Temperature and Trapping: An Observational Analysis of the Relationships between Temperature and Trapping Rates of Western Painted Turtles (*Chrysemys picta bellii*) in Clay County, Minnesota

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Abstract

In our long-term study (2001-2019), western painted turtles (*Chrysemys picta bellii*) have been captured with basking traps in Clay County, Minnesota, to study population characteristics and behaviors. Captured turtles were weighed, sexed, measured, scute notched, and PIT-tagged. All turtles were released at a fixed point on the shoreline of the corresponding slough where originally captured. We are currently trapping three sloughs with less than one km between the two most distant sloughs. Over the years, there have been observations of the trapping success rates varying between days. Our team has been interested in analyzing the factors involved with the varying success rates. One of the factors that is believed to cause this difference is weather and temperature. This project aims to examine the relationship between trapping success and temperature in hopes of finding correlations between the two factors and an optimal temperature range for trapping that can be utilized in future studies for predictions of trapping numbers.

Introduction

Western painted turtles (*Chyrsemys picta bellii*) are a small aquatic turtle species whose distribution spans much of the mid-to-upper United States (Ernst and Lovich, 2009, Palmer and Braswell, 1995, Rowe, 2003). A big characteristic of their lifestyle is the need to thermoregulate their bodies, either by exposure to the sun or residing in warm, shallow waters (Janzen et al., 1992, Lindeman, 1993, Edwards and Blouin-Demers, 2007). Due to this biological need, scientists have implemented the use of basking-traps in order to capture and observe turtle characteristics (Gamble, 2006). Our team was interested in which daily temperatures yielded the highest number of turtle captures and if there had been an observable increase in daily temperatures throughout our project. Our long-term study has been conducted in Clay County since 2001, but for the purposes of this analysis, our team will be focusing on the data specifically from 2006, 2013, and 2019 using only PIT-tagged turtles. We chose those 3 years due to the quality of data available. For example, 2006 is the first year we made use of PIT tags, 2013 is somewhat of a halfway point between 2006 and 2019, and 2019 has the most recent data available. Overall, it is our hope to see possible relationships between turtle captures and temperature increases over the years.

Methods

Turtles were live trapped in 3 sloughs: Stockrahm, Aakre, and Middle from May to August in the years of 2001 to 2019. Floating/basking traps were used with 6 traps in both Stockrahm and Aakre Sloughs, and, starting in 2011, 3 traps in Middle slough. Captured turtles were scute notched, PIT-tagged (passive integrated transponder) if deemed large enough, measured (carapace length/width, plastron length, and curvature), weighed, sexed, and then released back into the slough where initial capture occurred. Data from each summer were entered by students into a collective Excel spread sheet. The data were then filtered down to 2006, 2010, and 2019 and then sorted by how many turtles were captured each trapping day throughout the summer. Each day's data were then sorted by sex, to further look at the capture ratios between the sexes.

Temperature data were retrieved from the WeatherUnderground (https://api.wunderground.com/) using data pulled from the "Daily Weather History & Observation" chart. Data pulled from this chart included high, low, and average daily temperatures (°F). Data were compiled into an Excel spreadsheet and then compared to number of turtle captures recorded for each surveyed day. These data were collected and made available by airports, and the location closest available to our surveyed site was Moorhead, MN. Data analysis and graph creation was completed using RStudio software.

Results

Fig. 1. Daily temperatures recorded and made available by WeatherUnderground. Red indicates daily high temperatures, green indicates daily average temperatures, and blue indicates daily low temperatures. Note the missing temperature data in 2019.

Results

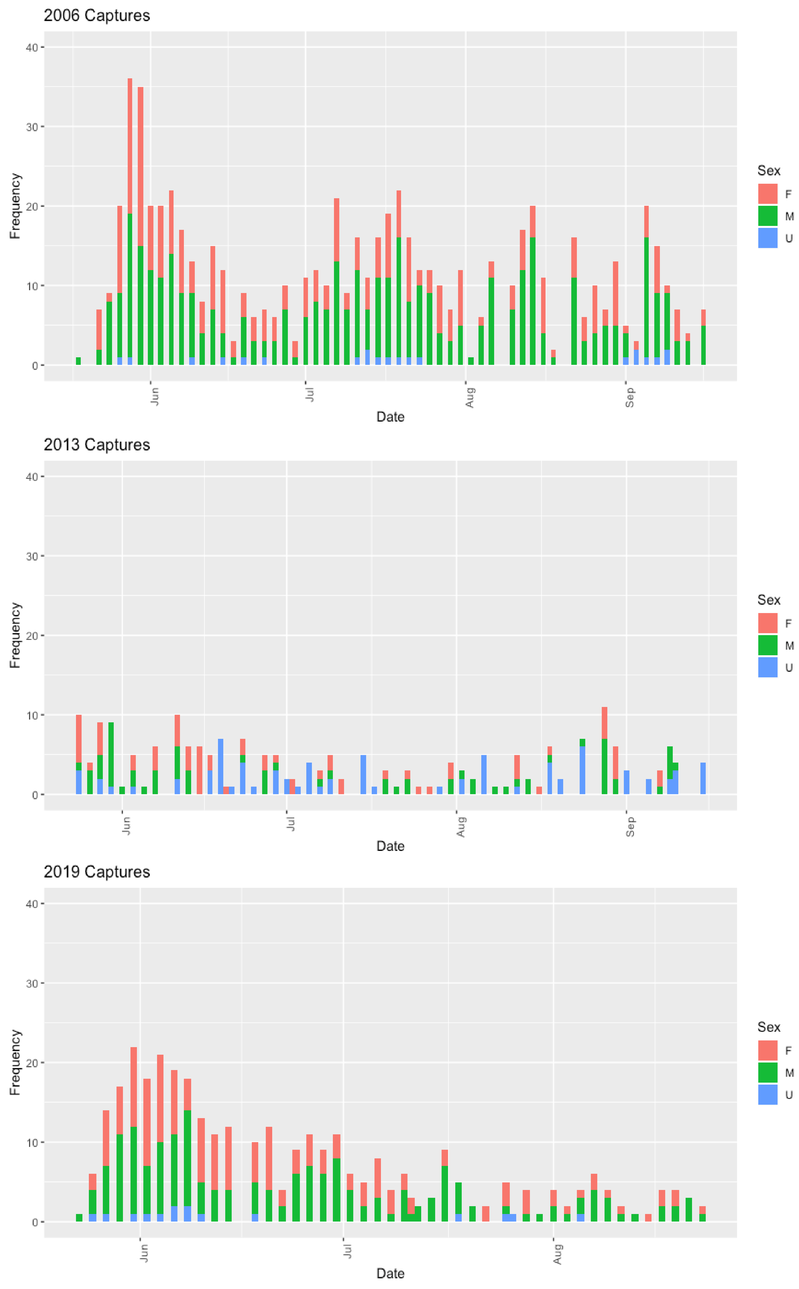

Fig. 2. Numbers of daily captures sorted by sex for the 2006 (top), 2013 (middle), and 2019 (bottom) trapping seasons. Sex is identified in each of the legends using female (F, red), male (M, green), and unknown (U, blue) categories.

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- Minnesota State University Moorhead Dille Grants
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Results (cont.)

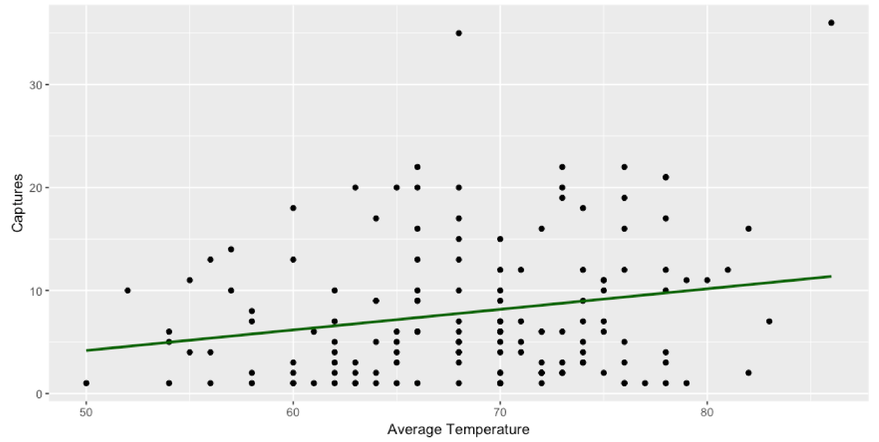

Fig. 3. Number of turtles captured in 2006, 2013, and 2019 combined into a single graph and then compared to the respective daily average temperature. The data were then plugged into a linear regression, with the line shown in dark green, where a surprisingly low correlation was found between the two variables ($R^2 = 0.0364$).

Results & Discussion

General trends showed that higher temperatures resulted in an increased capture of turtles. In 2006, the spikes in temperature (around 80 ºF) were clearly associated with the spike in turtle captures, specifically female ones (Fig 1 & 2). However, the spikes in late May and June also corresponded to the nesting season and more movements in general during this time. The spikes were harder to see in 2019 data because of the lack of temperature data, but they still appeared to corroborate with the 2006 data (Fig 1 & 2). Regarding the number of overall captures from year-to-year, captures for 2013 were vastly lower than for both 2006 and 2019. This might have to do with the temperatures not spiking as high in the earlier months of the summer, which could affect the basking and therefore trapping rates for the rest of the season. However, this also corresponded to the time when we had several years of low capture rates while using our older-style PVC pipe traps. When we switched to a different style wooden trap in 2015 with slanted walls (Gamble, 2006), we had better trapping success for all successive years. A regression analysis (Fig 3) indicated a very low correlation between the two variables (R2 = 0.0364, Fig. 3). In the future, it might be more beneficial to run a different sort of analysis to find an accurate relationship between the capture rates and temperature, and therefore an optimal range for captures.

Conclusion

Overall, our results supported the idea that the capture rates of western painted turtles were influenced by air temperature. This can be seen with the correlation of higher temperatures producing higher capture rates. Although they might not be directly linearly related to each other, there might be another analysis to be done, perhaps with a normal distribution, resulting in a more accurate correlation. In addition to air temperature, water temperature could be another major factor influencing the basking preferences of this species. Another similar, future study could be performed with the additional collection of water temperatures by researchers daily. In addition to looking at water temperature, analyzing the data more specifically regarding differences in capture rates between males and females could be undertaken.

Additional Field Crew Members: Alex G. Hexum, Fernando Lambert, Chantell L. Mindt, Kira R. Johnson, Syreeta M. Shigematsu, Emily A. Larsen, Avery J. Knisley, Patrice M. Delaney, Nick R. Wilm, Samantha A. North, Joanna E. Blum, Stephanie E. Sonnenberg, Ajayi A. Temiloluwa, Savanna J. Hohenstein, and Nicholas A. Marshall

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