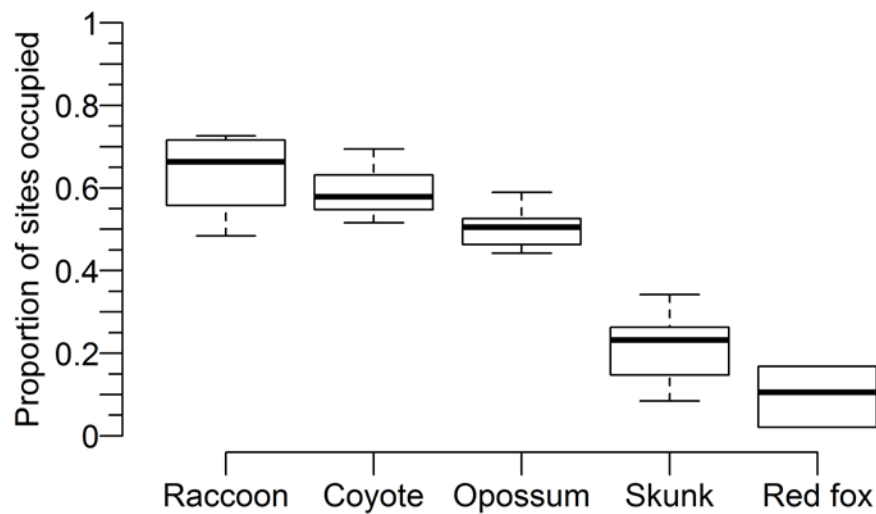
Raccoons had the highest initial occupancy, followed by the coyote, opossum, striped skunk, and then the red fox (Figure S1). Prior distributions closely followed posterior estimates for the red fox, striped skunk, and opossum, but underestimated initial occupancy for the coyote and raccoon (Figure S1).



**Figure S1.** The prior and posterior densities of initial occupancy,  $\psi$ , from the best fit A) coyote, B) red fox, C) striped skunk, D) raccoon, and E) Virginia opossum models estimated from 9 seasons of camera trap data collected from spring 2011 to summer 2013 in Chicago, Illinois. Prior distributions were calculated for each species using empirical Bayes methods from the observed presence-absence camera trap data.

### *Overall occupancy*

Of the five species analyzed, raccoon occupied the most sites at each time step, followed by the coyote, opossum, striped skunk, and then the red fox (Fig. S2). Raccoon, the most common species, were never observed at 5.26% of sites, while coyote and opossum were respectively never estimated to be present at 16.84% and 18.95% of sites across all time steps. Striped skunk were estimated never to be present across all time steps at 42.11% of sites. Red fox, though they had similarly low overall occupancy rates, were estimated never to be present across all time steps at 69.47% of sites.



**Figure S2.** Box and whisker plots of the proportion of sites occupied by each species over time as estimated by its best fit model from nine seasons of camera trap data collected from spring 2011 to summer 2013 in Chicago, Illinois. The occupancy status of each species at each site was collected by taking the median estimate of the posterior distribution of each species incidence matrix,  $\mathbf{Z}$ , at each site and time step.

## Colonization

The spatial covariate URB positively influenced the colonization rate of coyotes, opossum, and raccoon, but did not have a definite positive or negative influence on striped skunk or red fox colonization rates (Table S1). Raccoons had the highest average rate of all species, followed by the opossum, coyote, striped skunk, and then the red fox (Table S1).

**Table S1.** Median estimates of colonization parameters from the best fit coyote, red fox, striped skunk, Virginia opossum, and raccoon models estimated from 9 seasons of camera trap data collected from spring 2011 to summer 2013 in Chicago, Illinois. The table includes estimates of the intercept ( $m_0$ ), the influence that the spatial covariate URB has on each species persistence rates ( $m_{urb}$ ), the standard deviation of how much  $m_0$  varies over time ( $\sigma_u$ ), the amplitude of a pulse ( $A$ ), and the phase shift of a pulse ( $\delta$ ). Parameters are on the logit-scale. The 95% credible interval for each estimate is located within the square brackets next to the parameter save for  $\delta$ , which is instead the proportion of samples in which  $\delta$  took this value across all 200,000 MCMC samples of the posterior distribution. Parameters are reported as NA if the best fit model did not include them.

	Parameters				
	$m_0$	$m_{urb}$	$\sigma_u$	$A$	$\delta$
Coyote	-0.77 [-1.48 – -0.04]	1.07 [0.41 – 1.74]	NA	1.60 [0.44 – 2.96]	2 [0.99]
Red fox	-2.61 [-3.56 – -1.07]	0.34 [-0.43 – 0.96]	NA	1.50 [0.46 – 2.71]	2 [0.99]
Striped skunk	-1.61 [-2.30 – -0.30]	1.15 [-0.58 – 1.75]	0.41 [0.02 – 1.41]	NA	NA
Virginia opossum	-0.62 [-1.10 – 0.01]	0.50 [0.04 – 0.95]	NA	0.48 [0.11 – 0.90]	0 [0.99]
Raccoon	0.47 [-0.11 – 1.17]	0.88 [0.43 – 1.37]	NA	NA	NA

## Persistence

Coyotes had both the highest average persistence rate of the species analyzed and the lowest amount of temporal variance in their persistence rates through time (Table S2). Red fox and striped skunk had similar persistence rates that were lower than coyote, opossum, and raccoon. Persistence rates varied more through time for the red fox than all other species, but given their rarity the precision of this estimate was the lowest of all species (Table S2). On average, the probability of persistence was highest for coyote (82.64% [95% CI 75.40 – 88.39]),

followed by raccoon (79.74% [95% CI 71.50 – 86.99]), opossum (74.46% [95% CI 65.25 – 82.92]), red fox (63.41% [95% CI 25.54 – 92.76]), and striped skunk (60.35% [95% CI 42.31 – 77.56]). Raccoon persistence rates increased with URB, but 95% credible intervals for  $d_{\text{URB}}$  bounded zero for all other species (Table S2).

**Table S2.** Median estimates of persistence parameters from the best fit coyote, red fox, striped skunk, Virginia opossum, and raccoon models estimated from 9 seasons of camera trap data collected from spring 2011 to summer 2013 in Chicago, Illinois. The table includes estimates of the intercept ( $d_0$ ), the influence that the spatial covariate URB has on each species persistence rates ( $d_{\text{URB}}$ ), and the standard deviation of how much  $d_0$  varies over time step ( $\Sigma_g$ ). Parameters are on the logit-scale and estimate the probability that each species persists at a site from one time step to the next. The 95% credible interval for each estimate is located within the square brackets next to the parameter.

	Parameters		
	$d_0$	$d_{\text{URB}}$	$\Sigma_g$
Coyote	1.56 [1.12 – 2.03]	0.11 [-0.15 – 0.40]	0.11 [0.01 – 0.53]
Red fox	0.55 [-1.07 – 2.55]	-0.02 [-0.93 – 1.00]	1.00 [0.02 – 6.11]
Striped skunk	0.43 [-0.30 – 1.26]	-0.09 [-0.58 – 0.56]	0.21 [0.01 – 1.28]
Virginia opossum	1.07 [0.63 – 1.58]	0.17 [-0.12 – 0.46]	0.55 [0.42 – 0.68]
Raccoon	1.37 [0.92 – 1.90]	0.52 [0.17 – 0.85]	0.23 [0.01 – 0.90]

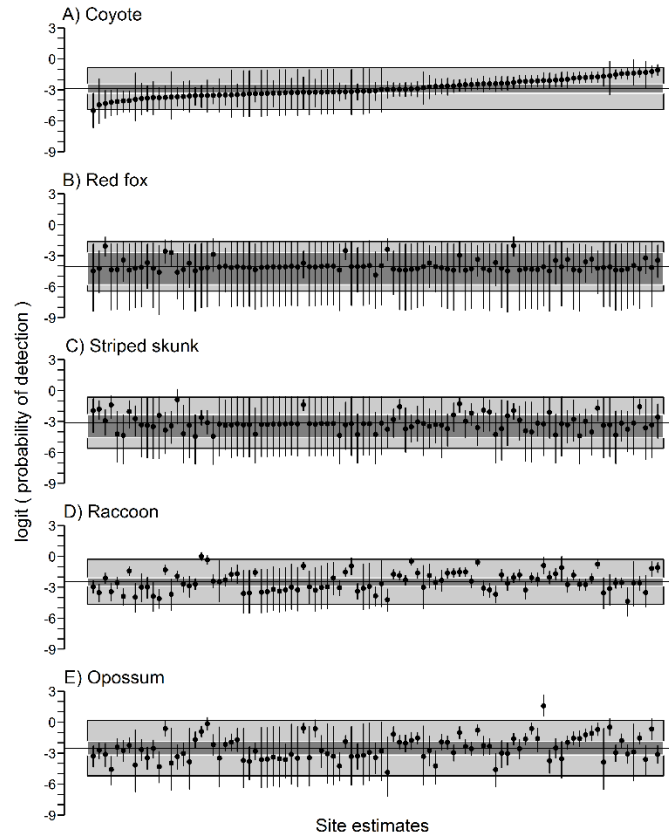
### *Detection*

The daily probability of detecting each species was low and varied more across sites than it did across time (Table S3). Coyote, opossum, and raccoon were more detectable in sites with higher levels of URB (Table S3). Raccoon had the lowest temporal variability in their detection rate, while opossum detection rates varied most across sites (Table S3). The average daily probability of detecting a species given its presence was 5.36% for coyote [95% CI 3.44 – 8.34], 2.00% for red fox [95% CI 0.30 – 6.50], 4.43% for striped skunk [95% CI 1.65 – 9.20], 7.42% for opossum [95% CI 4.03 – 12.74], and 7.92% for raccoon [95% CI 5.44 – 11.45].

**Table S3.** Median estimates of detection parameters from the best fit coyote, red fox, striped skunk, Virginia opossum, and raccoon models estimated from 9 seasons of camera trap data collected from spring 2011 to summer 2013 in Chicago, Illinois. The table includes estimates of the intercept ( $f_0$ ), the influence that the spatial covariate URB has on each species detection rates ( $f_{\text{URB}}$ ), and the standard deviation of how much  $f_0$  varies over time ( $\sigma_\omega$ ) and across sites ( $\sigma_\epsilon$ ). Parameters are on the logit-scale and estimate the probability of detecting a species per day given its presence. The 95% credible interval for each estimate is located within the square brackets next to the parameter

	Parameters			
	$f_0$	$f_{\text{URB}}$	$\sigma_\omega$	$\sigma_\epsilon$
Coyote	-2.87 [-3.33 – -2.39]	0.33 [0.12 – 0.54]	0.41 [0.26 – 0.75]	1.04 [0.80 – 1.35]
Red fox	-3.90 [-5.70 – -2.67]	0.30 [-0.29 – 1.02]	0.57 [0.11 – 1.35]	1.14 [0.44 – 2.18]
Striped skunk	-3.07 [-4.09 – -2.29]	-0.40 [-0.90 – 0.21]	0.52 [0.30 – 1.00]	1.26 [0.85 – 1.81]
Opossum	-2.52 [-3.17 – -1.92]	0.38 [0.05 – 0.76]	0.57 [0.37 – 1.00]	1.37 [1.05 – 1.82]
Raccoon	-2.45 [-2.86 – -2.06]	0.63 [0.40 – 0.87]	0.29 [0.18 – 0.52]	1.10 [0.89 – 1.39]

Given their general rarity (Figure S2) and the fact that they were never detected in > 40% of sites, site-specific detection estimates for red fox and striped skunk tended toward their mean detection rate and were less precise than the other species (Figure S3). As species became more common, estimates of site-specific detection probabilities and mean detection rates increased in precision.



**Figure S3.** Site-specific detection probabilities estimated by the best fit model for A) coyote, B) red fox, C) striped skunk, D) raccoon, and E) Virginia opossum from 9 seasons of camera trap data collected from spring 2011 to summer 2013 in Chicago, Illinois. The black horizontal line is the median estimate of the mean detection rate for each species ( $f_0$ ), the dark gray bar is the 95% credible interval for  $f_0$ , and the light gray bar is the 95% posterior predictive distribution of site-specific detection rates calculated from each species  $m_0$  and the site-level standard deviation hyperparameter ( $\sigma_\epsilon$ ). Along the x-axis are site-specific detection estimates on the logit scale. The black dots are median estimates for each site while the vertical lines are 95% credible intervals. All sub-figures A-E are sorted by site-specific detection estimates for coyote.