Determining Sexual Maturity of *Crotaphytus collaris* hatchings and yearlings as compared to body size, sex, and season.

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Abstract:

In a few animal species, sexual mature is linked to body size. These species will be sexually mature once they hit a certain size regardless of their age. This type of sexual maturity is what I am setting out to test in *Crotaphytus collaris*, eastern collared lizards. Collared lizards are interesting in that they display sexual dimorphism. Even as hatchlings, males have bright, horizontal orange bars that reach across their backs while females' coloring remains drab. The purpose of the hatchling orange bars is still up for debate but the questions the orange bars raise are vital in understanding their purpose. Collared lizards also practice the act of pair bonding. Pair bonding is where males of the species spend time with females to create a bond so that when mating season comes, the females will be more likely to join a particular male's mating harem. A harem is a group of females who mate with a particular male collared lizard and stay in that male's territory. Collared lizard hatchlings also practice pair bonding and territorial instincts although they are not thought to be sexually mature. This raises the question of why would the hatchlings exhibit these behaviors if they are not yet sexually mature. To test this question, I will be collecting a cloaca smear from yearlings in the spring and hatchlings in the spring. This involves expressing the cloaca of the specimen onto a microscope slide and letting the slide dry. If mature spermatozoa are present from a male specimen, the specimen lizard is sexually mature. If mature spermatozoa are found, this means that she has been engaged in copulation. The field steps of the project are as follows: capture specimen, record the area the specimen was found, identify specimen, take body measurements, and perform a cloaca smear. Each lizard, apart from newborn hatchlings, has a set of toe clippings and paint drops on the back to identify it. Body size measurements are taken to compare to sexual maturity. The measurement is taken from nose to vent on the collared lizard as well as mass in grams. The cloaca smears will be compared to body size, sex, and season to produce the results of the project

Keywords: Eastern Collard Lizards, Sexual Maturation, Reptiles, Hatchling Orange Bars

Introduction

Timing of sexual maturation varies across species. In humans, it generally happens between the ages of 10 and 15 years of age. In most other animal species, sexual maturation occurs when the animal reaches adulthood. In *Bufo bufo*, the common toad, sexual maturity is linked to body size rather than age (Reading, 1991). The body sizes of toads that were able to breed were similar to each other and not linked to age. This type of sexual maturity is what I am setting out to test in *Crotaphytus collaris*, the eastern collared lizard.

Collared lizards display sexual dimorphism as adults. Even as hatchlings, males have bright, lateral orange bars that reach across their backs, while females' coloring remains drab. The purpose of the hatchling orange bars is still up for debate, but the questions the orange bars raise are vital in understanding their purpose. Collared lizards also practice the act of pair bonding. Pair bonding is where males of the species spend time with females to create a social bond so that when mating season comes, the females will be more likely to join a particular male's mating harem and they can mate early on in the season. A harem is a group of females who mate with a particular male collared lizard and stay in

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that male's territory. Collared lizard hatchlings also practice pair bonding and territorial instincts although they are not thought to be sexually mature. This raises the question of why would the hatchlings exhibit these behaviors (and display the orange bar coloration) if they are not yet sexually mature. We propose that this is a rare case of precocial sexual selection and benefits are delayed until later sexual maturity.

Literary Review

Studies involving *Crotaphytus collaris* have been focused more around adults of the species but they still provide useful information that I can use for my project. Studies with collared lizards from past years that pertain to my project include "Population differences in the roles of size and coloration in intra-and intersexual selection in the collared lizard, *Crotaphytus collaris*: influence of habitat and social organization," by Troy A. Baird, Stanley F. Fox, and J. Kelly McCoy and "Social inhibition of territorial behaviour in yearling male collared lizards, *Crotaphytus collaris"* by Troy A. Baird and Dusti K. Timanus. These two studies took place in the area where I will be conducting my research. In the second listed article, the authors go into detail about age-dependent behavior exhibited by male collared lizards. Collared lizard males have harems females who sit in the males territories and mate with the sexually mature males. Yearling males who are sexually mature do not claim or defend territories of their own. They take lower positions compared to sexually mature males who are two years old and older. (Baird & Timanus 1998). The researchers involved in the study set out to find out if the social behavior of sexually mature yearling males were influenced by the presence of sexually mature adult males. This study pertains to my project because it sets the ground that some yearlings are sexually mature. My project will grow off that information and go deeper into which are sexually mature and if body size, sex and season affect sexual maturity. The first article serves to give some background in how collared lizards differ from group to group. It talks about testing adults from three different areas and their preferences. It talks about coloring differences, size differences and whether or not females from the three areas preferred males from different areas or the same area. Although this study was done with adult collared lizards, it highlights behavior in collared lizards and gives useful information about collared lizards as a species.

Methods

This study will take place from May of 2015 to October of 2015. The early months of the study will focus on yearlings because of the lack of hatchlings during May and June. From August to October, hatchlings will be the focus because they are just beginning to hatch out of their eggs. All of the samples will be taken from the two sites located on Sooner Lake in Pawnee, Oklahoma. The field steps of the project are as follows: capture specimen, record the area the specimen was found, identify specimen, take body measurements, and perform a cloaca smear. To safely capture a specimen for testing, we will use a technique called noosing. To correctly noose a collared lizard, one will gently slip the noose end of the noosing pole around the specimen's neck and pull to tighten the noose. This step ensures the safe capture of the specimen and also the safety of the researcher. After capturing the specimen, I will record the specific area of where the specimen was found. This step helps in identifying trends in results and to keep data organized. Identifying the specimen helps determine age and sex. Each lizard, apart

from newborn hatchlings, has a set of toe clippings and paint drops on the back to identify it. Identifying the specimen used in my study will prevent errors in age and sex when recording and comparing data. Body size measurements are taken to compare to sexual maturity. The measurement is taken from nose to vent on the collard lizard. Mass is taken with a Pesola spring scale. The final step of the field work for this project is taking a cloaca smear from the specimen. This involves expressing the cloaca of the specimen onto a microscope slide and letting the slide air dry (Baird &Timanus 1998). This step gathers data that I will be comparing body size, season, and sex to later in the lab. After the field work has been completed, the samples on the microscope slides will be transported back to the university lab. In the lab, the samples will be observed under a microscope to determine if the specimen had mature spermatozoa present (Baird &Timanus 1998). Mature spermatozoa from collared lizards have a unique blue-green color which allows us to look under the microscope for the spermatozoa with staining the side. If mature spermatozoa are present and the specimen is a male, it is sexually mature. If mature spermatozoa are present and the specimen is a female, then we can conclude that it has recently engaged in copulation. These data will be compared to body size, sex, and season to produce the results of the project.

Expected Results

Because I am working with a live, natural population, I am at the disposal of the animals. The collared lizard populations found on Sooner Lake are only active from May to October, meaning that we have had to wait to start research. We expect that the hatchlings will not be sexually mature. If the hatchlings are not sexually mature, and yet the orange bars of males are used to repel other hatchling males and attract hatchling females, we can develop further our hypothesis that this is precocial sexual selection and the hatchling behavior and color are beneficial later when the lizards become sexually mature.

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