

Supplementary Materials and Methods

Although observations under diurnally variable environmental conditions are independent, the same animals were recorded under both constant warm and constant cool conditions, making these observations non-independent and violating ANOVA assumptions. Within each response variable, we performed a secondary screen for outliers (> 3 sd from the mean) and produced another data subset excluding additional outliers. We used a Shapiro-Wilk's test (*shapiro.test* in the *rstatix* package v. 0.6.0; Kassambara 2020) for normality ($p < 0.05$, Bonferroni corrected) for each response variable, raw and log transformed. Levene's test (*rstatix::levene_test*) was used to assess homogeneity of variance, again p-values were Bonferroni corrected for multiple comparisons ($p < 0.05$). Exploratory ANOVA tests (*rstatix::anova_test*) were run for each response variable, using Tukey's Honest Significant Differences (HSD; *rstatix::tukey_hsd*) correction for multiple comparisons ($p < 0.05$).

Table S1. ANOVA pairwise mean differences between treatment groups (variable [var], constant warm, constant cool) based on log-transformed data for each response variable (Total energy expenditure [TEE; kcal h⁻¹], respiratory quotient [RQ], relative water loss [RWL; mg h⁻¹], VO₂ [ml min⁻¹], VCO₂ [ml min⁻¹]) across the entire experiment (All) and light and dark intervals separately. All values are significant ($p < 0.05$) except those highlighted in grey or **bolded** which were not significant for log-transformed or untransformed datasets, respectively. All significance values are corrected for multiple comparisons (Tukey's HSD).

Sex	Subset	TEE			RQ			RWL			VO ₂			VCO ₂		
		var-cool	var-warm	cool-warm	var-cool	var-warm	cool-warm	var-cool	var-warm	cool-warm	var-cool	var-warm	cool-warm	var-cool	var-warm	cool-warm
Females	All	0.53	-0.07	-0.60	-0.04	-0.08	-0.03	0.00	0.05	0.05	0.55	-0.05	-0.59	0.5	-0.12	-0.63
	Light	0.85	0.16	-0.69	-0.14	-0.16	-0.02	-0.04	0.01	0.05	0.88	0.19	-0.69	0.74	0.03	-0.71
	Dark	0.2	-0.32	-0.51	0.07	0.03	-0.05	0.07	0.12	0.05	0.18	-0.32	-0.5	0.26	-0.30	-0.55
Males	All	0.42	-0.32	-0.74	-0.03	0.01	0.04	-0.01	0.01	0.02	0.43	-0.32	-0.75	0.40	-0.31	-0.71
	Light	0.80	-0.07	-0.87	-0.11	-0.06	0.05	-0.06	-0.05	0.02	0.82	-0.06	-0.88	0.71	-0.12	-0.83
	Dark	0.06	-0.52	-0.58	0.07	0.09	0.02	0.07	0.11	0.03	0.04	-0.54	-0.58	0.11	-0.45	-0.56

Table S2. Summary statistics (median = med, mean, standard deviation = sd, range) for females (top) and males (bottom) for carbon dioxide produced (VCO₂ ml min⁻¹) and oxygen consumed (VO₂ ml min⁻¹) across each experiment (diurnal, cool, warm) during the light (rest) and dark (active) photoperiods.

	Data	VCO ₂				VO ₂			
		med	mean	sd	range	med	mean	sd	range
Females	All	0.45	0.52	0.29	0.06-1.59	0.51	0.58	0.33	0.05-1.82
	Diurnal	0.38	0.46	0.28	.07-1.59	0.41	0.51	0.34	0.05-1.59
	Light	0.26	0.29	0.15	0.09-1.12	0.24	0.28	0.16	0.08-1.05
	Dark	0.64	0.69	0.26	0.10-1.39	0.78	0.81	0.30	0.14-1.59
	Cool	0.65	0.69	0.28	0.17-1.59	0.71	0.76	0.30	0.19-1.82
	Light	0.55	0.58	0.20	0.17-1.51	0.62	0.64	0.21	0.19-1.59
Males	Dark	0.82	0.87	0.30	0.17-1.59	0.89	0.95	0.33	0.19-1.82
	Warm	0.33	0.39	0.22	0.06-1.24	0.38	0.45	0.25	0.06-1.44
	Light	0.26	0.30	0.14	0.08-1.13	0.31	0.33	0.16	0.08-1.32
	Dark	0.49	0.53	0.24	0.06-1.24	0.57	0.61	0.28	0.06-1.38
	All	0.51	0.59	0.34	0.09-1.82	0.57	0.65	0.39	0.09-2.03
	Diurnal	0.43	0.58	0.36	0.10-1.62	0.48	0.66	0.43	0.09-1.85
	Light	0.29	0.33	0.17	0.10-1.54	0.29	0.34	0.19	0.09-1.62
	Dark	0.90	0.89	0.30	0.10-1.57	1.07	1.04	0.33	0.20-1.79
	Cool	0.72	0.76	0.29	0.34-1.82	0.80	0.85	0.32	0.33-2.03
	Light	0.59	0.64	0.18	0.34-1.71	0.66	0.71	0.21	0.33-1.95
	Dark	0.95	0.97	0.30	0.36-1.82	1.05	1.08	0.34	0.39-2.03
	Warm	0.34	0.41	0.26	0.09-1.42	0.36	0.45	0.28	0.10-1.58
	Light	0.27	0.29	0.12	0.10-0.80	0.28	0.31	0.13	0.10-0.90
	Dark	0.56	0.60	0.30	0.13-1.42	0.61	0.65	0.32	0.12-1.58

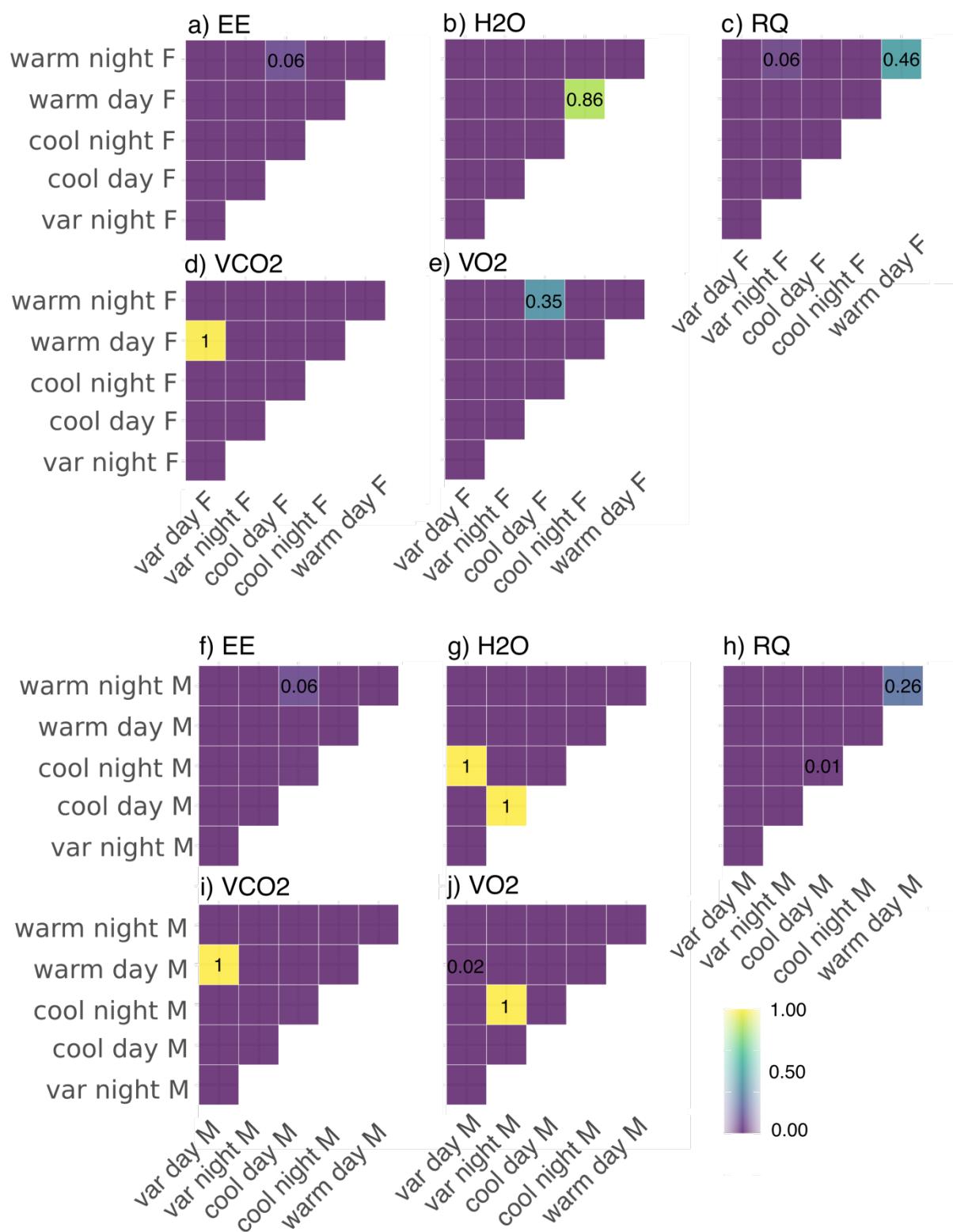


Fig. S1. Heat map of Bonferroni adjusted p-values for pairwise comparisons between dark and light phases for each experimental group (variable [var], constant warm, constant cool) within each sex (females [F]: a-e; males [M]: f-j), and each response variable (EE, H₂O [RWL], RQ, VCO₂, VO₂).

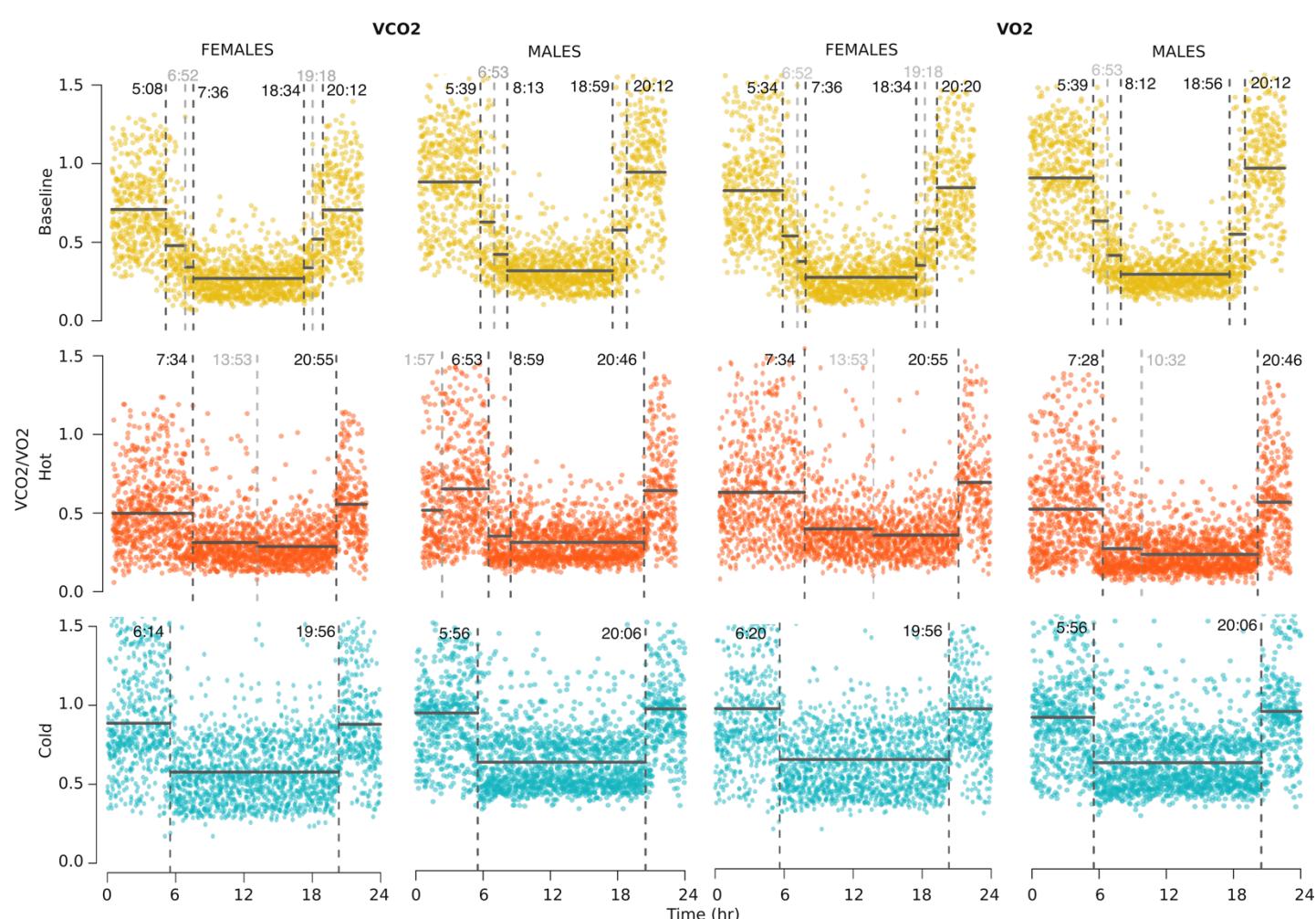


Fig. S2. Change point (hr:min) plots, denoting shifts in mean and variance, estimates for VCO₂ (left) and VO₂ (right) for females and males across a 24 hour cycle. Responses to diurnally variable environmental conditions are in yellow, war conditions in orange, and cool in blue. Vertical, dashed bars indicate change point occurrence, light grey dashed lines indicate potentially over fit change points (Table 2).

Table S3. Mean of each change point segment (Seg#) for each dependent variable (DV), experiment (Variable, Warm, Cool), and sex (Females, Males). Recalculated segment means, excluding over fit change point estimates (e.g., those shown in grey in Table 2), are shown in the Alt mean column with an X indicating ignored change points.

Exp. Sex	Variable												Warm												Cool											
	Females				Males				Females				Males				Females				Males															
	DV	Seg#	mean	Alt mean	Seg#	mean	Alt mean	Seg#	mean	Alt mean	Seg#	mean	Alt mean	Seg#	mean	Alt mean	Seg#	mean	Alt mean	Seg#	mean	Alt mean	Seg#	mean	Alt mean											
EE	1	0.242	0.242	-	1	0.300	0.300	1	0.170	0.170	1	0.186	0.186	1	0.306	-	-	1	0.313	-	-	-	-	-	-	-	-	-	-							
	2	0.163	X	-	2	0.207	X	2	0.106	X	2	0.102	X	2	0.212	-	-	2	0.212	-	-	-	-	-	-	-	-	-	-							
	3	0.108	0.147	-	3	0.133	0.172	3	0.095	0.100	3	0.091	0.094	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	4	0.080	0.080	-	4	0.093	0.093	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	5	0.102	X	-	5	0.18	0.180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	6	0.170	0.141	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
RQ	1	0.871	-	1	0.849	-	1	0.874	-	1	0.925	-	1	0.914	-	-	1	0.907	-	-	-	-	-	-	-	-	-	-	-	-						
	2	1.051	-	2	0.91	-	2	0.885	-	2	0.961	-	2	0.893	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	-	-	-	3	1.081	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	-	-	-	4	0.985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	-	-	-	5	0.915	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	1	0.108	-	1	0.112	-	1	0.223	-	1	0.237	0.237	1	0.192	0.192	1	0.188	-	-	-	-	-	-	-	-	-	-	-	-	-						
RWL	2	0.209	-	2	0.163	-	2	0.156	-	2	0.151	X	2	0.126	X	2	0.115	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	3	0.129	-	3	0.280	-	-	-	-	3	0.128	0.133	3	0.105	0.117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	-	-	-	4	0.199	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	-	-	-	5	0.157	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
	1	0.709	0.709	1	0.873	0.873	1	0.505	0.505	1	0.496	X	1	0.944	-	-	1	0.958	-	-	-	-	-	-	-	-	-	-	-	-						
	2	0.479	X	2	0.618	X	2	0.340	X	2	0.632	0.591	2	0.639	-	-	2	0.640	-	-	-	-	-	-	-	-	-	-	-	-						
VCO ₂	3	0.341	0.438	3	0.412	0.518	3	0.278	0.314	3	0.331	0.331	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	4	0.270	0.270	4	0.308	0.308	-	-	-	4	0.292	0.292	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	5	0.337	X	5	0.567	0.567	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	6	0.520	0.436	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	1	0.813	0.813	1	1.022	1.022	1	0.577	0.577	1	0.623	0.186	1	1.033	1.033	1	1.055	-	-	-	-	-	-	-	-	-	-	-	-	-						
	2	0.524	X	2	0.703	X	2	0.359	X	2	0.345	X	2	0.718	0.718	2	0.725	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
VO ₂	3	0.363	0.467	3	0.448	0.580	3	0.322	0.338	3	0.304	0.094	3	1.083	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	4	0.262	0.262	4	0.308	0.308	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	5	0.337	X	5	0.605	0.605	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	6	0.567	0.471	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					

Table S4. Bayesian change point estimates for each experiment (Exp.: Variable, Warm, Cool), sex, and dependent variable (DV) across a 24 hour cycle. *Italics* indicate multiple change points located within 5 minutes of each other which are herein considered as a single change point. Dark grey columns indicate hours for which no change points were detected within an experiment.

Exp.	Sex	DV	Time (hr:min)																								
			1	2	3-4	5	6	7	8	9	10	11	12	13-18	19	20	21	22	23	24							
Variable	Females	EE				5:08, 5:26/5:28									19:18	20:12 /20:20											
		RQ					6:40							12:52 /12:53		19:52											
		H ₂ O					6:50 /6:55	7:42			10:16																
		VCO ₂				5:08									19:18												
		VO ₂				5:08, 5:26/5:28	6:51 /6:52									20:12 /20:20											
	Males	EE					6:25								19:18	20:12	21:26										
		RQ					6:53		8:46																		
		H ₂ O										11:00															
		VCO ₂					6:25										20:04 /20:12	21:26									
		VO ₂					6:22 /6:25								19:18	20:12	21:26										
Warm	Females	EE				5:16		7:33 /7:34								20:55											
		RQ																									
		H ₂ O																									
		VCO ₂				5:16		7:34								20:55		22:18									
		VO ₂				5:16		7:33 /7:34								20:55											
	Males	EE					6:48															22:24 /22:26					
		RQ							8:25																		
		H ₂ O					6:57	7:28										21:36									
		VCO ₂					6:48															22:45 /22:48					
		VO ₂					6:48															22:45 /22:48					
Cool	Females	EE				5:16		7:33 /7:34								20:55											
		RQ																									
		H ₂ O																									
		VCO ₂				5:16																					
		VO ₂				5:16		7:33 /7:34								20:55											
Males	Males	EE	2:22		5:56																		23:24 /23:26				
		RQ																									
		H ₂ O																									
		VCO ₂	2:22/2:23 /2:27		5:56											19:54							23:24 /23:26				
		VO ₂	2:22 / 2:54		5:56																		23:34 / 23:36				