2013

Effects of Overwintering Conditions on Nesting Behavior of Painted Turtles

Timothy Mitchell
Iowa State University

Cecilia Hinsley
Iowa State University

Fredric J. Janzen II
Iowa State University, fjanzen@iastate.edu

Effects of Overwintering Conditions on Nesting Behavior of Painted Turtles

Abstract
For painted turtles (Chrysemys picta) and many other reptiles, the temperature experienced by developing eggs determines whether the embryo will become a male or a female. Animals with this temperaturedependent sex determination (TSD) are vulnerable to rapid climate change, as consistent, directional changes in climate may result in detrimental population sex-ratio shifts. Yet, many animals with TSD have persisted for millions of years, through many periods of global warming and cooling. How have these animals evolved to maintain healthy sex ratios, despite this apparent vulnerability?

Keywords
RFR A1223, Ecology Evolution and Organismal Biology

Disciplines
Agricultural Science | Agriculture | Evolution | Population Biology | Terrestrial and Aquatic Ecology

Effects of Overwintering Conditions on Nesting Behavior of Painted Turtles

RFR-A1223

Timothy Mitchell, graduate student
Cecilia Hinsley, George Washington Carver intern
Fredric Janzen, professor
Department of Ecology, Evolution, and Organismal Biology

Introduction

For painted turtles (*Chrysemys picta*) and many other reptiles, the temperature experienced by developing eggs determines whether the embryo will become a male or a female. Animals with this temperature-dependent sex determination (TSD) are vulnerable to rapid climate change, as consistent, directional changes in climate may result in detrimental population sex-ratio shifts. Yet, many animals with TSD have persisted for millions of years, through many periods of global warming and cooling. How have these animals evolved to maintain healthy sex ratios, despite this apparent vulnerability?

One mechanism that may contribute to the maintenance of balanced sex ratios is the nesting behaviors of reproducing females. Each spring or early summer, the turtles dig a terrestrial nest, lay their eggs, and abandon them forever. Yet the mother can influence the conditions likely to be experienced by her eggs by choosing when and where to nest. Our long-term research on turtles in the Mississippi River suggest that winter conditions prior to nesting can influence when and where (how shady of a nest location) turtles nest. Because turtles naturally hibernate under the ice, the spring ice thaw could be the most biologically relevant characteristic for turtle hibernation. Spring ice-out marks the time when turtles can begin basking and feeding after winter hibernation. Our study experimentally evaluates the influence of differing simulated ice-out conditions on painted turtle nesting phenology (when) and nest-site choice (where).

Materials and Methods

We collected adult male and female painted turtles during the summer from our study site on the Mississippi River near Clinton, Iowa. All turtles were hibernated in tubs of water maintained in cool temperatures in the laboratory at ISU the following winter. To evaluate the effects of differing winter conditions, two release dates were chosen to represent a warm winter with early ice-out and a cold winter with late ice-out. The “early” treatment, simulating warm winters, was released into an artificial pond (Figure 1) at the ISU Horticulture Research Station on March 25. The “late” treatment was released into the same pond on April 13. Turtles were marked and randomly assigned to each treatment. Upon being released into the pond, turtles were able to mate and nest for the duration of the season.

The pond was checked multiple times daily for nesting activity. Each time a turtle nested, we noted the date and subsequently measured shade cover above the nest using hemispherical photography. Using this photograph, we calculate the openness of the canopy and the amount of solar radiation transmitted to the nest. Analysis of variance was used to evaluate whether treatment means differed.

Results and Discussion

Our experimental treatment simulating the different ice-out dates had no influence on

either nesting date or nest-site choice in maternal painted turtles (Table 1). There are several explanations for why we observed no difference between treatments. First, perhaps the differences in ice-out conditions in our experiment, while ecologically relevant, were not extreme enough to produce differences in phenology or nest-site choice. Additionally, a cold front that passed through central Iowa after all turtles had been released into the pond may have minimized any thermal advantage that had been gained by the early-release turtles. Finally, other environmental factors not manipulated in our experiment may be more relevant for plasticity in nesting behavior (e.g., availability of emergent aquatic vegetation). Nonetheless, our study is the first to experimentally investigate how hibernation conditions might influence nesting behavior in turtles.

Acknowledgements

Thanks to Mark Honeyman, Nick Howell, and the staff of the Horticulture Research Station. This project was supported by ISU Research Farms and the National Science Foundation.

Table 1. Influence of simulated early and late ice-out treatments on nesting behavior of painted turtles (*Chrysemys picta*).

Variable	N	Early	Late	P-value
Nesting Julian Date	25	159±9	160±9	0.90
% Canopy Open	25	79±11	75±14	0.42
Nest radiation	25	9±1	9±2	0.29

Figure 1. Painted turtles basking in the turtle ponds at the ISU Horticulture Research Station.