

# The Importance of Female Temperature in the Attraction of Courting Males in Red-Sided Garter Snakes (*Thamnophis sirtalis parietalis*)



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## Introduction and Methods

- Sexually reproducing animals across all taxonomic orders use cues for mate selection.
- Upon emergence, female red-sided garter snakes (*T. sirtalis parietalis*) produce pheromones that indicate reproductive state to courting males.
- Female surface temperature ( $T_s$ ) is thought to be an indicator of reproductive state. When females emerge from hibernation they exhibit low  $T_b$  ( $< 5^\circ\text{C}$ ).
- A central dogma of this system is low  $T_b$  of female snakes act as a cue for courting male snakes. To our knowledge, this hypothesis has not been tested.
- The goal of our study was to address:

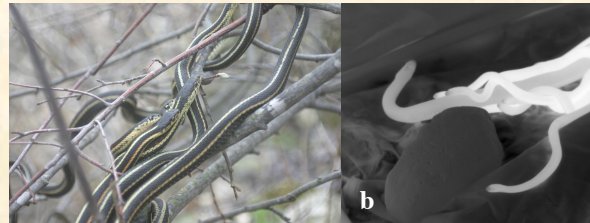
### Does low $T_b$ attract male snakes for courtship?

#### Experiment 1

- We collected 10 virgin females (unmated) and 10 females that had already mated from the Inwood den site in Manitoba, Canada during the spring mating season.
- A single unmated or mated female snake was randomly placed into an 1m x 1m arena with 25 male snakes for courtship trials. Each unmated/mated female  $T_b$  was artificially lowered to  $\sim 4^\circ\text{C}$  prior to the courtship trial.
- Courtship trials lasted  $\sim 30$  minutes. During each trial, female  $T_s$  was measured via infrared (IR) thermography using a FLIR SC6700 IR video camera (Fig. 1b). IR videos were taken at regular intervals throughout each courtship trial and each IR video recording lasted 15 seconds.
- We also recorded whether or not the male snakes were courting the unmated/mated female snake and operative temperature ( $T_e$ ) using sphere thermometers

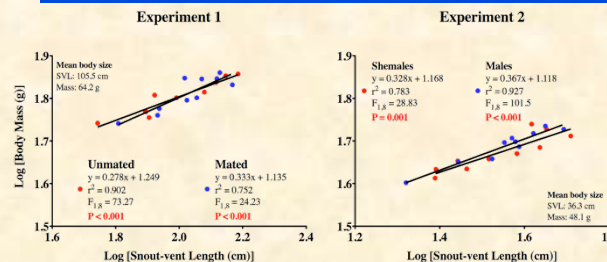
#### Experiment 2

- We collected 10 “attractive” shemal snakes and 10 “unattractive” male snakes from the Inwood den site.
- Courtship trials were done in the same manor as Experiment 1 with shemal and male snakes
- We also measured shemal/male  $T_s$ ,  $T_e$ , and recorded courtship behavior male snakes in the same manor as experiment 1.

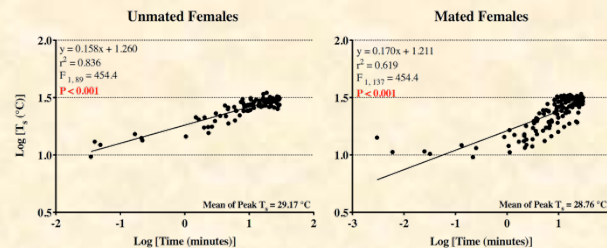


**Figure 1.** (a) Male and female red-sided garter snakes. (b) IR image of a courtship trial.

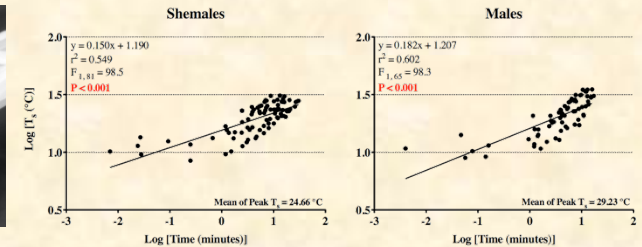
## Results



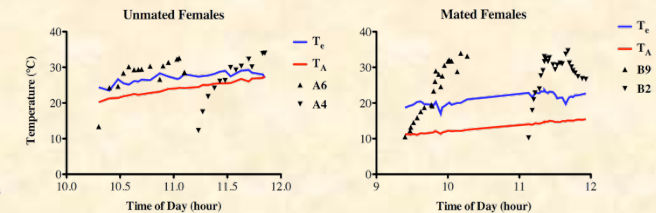
**Figure 2.** A comparison of regressions for body size in Experiment 1 revealed no significant differences between unmated and mated females ( $F_{1,16} = 0.03$ ,  $P = 0.873$ ). The same was true for the comparison between shemal and male regressions ( $F_{1,16} = 1.91$ ,  $P = 0.184$ ).



**Figure 3.** During courtship trials all unmated females were courted while mated females were not. Unmated females showed less variation in  $T_s$  relative to mated females. Warming rates between treatments were not significantly different. ( $F_{1,226} = 0.52$ ,  $P = 0.470$ ). However, we did find that unmated females were able to achieve significantly higher  $T_s$  relative to mated females ( $F_{1,227} = 14.64$ ,  $P < 0.001$ ).



**Figure 4.** During courtship trials all shemales were courted while males were not. Males showed slight less variation in  $T_s$  relative to shemales. Warming rates between treatments were not significantly different ( $F_{1,146} = 1.86$ ,  $P = 0.175$ ), but male snakes were able to achieve significantly higher  $T_s$  than shemales ( $F_{1,227} = 4.67$ ,  $P = 0.032$ ).



**Figure 5.** These figures represent changes in female  $T_s$ , ambient temperature ( $T_a$ ), and  $T_e$  overtime. These were back-to-back measurements taken on two different mornings. These data show rapid warming of  $T_s$  up to and even above  $T_e$ .

## Conclusions

- $T_s$  alone does not attract courting males because only unmated females and shemal snakes were courted. Also, the rapid rates of warming would limit the time for  $T_s$  to be a cue following emergence from hibernation.
- All snakes were able to achieve or come close to peak operating temperatures. The higher  $T_s$  achieved by unmated females could be a result of increased muscular activity (chased during courtship) relative to mated females. The higher temperatures achieved by males relative to shemales maybe due to greater exposure to solar radiation since they were not being courted.

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