American Wildlife Conservation Foundation Progress Report

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Project Overview

The goal of the study was to monitor the field metabolic rate (FMR) and precise time-stamped GPS location in the field of free-ranging Eastern box turtles (*Terrapene carolina carolina*) near their northern range limit in Ohio. Specifically, we set out to characterize the daily and seasonal energy allocation of a terrestrial ectotherm at the northern limit of its population range. The focus of the project was (1) spatial monitoring and (2) physiological monitoring of box turtles in the field. Using the GPS-locations, we determined habitat use and daily movement of box turtles. Further, we determined the thermoregulatory strategy of box turtles as well as FMR using heart rate, body temperature, and body mass as a proxy.

Progress on Project

Spatial Monitoring

We found that in Southwest Ohio, box turtles were selected deciduous and evergreen forests, as well as grasslands and shrubs using methods proposed by Neu et al. (1973) and land-use land-cover data from the Multi-Resolution Land Characteristics Consortium (MRLC). Individuals spent proportionally less time in areas such as agricultural plots and residential areas. Box turtles would move anywhere from 0 – 400 m in a given day, and temperature did not affect movement (Fig. 1).

Physiological Monitoring

We found that box turtles were thermoconforming (i.e., internal temperatures heavily influenced by external temperatures) with the environment. Using lab data, we generated individualized VO_2, and a group VO_2 estimation equation. We are currently in the process of analyzing the remaining data for individual box turtles. For box turtles that do not have individualized equations, we will estimate FMR from a group equation using heart rate, mass, and body temperature as proxies for oxygen consumption (see Fig. 2 as an example).

Future Directions

Based on the results of habitat use by box turtles, our next objective is to better understand how fragmentation of habitats in the Southwest of Ohio may impact box turtle dispersal to new locations. We are also interested in continuing analysis of the GPS movement, as well as accelerometer data that was collected. Accelerometer data will allow us to determine daily activity patterns that we can later combine with heart rate, VO_2, and ideally location.

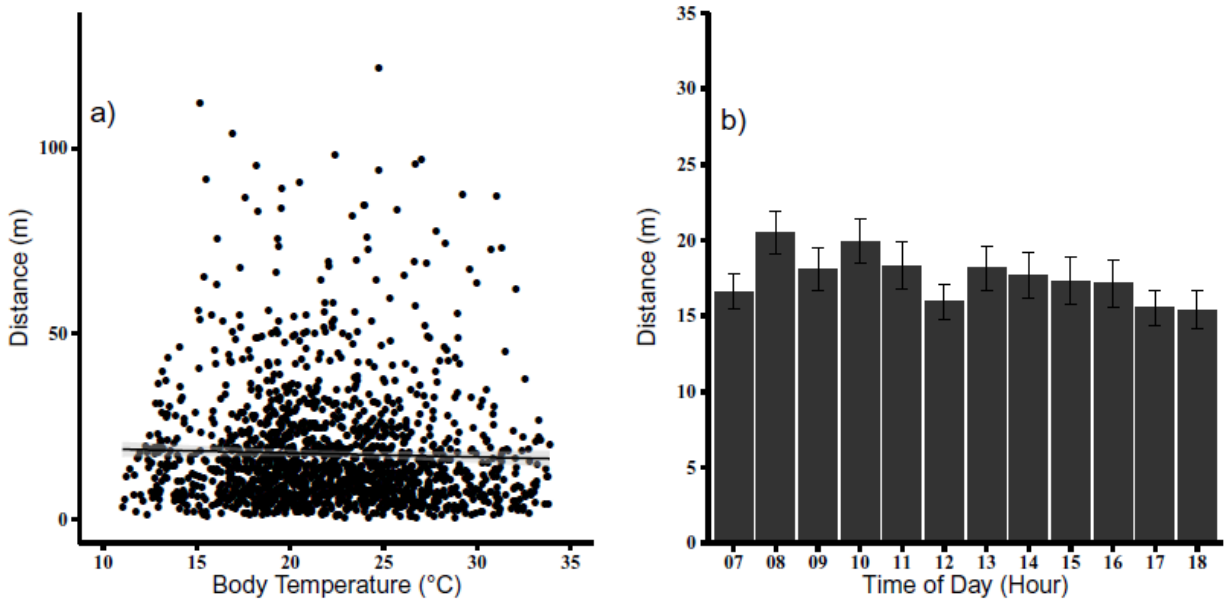

Figure 1. Distance moved plotted against body temperature (a) and time of day (b). In 2015, a total of 1666 GPS coordinates were obtained between 13 turtles. Body temperature and distance moved (a) between GPS points had no correlation. Time of day and mean (± standard error) hourly distance moved (b) had similar variation throughout the day but a significant difference between 0800 and 1800 h ($F_{11, 1534}$= 0.03856, $p < 0.05$; Tukey-HSD $p < 0.05$).

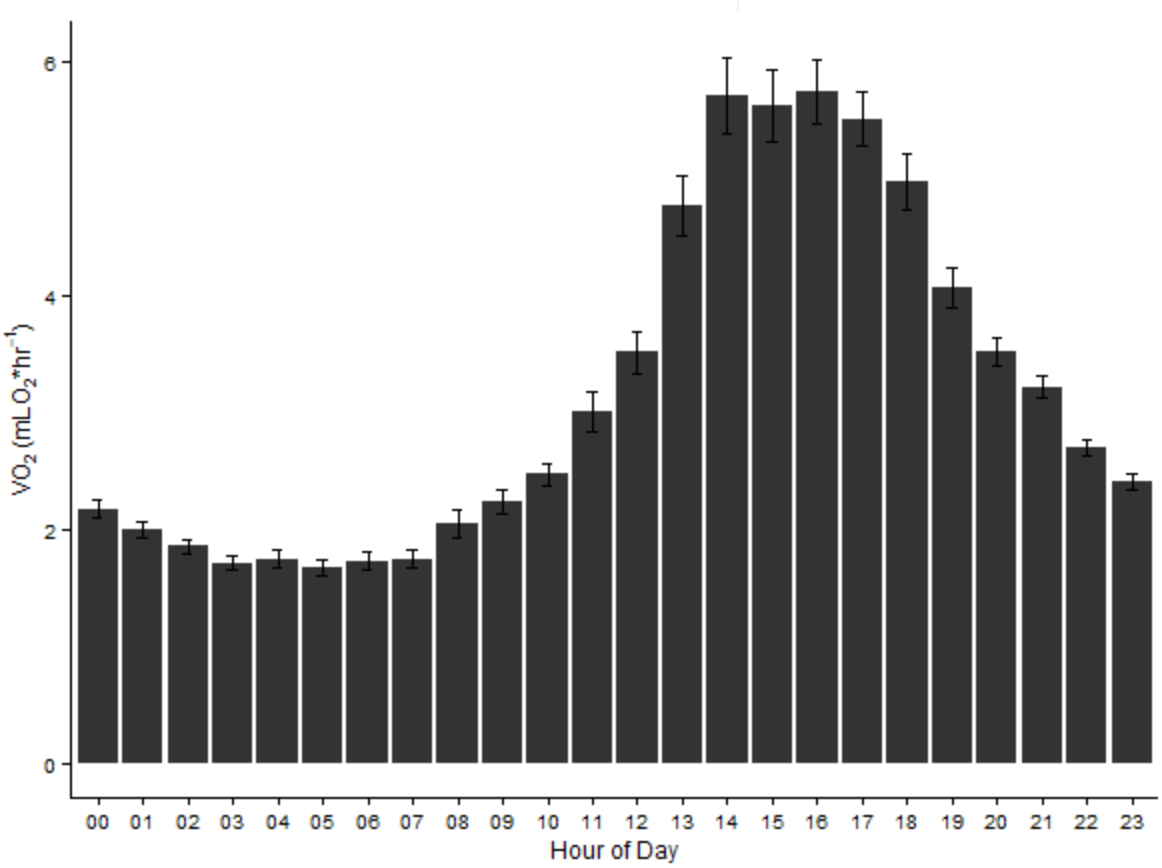

Figure 2. Oxygen consumption of a single box turtle (ID: R1) in a 24-hour representative day. The box turtle was monitored for 10 days in the field. Data are reported as hourly mean (± standard error). Oxygen consumption was higher during the midday between 1100 and 2100 h in comparison to early morning and night.