

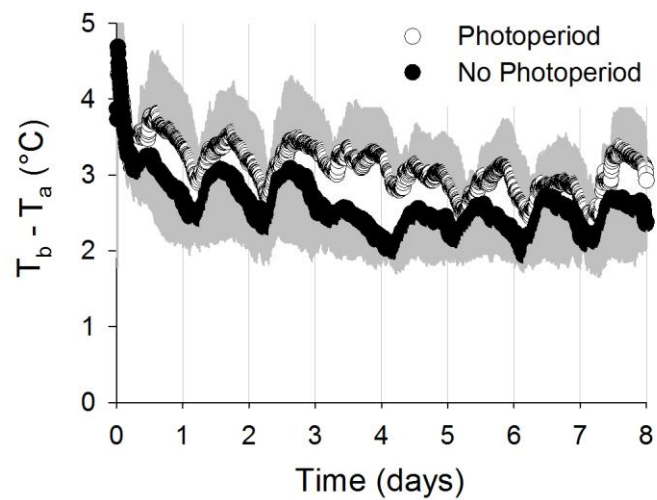
## Supplementary Materials for Seasonal reproductive endothermy in tegu lizards

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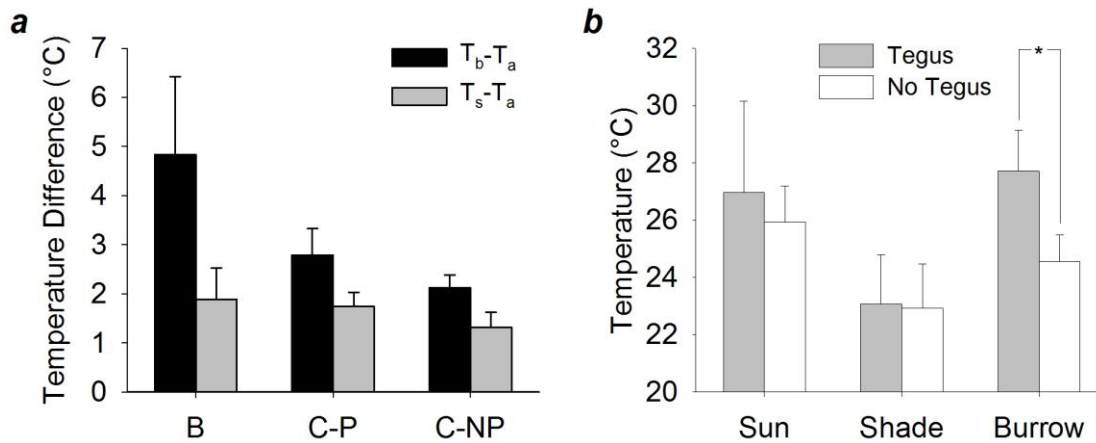
### The PDF file includes:

- Fig. S1. Temperature differentials for tegu ( $n = 11$ ) held under constant temperature conditions ( $T_a = 18^\circ\text{C}$ ) indoors with and without a photoperiod plotted against days after transfer indoors ( $\pm\text{SD}$ , one direction, gray area).
- Fig. S2. Mean ( $\pm\text{SD}$ ) temperature differences (A) between tegu ( $T_b$ ), skin ( $T_s$ ), and ambient ( $T_a$ ) temperature in a seminatural burrow (B), indoor chamber with (C-P) and without (C-NP) a photoperiod.
- Fig. S3. Transient thermal changes in tegu lizards associated with photoperiod.
- Fig. S4. Trace from a tegu in a natural enclosure during 3 days in January when it did not emerge out of its burrow.
- Fig. S5. Average ( $\pm\text{SEM}$ ) minimum daily HRs (that is, between 4:00 a.m. and 6:00 a.m.) as a function of body temperature in tegu lizards in seminatural outdoor enclosures.
- Fig. S6. Thermal equilibrium curves from tegu that had previously warmed in the sun and then transferred themselves to their lower temperature burrows.



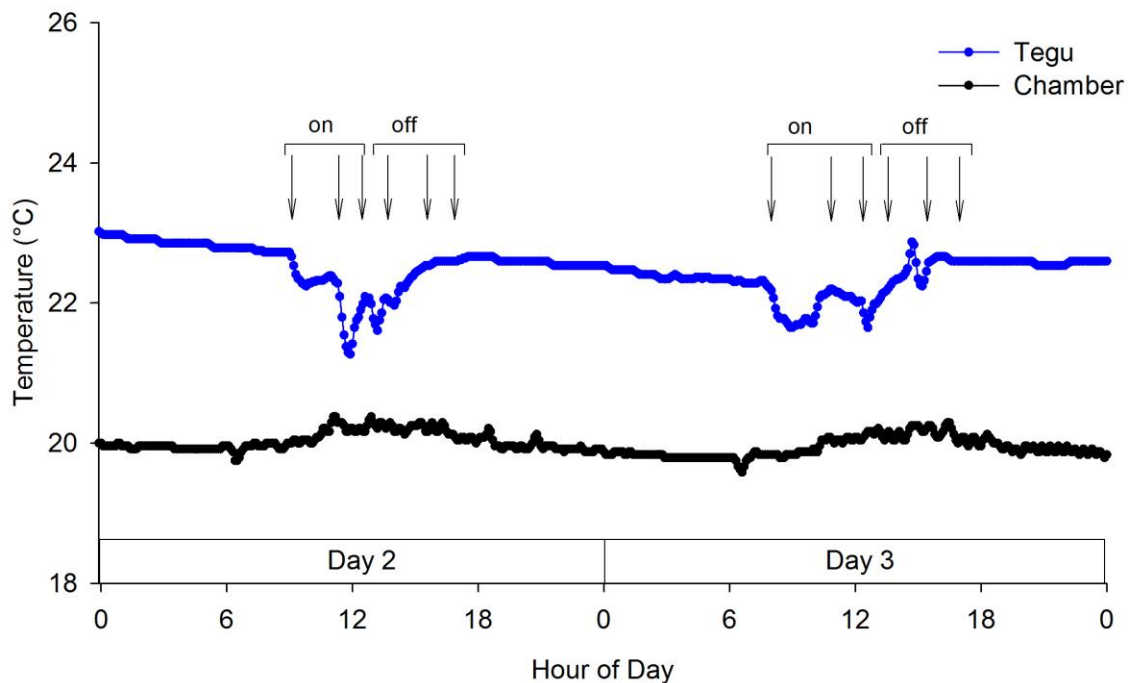
**Figure S1**

Temperature differentials for tegus ( $n = 11$ ) held under constant temperature conditions ( $T_a = 18^\circ\text{C}$ ) indoors with and without a photoperiod plotted against days after transfer indoors ( $\pm\text{SD}$ , one direction, gray area). The presence of a photoperiod had a significant effect on the temperature differential (Photoperiod:  $F_{1,10}=15.4$ ,  $P=0.003$ ) although there was still a significant diurnal influence on thermogenesis under both photoperiod and no photoperiod conditions (Daily Max/Min:  $F_{1,10}=160$ ,  $P<0.001$ ).



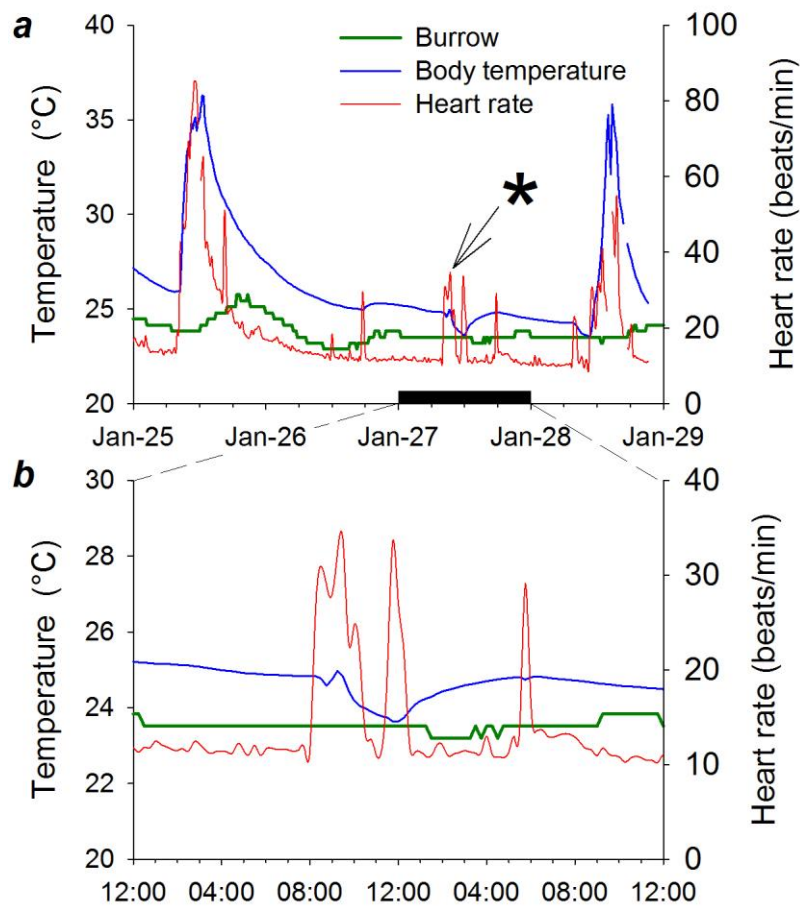
**Figure S2.**

Mean ( $\pm$ SD) temperature differences (A) between tegu ( $T_b$ ), skin ( $T_s$ ), and ambient ( $T_a$ ) temperature in a seminatural burrow (B), indoor chamber with (C-P) and without (C-NP) a photoperiod. In all three cases, tegus maintain a  $T_b$  different from the environmental temperature by 2-5°C. During the period of time when outdoors, tegus could choose to bask in the sun or shade in the day time and retreat to burrows at night. In the outdoor environments (b), sun and shade temperatures were not affected by tegu presence ( $F_{1,10}=0.297$ ;  $P=0.598$ ), although sun and shade temperatures were significantly different ( $F_{1,10}=0.10.3$ ;  $P=0.009$ ). In the outdoor environments with tegus, the burrow temperatures were higher when tegus were occupying them (asterisk;  $t_5=3.6$ ;  $P=0.015$ ), suggesting that endogenous heat production and the heat tegus derived from the environment contributed to the burrow environment.



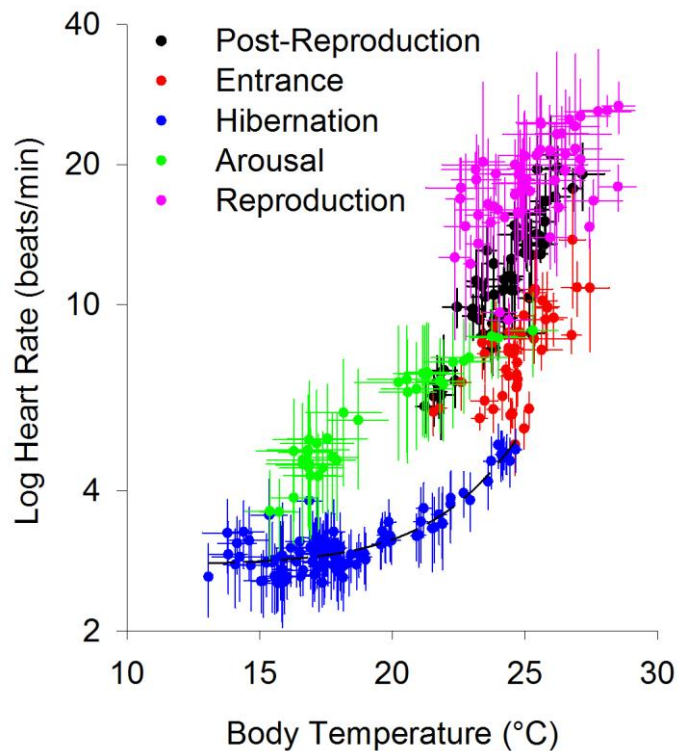
**Figure S3. Transient thermal changes in tegu lizards associated with photoperiod.**

When housed indoors with a photoperiod, tegu body temperatures responded to changes in light with transient decline toward ambient temperature, a pattern that was reversed when the lights went off (3 banks of lights were turned on progressively and then off progressively). The above plot shows the body temperature of a tegu lizard 2 days after being transferred from outdoors to an indoor environment held at constant temperature ( $20\pm 0.4^{\circ}\text{C}$ ). When the lights in the chamber were turned on, the temperature differential ( $\Delta T$ ) was diminished, suggesting that peripheral vasodilation, usually timed to early morning basking under normal conditions, was leading to an increase in the loss of the endogenously produced heat. This is further supported by data from the field (see Figure S4).



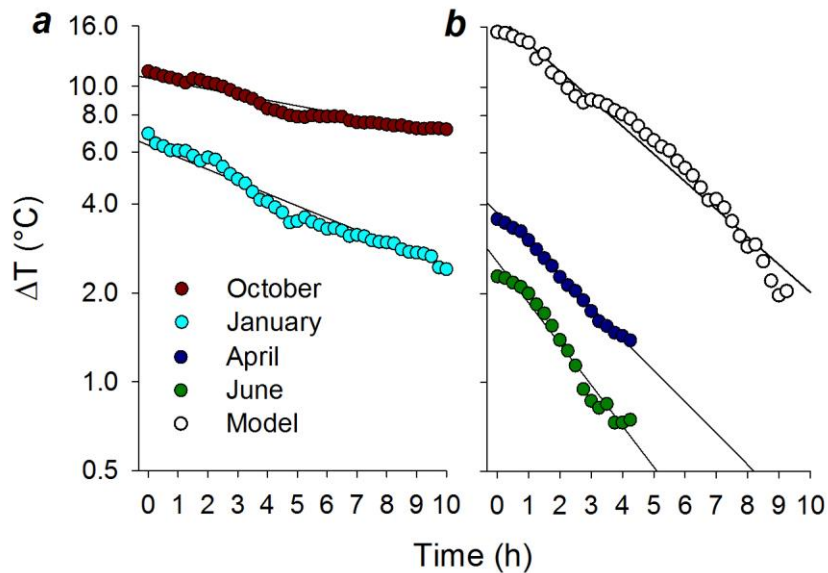
**Figure S4.**

Trace from a tegu in a natural enclosure during 3 days in January when it did not emerge out of its burrow. On Jan 27<sup>th</sup>, the tegu's body temperature fell toward burrow temperature in the morning in association with a rapid increase in heart rate. If blood pressure remained constant, this rapid rise in heart rate must have been accompanied by strong peripheral vasodilation. Later in the afternoon when heart rate had fallen back to normal, the tegu body temperature increased again, even though burrow temperature remained constant. This is consistent with vasoconstriction and subsequent retention of internally generated body heat.



**Figure S5.**

Average ( $\pm$ SEM) minimum daily HRs (that is, between 4:00 a.m. and 6 a.m.) as a function of body temperature in tegu lizards in seminatural outdoor enclosures. For the most part, heart rate demonstrates a typical  $Q_{10}$  relationship (dashed line) with body temperature during the progressive passive cooling observed during entrance (March-April) and especially during the dormant period (May – July). Distinct differences between the periods of the year are apparent, with heart rates elevated initially by two fold above the passive temperature dependency observed during the arousal from hibernation period (August) leading into the more active reproductive season (September-October), where heart rates are highly variable and three to five fold higher than predicted from simple temperature dependency (at  $T_b=25^\circ\text{C}$ ). Because the arousal heart rates follow a different relationship with body temperature supports the notion that tegus raise their heart rates and metabolism in the early morning prior to emergence. See also ref 25.



**Figure S6.** Thermal equilibrium curves from tegus that had previously warmed in the sun and then transferred themselves to their lower temperature burrows.  $\Delta T$  values (time aligned monthly average values from the time when tegus entered their burrow) represent the equilibration of body temperature toward ambient temperature after tegus returned to their burrows in the late afternoon (time zero). Values in October and January (a) represent the large thermogenesis typical of the reproductive and post-reproductive seasons. Tegus during the entrance and dormant period (April and June; b) leave burrows for short periods of time and show much reduced  $\Delta T$  values and equilibrate much faster with the environmental temperature (steeper slope). Model tegu values represent the equilibration of body temperature with burrow temperature of a deceased tegu. The slopes of  $\ln(\Delta T)$  vs. time represent cooling constants. The slopes for tegus in October and January were approximately 5 times lower than the model or dormant tegu values.  $C$  was estimated from the cooling constant of the model tegu.