



Variation in Body Mass Index in a Colorado Population of Ornate Box Turtles (*Terrapene ornata ornata*)

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Abstract

The demographics and life history of the ornate box turtle (*T. o. ornata*) have yet to be studied in Colorado. To provide comparison with other populations and to inform land management questions, morphometric data were collected for two seasons in a population of *T. o. ornata* on the sandhills of eastern Colorado ($n = 84$). Ratios of mass to calculated volume, or body mass index, were compared between males and females and between years. A significant difference was found between mean body mass index for females in 2007 and females in 2008, while males did not demonstrate such a difference. This difference is most likely due to variation in egg development and reproductive output in females, possibly as a result of environmental factors and resource availability. Continued studies will provide more data to address these and other questions of box turtle ecology.

Introduction

- T. o. ornata* dwells primarily in the grasslands of the North American Great Plains (Legler 1960, Ernst and Barbour 1989), including the sandhills and plains of eastern Colorado.
- Despite Studies of *T. o. ornata* in other states indicate that human impact is directly responsible for declining numbers (Converse et al. 2005; Redder et al. 2006) and listing in Appendix II of CITES, no comprehensive studies of *T. o. ornata* populations have been conducted in Colorado to date.
- Comparing mass-to-size ratio (body mass index) between sexes may indicate variation in resource allocation that may then impact reproductive success.
- We hypothesize that females will exhibit a greater year-to-year fluctuation in body mass index because of variation in egg production and reproductive output.



A male chows on epiderwort (*Tradescantia bracteata*), a box turtle favorite.

Methods

- Broad-area visual surveys were conducted on a study site of approximately 50 hectares from June-October 2007 and March-September 2008.
- Morphometric data, including straight carapace length, maximum height, width at hinge, anterior plastron length, posterior plastron length, and mass were collected for each turtle; turtles were marked to identify recaptures.
- An ellipsoid model (volume = $\pi/6 \times \text{length} \times \text{height} \times \text{width}$) was used to calculate volume, as in Macías-Ordóñez and Draud (2005).

Results

- Data were collected on 16 female and 11 male-adult turtles in 2007 and 32 female and 25 male adult turtles in 2008.
- | | Mean Calculated Volume (cm ³) | | Mean Mass (g) | |
|---------|-------------------------------------------|--------|---------------|-------|
| | 2007 | 2008 | 2007 | 2008 |
| Females | 291.58 | 303.44 | 379.3 | 389.7 |
| Males | 289.15 | 290.63 | 369.2 | 365.2 |
- There was a significant difference in body mass indices for sex and year (2X2 ANOVA: $F = 3.07$, $p < 0.05$, $n = 84$).
 - Female box turtles had a significantly higher mean body mass index in 2007 compared to 2008 (2007 mean = 1.308 g/cm^3 , SE = 0.038; 2008 mean = 1.222 g/cm^3 , SE = 0.013; T-test: $T = 2.15$, $p < 0.05$, $n = 16$, $n = 32$).
 - Male box turtles did not differ significantly in mean body mass index in 2007 compared to 2008 (2007 mean = 1.287 g/cm^3 , SE = 0.035; 2008 mean = 1.258 g/cm^3 , SE = 0.015; T-test: $T = 0.767$, $p > 0.05$, $n = 11$, $n = 25$).
 - Male and female box turtle mean body mass indices did not differ significantly from each other in 2007 or 2008 (2007 T-test: $T = 0.411$, $p > 0.05$, $n = 16$, $n = 11$; 2008 T-test: $T = -1.789$, $p > 0.05$, $n = 32$, $n = 25$).

Body Mass Index for *T. o. ornata* in Colorado

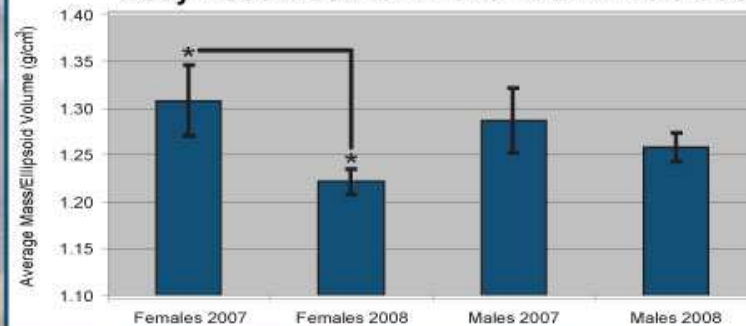


Figure 1: Mean mass to ellipsoid volume ratio (g/cm³) by sex and by year in *T. o. ornata*. Bars indicate standard error. Asterisks show statistically significant variations.



A male turtle strikes a frightening pose to ward us off; he was unsuccessful.

Discussion

- Our initial findings support the hypothesis that females will exhibit greater year-to-year fluctuation in body mass index than males.
- We hypothesize that variations in body mass index likely result from differences in resource availability, across both geography and time. These can be the result of stochastic or anthropogenic factors.
- Further studies across several years, including repeated measurements of individual turtles, are needed to link these factors to body mass index variation.
- As we understand how ornate box turtles allocate these resources toward reproduction and other biological functions, we can begin to construct life histories that will specifically inform conservation and preservation efforts.

Literature Cited

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Gratitudes

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