The Canadian Field-Naturalist

Supplementary Material:

Diel activity patterns of urban Woodchucks (*Marmota monax*) revealed by camera traps at burrows in southwestern Ontario, Canada

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Table S1. Monitoring effort (number of hours monitored) at each Woodchuck (*Marmota monax*) burrow, London, Ontario, Canada, in June 2015. Monitored periods for each den were: den 1: 11–25 June; den 2: 10–24 June; den 3: 11–18 June; and den 4: 22–25 June. Different monitoring periods were due to logistical reasons and accounted for by including burrow identity as a random effect in the models. Den 1 was occupied by one female with two young-of-the-year, and dens 2–4 were occupied by solitary males.

Time of the day	Den 1	Den 2	Den 3	Den 4	Total
Hour	Hour (*n*)	Hour (*n*)	Hour (*n*)	Hour (*n*)	Hour (*n*)
0	14	14	7	3	38
1	14	14	7	3	38
2	14	14	7	3	38
3	14	14	7	3	38
4	14	14	7	3	38
5	14	14	7	3	38
6	14	14	7	3	38
7	14	14	7	2	37
8	14	14	7	2	37
9	13	15	7	2	37
10	13	15	7	3	38
11	13	15	7	3	38
12	13	15	7	3	38
13	13	15	7	3	38
14	13	15	6	3	37
15	13	15	6	3	37
16	13	15	6	3	37
17	13	15	6	3	37
18	13	15	6	3	37
19	13	14	6	3	36
20	13	14	6	3	36
21	14	14	7	3	38
22	14	14	7	3	38
23	14	14	7	3	38
Total	324	346	161	69	900

TABLE S2. Models used to analyze Woodchuck (*Marmota monax*) activity, in June 2015, London, Ontario, Canada. Models were fitted using the cosinor method (cosine and sine functions), specified below, with x expressing time of day, t = temperature, w = wind, and Ɛ = the random effect of burrow site ID. M_0 represents the null model (no effect of time of the day), $M_{1,5,\&9}$ with 24 h as the fundamental period, $M_{2,6,\&10}$ with first harmonic component (12 h) and $M_{3,7,\&11}$ with second harmonic component (8 h). By including burrow site as a random effect, I control for repeated measurements at each site, individual variation between Woodchucks inhabiting the burrows (in particular for this study female with young versus solitary male), and different sampling effort among burrows.

Model: formula
M_0: $logit(f(x)) = a_0 + \varepsilon$
M_1: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + \varepsilon$
M_2: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + \left(a_2 \cos\frac{2*2\pi x}{24} + b_2 \sin\frac{2*2\pi x}{24}\right) + \varepsilon$
M_3: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + \left(a_2 \cos\frac{2*2\pi x}{24} + b_2 \sin\frac{2*2\pi x}{24}\right) + \left(a_3 \cos\frac{3*2\pi x}{24} + b_3 \sin\frac{3*2\pi x}{24}\right) + \varepsilon$
M_4: $logit(f(x)) = a_0 + t + \varepsilon$
M_5: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + t + \varepsilon$
M_6: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + \left(a_2 \cos\frac{2*2\pi x}{24} + b_2 \sin\frac{2*2\pi x}{24}\right) + t + \varepsilon$
M_7: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + \left(a_2 \cos\frac{2*2\pi x}{24} + b_2 \sin\frac{2*2\pi x}{24}\right) + \left(a_3 \cos\frac{3*2\pi x}{24} + b_3 \sin\frac{3*2\pi x}{24}\right) + t + \varepsilon$
M_8: $logit(f(x)) = a_0 + w + \varepsilon$
M_9: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + w + \varepsilon$
M_{10}: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + \left(a_2 \cos\frac{2*2\pi x}{24} + b_2 \sin\frac{2*2\pi x}{24}\right) + w + \varepsilon$
M_{11}: $logit(f(x)) = a_0 + \left(a_1 \cos\frac{2\pi x}{24} + b_1 \sin\frac{2\pi x}{24}\right) + \left(a_2 \cos\frac{2*2\pi x}{24} + b_2 \sin\frac{2*2\pi x}{24}\right) + \left(a_3 \cos\frac{3*2\pi x}{24} + b_3 \sin\frac{3*2\pi x}{24}\right) + w + \varepsilon$

TABLE S3. Analysis of diel activity rhythm models for Woodchuck (*Marmota monax*), in June 2015, London, Ontario, Canada. Model selection based upon AICc model comparison.

Model	K	AICc	ΔAICc	*W*	Cumulative *W*	LL
M_2	6	902.81	0.00	0.36	0.36	−445.36
M_{10}	7	903.30	0.49	0.28	0.64	−444.59
M_6	7	904.82	2.01	0.13	0.77	−445.35
M_3	8	905.32	2.51	0.10	0.87	−444.58
M_{11}	9	905.49	2.68	0.09	0.96	−443.65
M_7	9	907.36	4.55	0.04	1.00	−444.58
M_9	5	939.14	36.33	0.00	1.00	−464.54
M_1	4	940.00	37.19	0.00	1.00	−465.98
M_5	5	941.83	39.02	0.00	1.00	−465.88
M_4	3	1048.58	145.77	0.00	1.00	−521.28
M_8	3	1082.83	180.02	0.00	1.00	−538.40
M_0	2	1128.79	225.98	0.00	1.00	−562.39

TABLE S4. Analysis of diel activity rhythm models for Woodchuck (*Marmota monax*), in June 2015, London, Ontario, Canada. Parameter estimates from three highest ranked models (number of observations = 900; random effect: four burrow sites).

	Fixed Effects	Estimate	SE	*Z*-value	*P*-value
M_2	(Intercept)	−1.13	0.45	−2.50	0.012
	I(cos(2 · pi · Hour/24))	−1.66	0.15	−11.11	<0.001
	I(sin(2 · pi · Hour/24))	−0.74	0.12	−6.34	<0.001
	I(cos(2 · 2 · pi · Hour/24))	−0.78	0.13	−6.00	<0.001
	I(sin(2 · 2 · pi · Hour/24))	−0.19	0.12	−1.52	0.128
M_{10}	(Intercept)	−1.33	0.48	−2.79	0.005
	Wind	0.02	0.01	1.24	0.216
	I(cos(2 · pi · Hour/24))	−1.60	0.16	−10.07	<0.001
	I(sin(2 · pi · Hour/24))	−0.73	0.12	−6.26	<0.001
	I(cos(2 · 2 · pi · Hour/24))	−0.76	0.13	−5.90	<0.001
	I(sin(2 · 2 · pi · Hour/24))	−0.19	0.13	−1.54	0.124
M_6	(Intercept)	−1.03	0.80	−1.29	0.197
	Temp	−0.005	0.03	−0.15	0.878
	I(cos(2 · pi · Hour/24))	−1.68	0.18	−9.44	<0.001
	I(sin(2 · pi · Hour/24))	−0.75	0.14	−5.27	<0.001
	I(cos(2 · 2 · pi · Hour/24))	−0.78	0.13	−6.00	<0.001
	I(sin(2 · 2 · pi · Hour/24))	−0.19	0.13	−1.52	0.130