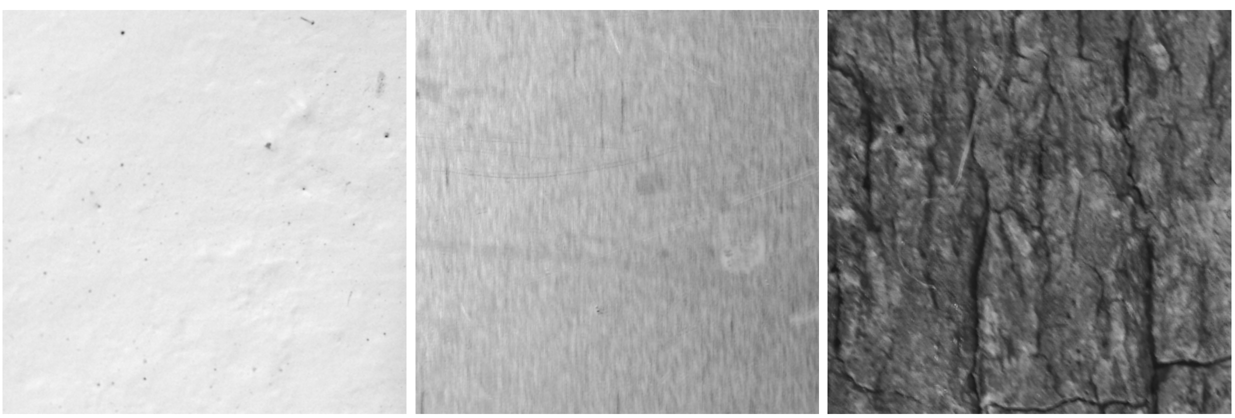
Supplemental Materials – Winchell et al. Sprint Performance in Urban Lizards

S1. Track surfaces

We constructed a 2.5m-long, 9cm wide race track with three alternate surfaces: wood bark collected from forest in Rincón, Puerto Rico; painted concrete cinderblocks (3 coats of BEHR Ultra interior and exterior flat matte paint and primer); and aluminium sheeting. Figure S1 shows sample macro photographs of each of the track surfaces cropped to $2cm^2$ and converted to grayscale. Painted concrete was the smoothest surface (estimated Rq=2.55μm) with very few bumps or pits. Unpainted metal was slightly rougher (estimated Rq=4.48μm) with small ridges and indentations. Bark (wood) was the roughest (estimated Rq=14.17μm) with deep indentations and bumps and pits on smoother surfaces between. Surface roughness (Rq) was estimated using ImageJ (V1.5, Rashband), with the plugin surfacecharJ (Chinga 2007).

At 90° the majority of lizards we tested were only able to climb on the bark under our laboratory conditions. Readers familiar with wild *A. cristatellus* in urban areas of Puerto Rico may know that this species regularly uses smooth vertical surfaces in the field. We suspect that this may be due to dirt, weathering, or microstructure on these surfaces that was absent from our laboratory substrates, and recommend that this be the subject of future study.



Painted Concrete **Unpainted Metal** **Bark (Wood)**

Figure S1. Representative macro photos of track surfaces.

S2. Sample toepad scans and x-ray of an anole lizard.

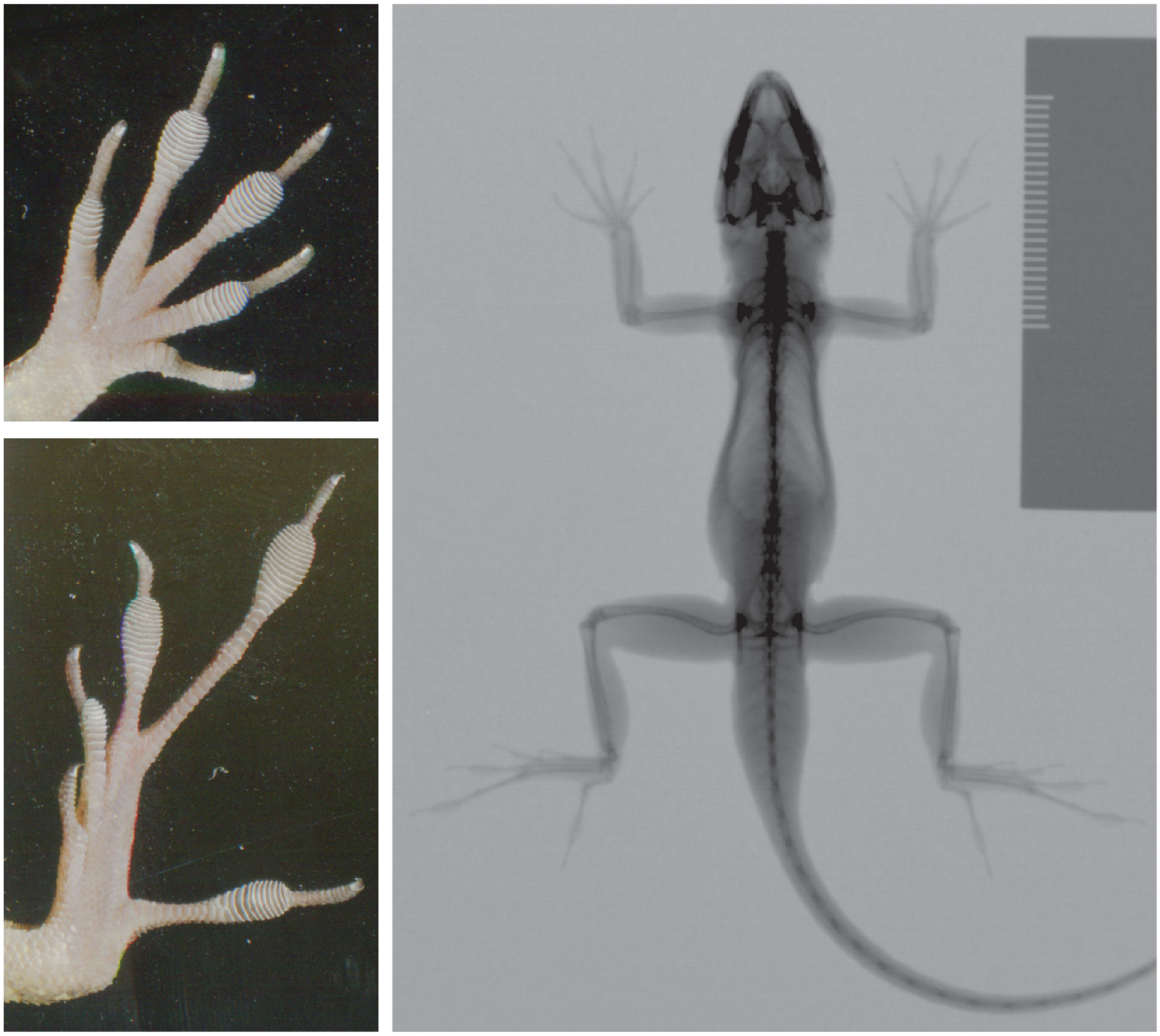


Figure S2: Forefoot (top left), hindfoot (bottom left), and x-ray of an anole lizard. We measured number of lamellae (flattened scales extending across the toepad) and toepad area of the 3rd (middle) digit on the forefoot and the fourth digit on the hindfoot, the longest digits on each.

S3. Sample size of successful sprint trials.

Table S3: Sample sizes for 128 lizards on each of the six tracks by substrate type and angle. Successful trials are those in which lizards sprinted at least 0.1 m/s sustained over a minimum distance of 20cm.

	Concrete	Metal	Wood	Total by Angle
37° ("Gradual")	120	123	127	370
60° ("Steep")	106	116	121	343
Total by Substrate	226	239	248	**713 (all trials)**

S4. Correlation between size-adjusted traits

Pearson's correlation (a) between forelimb and hindlimb size-adjusted traits (residuals of trait by SVL), and (b) between size-adjusted traits within forelimbs and hindlimbs. Pearson's correlations were calculated in R (R Core Team 2017).

Table S4-A: Correlations between corresponding hindlimb and forelimb traits.

	Pearson's Correlation	t	df	p-value
Front – Hind Limb Length	0.940	30.847	126	<0.001
Front – Rear Lamella Number	0.437	5.433	125	<0.001
Front – Rear Toepad Area	0.876	20.313	125	<0.001
Pectoral – Pelvic Width	0.719	11.598	126	<0.001

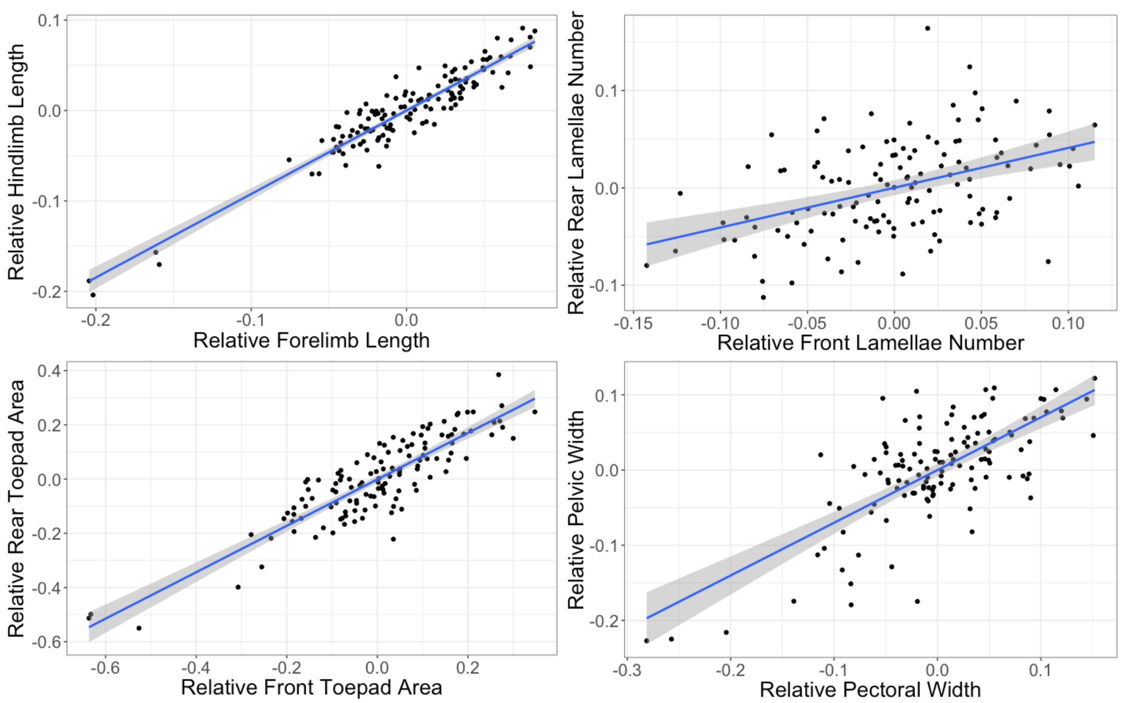


Figure S4-A: Relationships between corresponding forelimb and hindlimb traits. Traits are plotted as log-transformed size-adjusted traits (residuals on body size).

*Table S4-B: Trait correlations (Pearson's correlation) within forelimbs and hindlimbs for size-adjusted traits. Significance levels: p<0.001 ***, italicized values are not significant at p<0.05.*

	Front Lamella Number	Front Toepad Area	Pectoral Width	Rear Lamella Number	Rear Toepad Area	Pelvic Width
Forelimb Length	*0.172*	0.750***	0.635***			
Front Lamella Number		0.299***	*0.098*			
Front Toepad Area			0.646***			
Hindlimb Length				*-0.080*	0.704***	0.613***
Rear Lamella Number					*0.077*	*0.057*
Rear Toepad Area						0.626***

Forelimb Traits

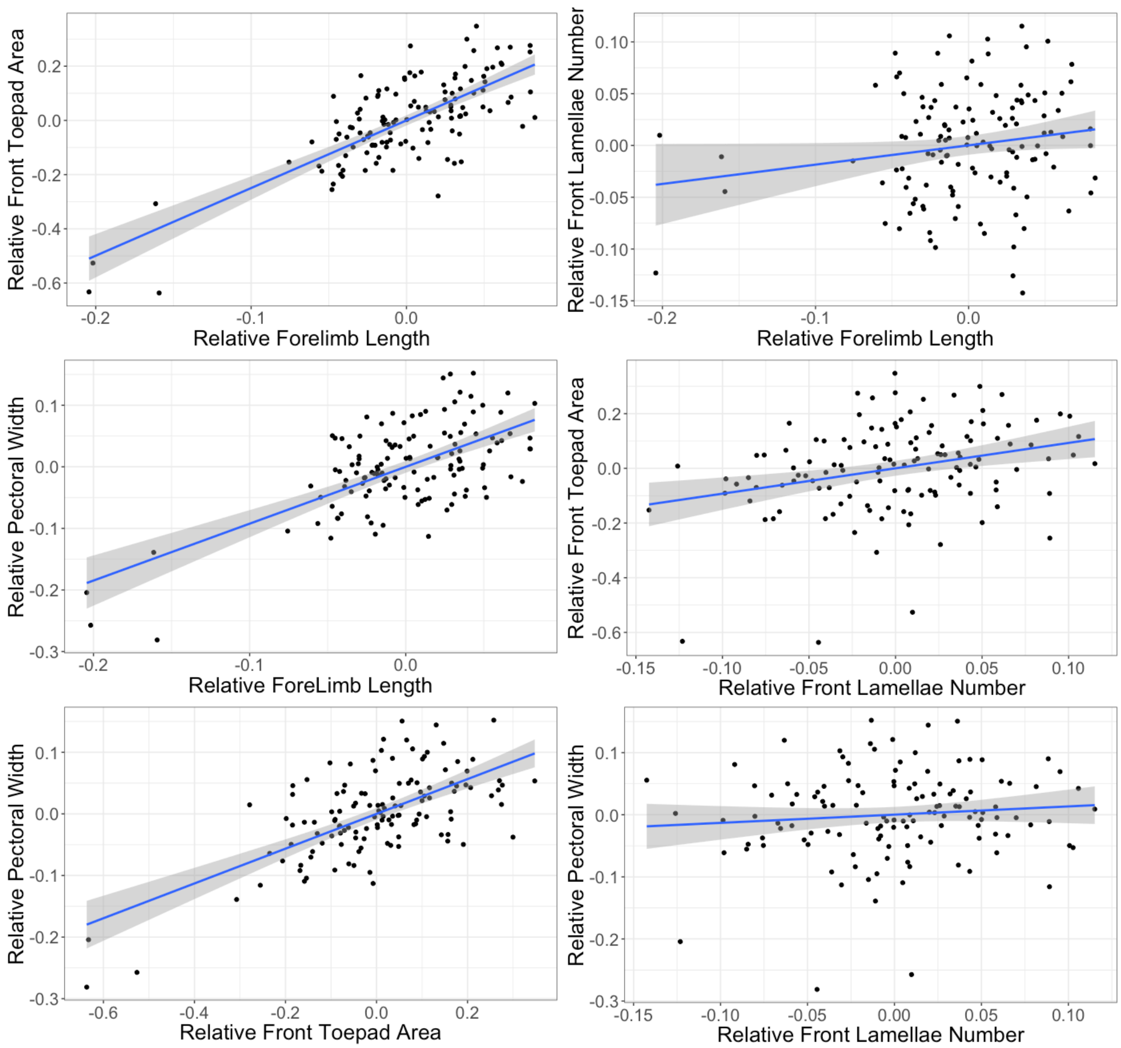


Figure S4-B: Relationships between traits within forelimbs. Traits are plotted as log-transformed size-adjusted traits (residuals on body size).

Hindlimb Traits

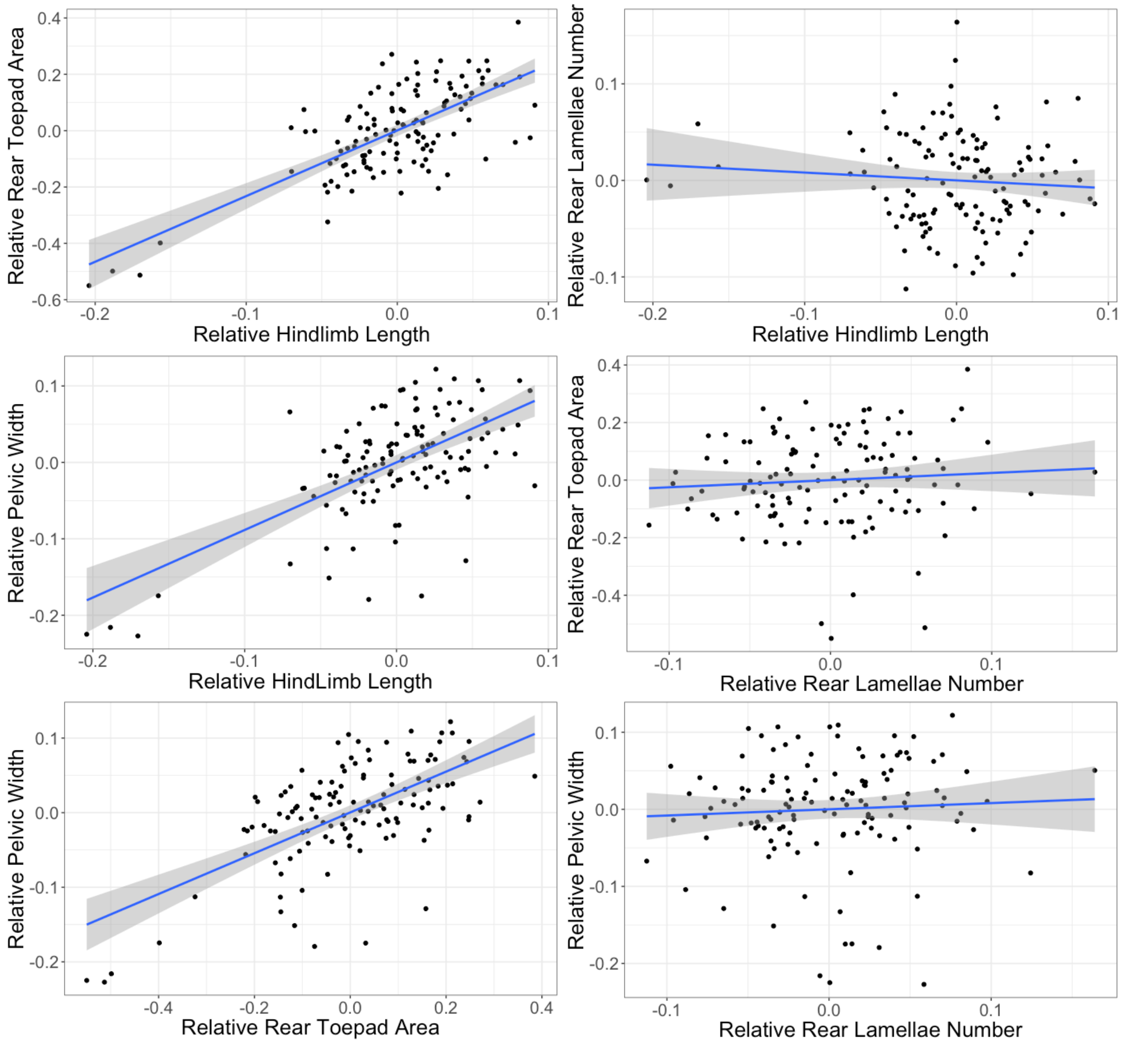


Figure S4-C: Relationships between traits within hindlimbs. Traits are plotted as log-transformed size-adjusted traits (residuals on body size).

S5. Trait-Performance Relationships: bivariate analysis

We determined the bivariate correlation of each trait with locomotor performance using linear mixed effects models of velocity by trait, plus body size and temperature as covariates and municipality as a random effect. We evaluated 4 models for each trait: trait interacting with track, trait interacting with angle with substrate as a covariate, trait interacting with substrate with track angle as a covariate, and across all tracks with track as a covariate. Although this analysis does not account for correlations between all traits, we took some trait correlations into account. Specifically, SVL was included as a covariate in all models. Additionally, even after correcting for body size, we found that limb lengths were correlated with body width and toepad areas (above, supplement S4). Consequently, in addition to including SVL as a covariate, we also included forelimb length as a covariate in the models for pectoral width and front toepad area, and hindlimb length as a covariate in the models for pelvic width and rear toepad area. We did not find that lamella number and toepad area were correlated with each other for the rear feet, and detected only a weak positive correlation between these characters for the front feet, so we did not include these traits as covariates in either model.

Table S5: Bivariate trait performance relationships estimated from mixed effects models for each trait with body size and body temperatures as covariates for all traits, and limb length as a covariate for body widths and toepad areas. Shaded values are positive relationships. Slopes significantly different from zero are bolded with significance levels: p<0.1 ".", p<0.05 "", p<0.01 "**", p<0.001 "***". W = wood, C = concrete, M = metal.*

	SVL	Forelimb Length	Hindlimb Length	Front Lamella Number	Rear Lamella Number	Front Toepad Area	Rear Toepad Area	Pectoral Width	Pelvic Width
W37	**+1.566*** **	**+1.392** **	**+1.707*** **	**+1.844** **	*+0.994*	**+0.709*** **	**+0.767*** **	**+1.662*** **	*+0.774.*
C37	**+1.479*** **	**+1.109***	**+1.386** **	**+2.430*** **	*+1.028*	**+0.524** **	**+0.601** **	**+1.602*** **	*+0.390*
M37	**+0.820***	*+0.418*	*+0.752*	*+1.097.*	*+0.570*	*+0.302.*	*+0.210*	**+0.856***	*+0.141*
W60	*-0.101*	**-1.272** **	**-1.045***	*+0.492*	*+0.794*	*-0.187*	*-0.183*	*-0.494*	**-1.109***
C60	*-0.254*	**-1.298***	*-1.013.*	*-0.326*	*+0.043*	*-0.111*	*-0.169*	*-0.412*	**-0.991***
M60	*-0.219*	**-0.996***	*-0.794*	*-0.177*	*+0.053*	*-0.054*	*-0.031*	*-0.009*	*-0.843.*
37	**+1.292*** **	**+0.976** **	**+1.286*** **	**+1.788*** **	**+0.860***	**+0.517*** **	**+0.533*** **	**+1.379*** **	*+0.344*
60	*-0.193*	**-1.197*** **	**-0.962** **	*-0.008*	*+0.313*	*-0.117*	*-0.127*	*-0.306*	**-0.992** **
W	**+0.732** **	*+0.055*	*+0.334*	**+1.183** **	*+0.894.*	*+0.273.*	*+0.300.*	*+0.615.*	*+0.151*
C	**+0.640***	*+0.017*	*+0.322*	**+1.064***	*+0.563*	*+0.234*	*+0.250*	**+0.673***	*-0.238*
M	*+0.314*	*-0.257*	*+0.028*	*+0.455*	*+0.313*	*+0.137*	*+0.098*	*+0.477*	*-0.453*
All	**+0.566*** **	*-0.051*	*+0.239*	**+0.897*** **	**+0.598***	*+0.214*	*+0.216*	**+0.586***	*-0.281*

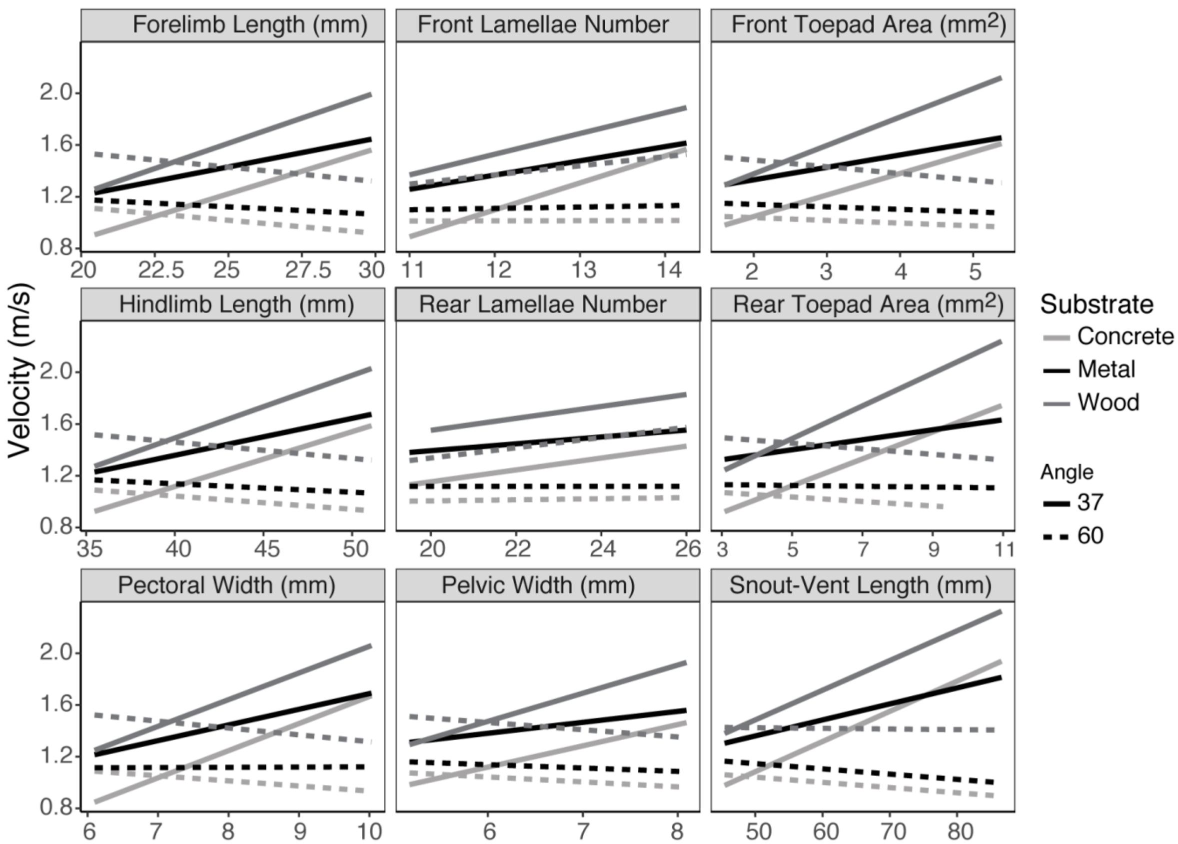


Figure S5: Bivariate relationships between each trait and velocity (visualized with linear model without correction for body size or limb lengths) on each of the six tracks (three substrate types and two angles of inclination).

S6. Differences in locomotor performance by track

Although the overall effect of context of origin across all tracks is significant, sprint speeds differed between urban and forest populations by angle of inclination: urban were faster on 37° tracks but not 60° tracks. They did not differ based on substrate type. Across all tracks urban lizards ran faster than forest lizards, stopped less, and slipped more.

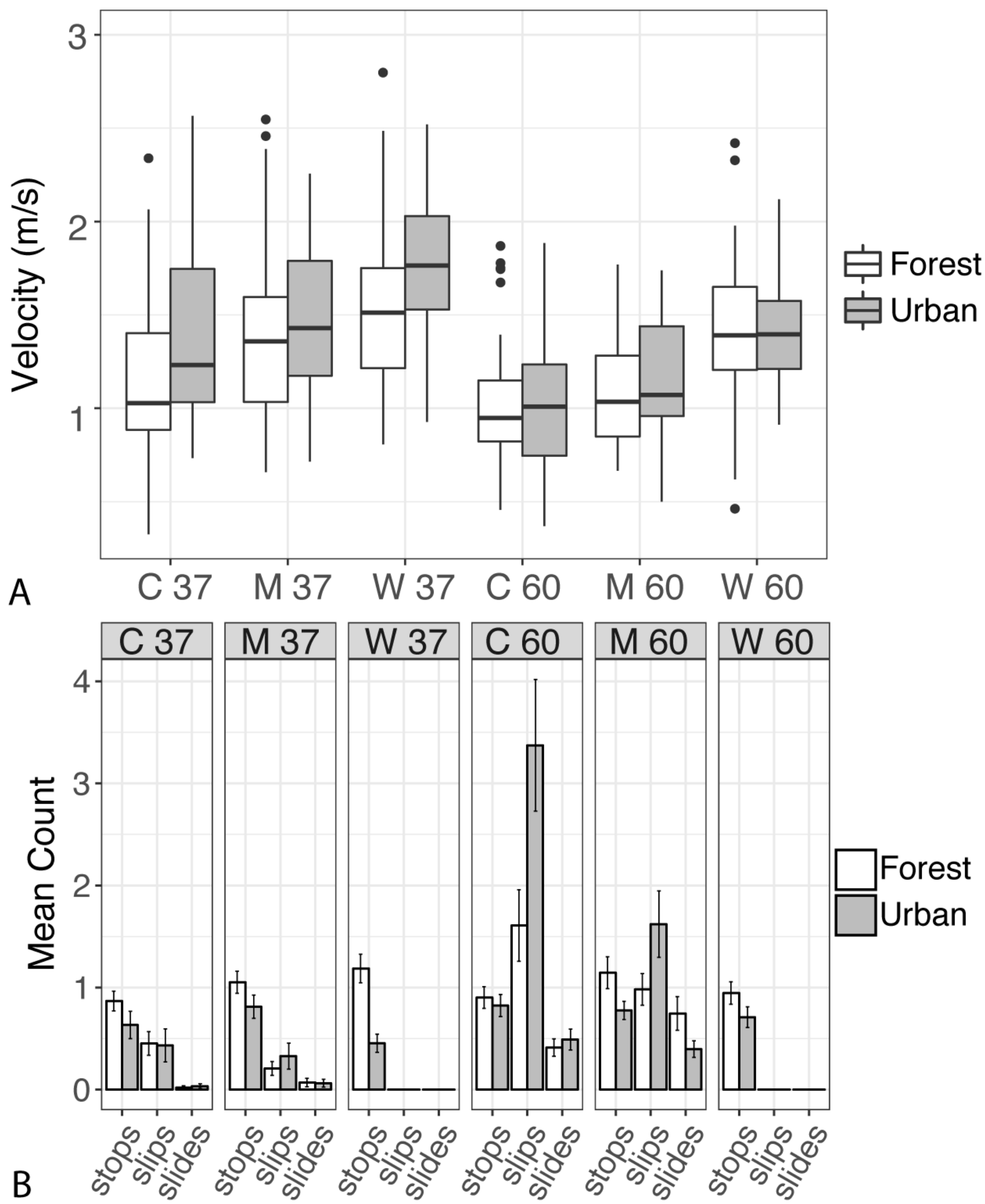


Figure S6. Differences between forest and urban lizards in (A) velocity (m/s) and (B) stops, slips, and slides on each track (whiskers showing mean ± SE).

S7. Used versus available perches in urban and forest environments

Urban lizards used perches that were smoother but similar angle of inclination to those used by forest lizards. Urban lizards chose perches that were rougher and of a lower angle (more horizontal) than are common in the habitat while forest lizards did not discriminate based on either factor.

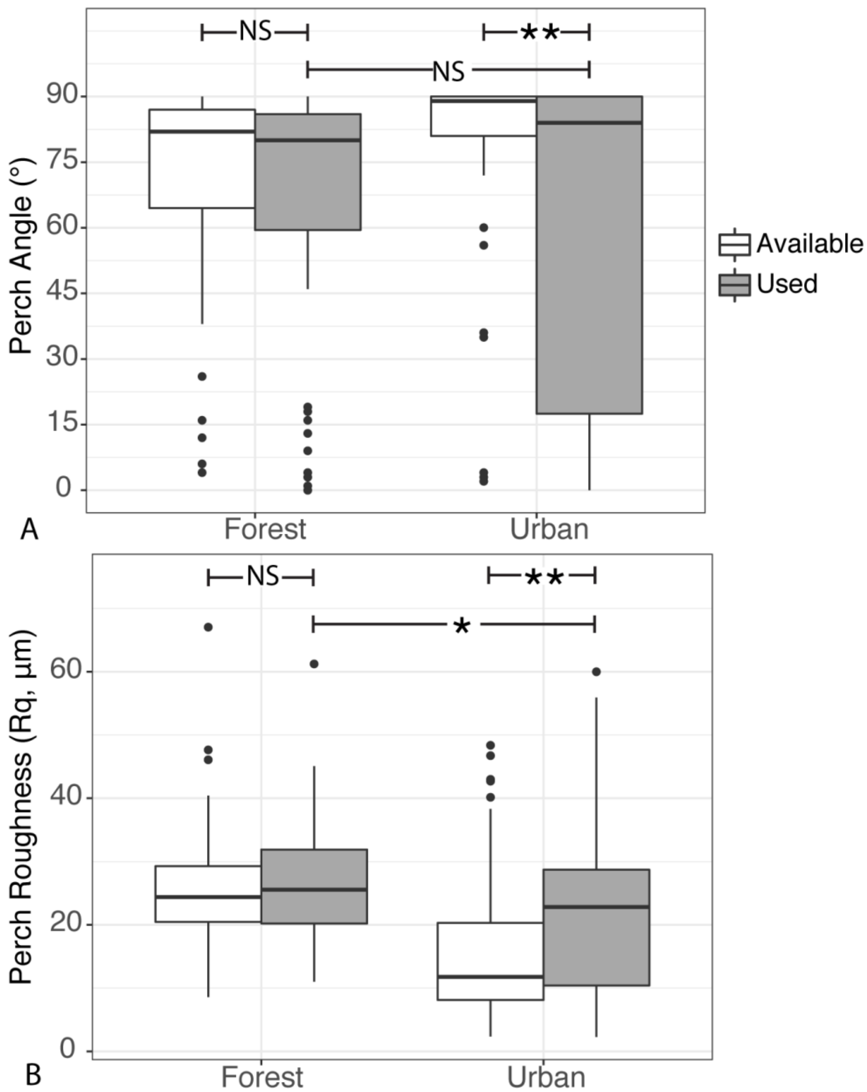


*Figure S7. The angle of inclination (A) and perch roughness (B) of random potential perches (white) and utilized perches (grey) in forest versus urban contexts. Horizontal bars are shown to indicate the different comparisons made: used vs. random within each habitat type; and utilized perches between types. Significance levels: p>0.05 "NS", p<0.05 *, p<0.01 **.*

Supplemental References

1. Chinga G, Johnsen PO, Dougherty R, Berli EL, Walter J. 2007 Quantification of the 3D microstructure of SC surfaces. *Journal of Microscopy*. **227**(3), 254-265. (doi: 10.1111/j.1365-2818.2007.01809.x)
2. R Core Team. 2017 R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing. (https://www.R-project.org)
3. Rashband, WS. 1997-2014 ImageJ. Bethesda, MD: U. S. National Institutes of Health. http://imagej.nih.gov/ij/.