



Distribution, temperature and population studies of *Sceloporus graciosus graciosus* in Yellowstone National Park
by George Allen Algard

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Zoology
Montana State University
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Abstract:

A study was conducted during the summers and the winter of 1964 and 1965 to determine the distribution of *Sceloporus graciosus graciosus* in Yellowstone National Park and to determine temperatures and selected population characteristics of the lizards in three study areas in the Rorris Geyser Basin. The main lizard populations were found in the Rorris, Shoshone and Heart Lake Geyser Basins. Small populations and scattered individuals were found in Black Sand Basin, a thermal area along the road to Mary Lake, a small thermal area near Mary Lake and the Artist Paint Pot area. Only one lizard population was found in a non-thermal area, that being within the town of Gardiner, Montana. No lizards were found at Mammoth, although they had previously been reported there. The largest male and female measured (snout-vent length) were 54 and 58 mm respectively, while the young-of-the-year averaged about 26 mm. Three age classes were recognized on the basis of snout-vent length; young-of-the-year, juveniles and adults. Data indicate that the lizards in the Rorris Geyser Basin exhibit growth at least through their third summer of life. The mean cloacal temperature for 32 field measurements made with a Schultheis rapid reading thermometer was 29.8 C. Both the mean air temperature one foot above the ground (22.3 C) and the mean substrate temperature (24.5 C), taken at site of capture, were significantly lower than the mean cloacal temperature. Six thermocouples were used to record temperatures in six selected sites in the Rorris Basin. A mean afternoon temperature of 31.8 C was recorded by a thermocouple on a basking rock in the Rorris Geyser Basin, which closely approximates the mean cloacal temperatures of the lizards. Population estimates were made by the use of marked lizards in the three study areas at Rorris. The highest estimate obtained was 120 lizards in Area 1. In 1964 the young-of-the-year were first seen on August 15th and in 1965 they were first seen on August 12th.

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by

GEORGE ALLEN ALGARD

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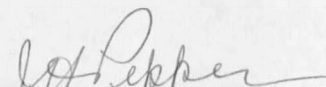
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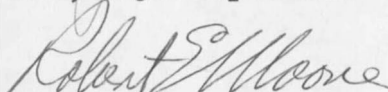
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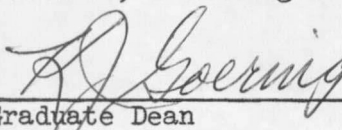
in

Zoology

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Bozeman, Montana

March, 1968

ACKNOWLEDGMENTS

To the following, the author wishes to extend sincere appreciation for their contributions to this study: Dr. Robert E. Moore, Montana State University, for field assistance and guidance in the preparation of the manuscript; Mr. John Good and Mr. Bryan Harry, National Park Service, for cooperation and specimen collection privileges granted in Yellowstone National Park; Mr. Charles Mueller and Mr. Britt Lewis, for field assistance and encouragement; Zoology and Entomology Department, Montana State University, for supplies and use of equipment. During the study, the author was employed by the National Park Service as a naturalist.

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ABSTRACT

A study was conducted during the summers and the winter of 1964 and 1965 to determine the distribution of Sceloporus graciosus graciosus in Yellowstone National Park and to determine temperatures and selected population characteristics of the lizards in three study areas in the Norris Geyser Basin. The main lizard populations were found in the Norris, Shoshone and Heart Lake Geyser Basins. Small populations and scattered individuals were found in Black Sand Basin, a thermal area along the road to Mary Lake, a small thermal area near Mary Lake and the Artist Paint Pot area. Only one lizard population was found in a non-thermal area, that being within the town of Gardiner, Montana. No lizards were found at Mammoth, although they had previously been reported there. The largest male and female measured (snout-vent length) were 54 and 58 mm respectively, while the young-of-the-year averaged about 26 mm. Three age classes were recognized on the basis of snout-vent length; young-of-the-year, juveniles and adults. Data indicate that the lizards in the Norris Geyser Basin exhibit growth at least through their third summer of life. The mean cloacal temperature for 32 field measurements made with a Schultheis rapid reading thermometer was 29.8 C. Both the mean air temperature one foot above the ground (22.3 C) and the mean substrate temperature (24.5 C) taken at site of capture, were significantly lower than the mean cloacal temperature. Six thermocouples were used to record temperatures in six selected sites in the Norris Basin. A mean afternoon temperature of 31.8 C was recorded by a thermocouple on a basking rock in the Norris Geyser Basin, which closely approximates the mean cloacal temperatures of the lizards. Population estimates were made by the use of marked lizards in the three study areas at Norris. The highest estimate obtained was 120 lizards in Area 1. In 1964 the young-of-the-year were first seen on August 15th and in 1965 they were first seen on August 12th.

INTRODUCTION

The distribution of the sagebrush lizard (Sceloporus graciosus graciosus Baird and Girard) includes parts of 11 states primarily in the Great Basin area of the United States (Stebbins, 1954). Within these states sagebrush lizards may be found in elevations varying from 4,500 to 10,000 feet where they commonly inhabit piñon-juniper zones, sagebrush zones and even sparse coniferous forests which allow sufficient light penetration. They are found in and around rocks, piles of brush, logs and debris, and low-growing shrubs in these areas.

The earliest reference to the sagebrush lizard in Yellowstone National Park was made by Yarrow (1883). Since that time there have been numerous reports of lizard sightings made by park rangers and recorded in museum records, which are located in the Yellowstone National Park Library in Mammoth. Sightings have been recorded for Old Faithful in 1926, Black Sand Basin in 1929, Mammoth in 1930, and Norris in 1951, 1954, 1964 and 1965. Several sources describe the lizard and some of its activities (Yeager, 1926, 1929; Beal, 1951; Turner, 1955). These references, when viewed in perspective, indicate several important things: all the lizard sightings were made in or near areas of thermal activity, the lizard populations seem to be discontinuous, and the lizards are no longer found in some of the areas in which they were originally reported.

The objectives of the present study were to first, determine the distribution of the sagebrush lizard in Yellowstone National Park, second, determine the size and relative isolation of adjacent but partially isolated lizard populations in the Norris Geyser Basin, and third, record

snout-vent lengths and environmental and cloacal temperatures of the lizards. The study was conducted during the summers of 1964 and 1965, and some field observations were conducted in the winter of 1964-65 in Yellowstone National Park, Wyoming.

METHODS

During both summers of the study visits were conducted to areas where Sceloporus had been reported and to areas in which their presence was probable. Due to the limited amount of time and the inaccessibility of some of the areas, some lizard populations may have been missed, but all the most likely areas, both thermal and non-thermal, were checked.

Warm, sunny days were chosen whenever possible in checking the areas for the presence of lizards. The possibility of over-looking lizards which may have been under cover due to cool temperatures was diminished in this way.

A population study was conducted in three adjacent but partially isolated areas in the Norris Geyser Basin both summers, with most of the study time being allotted to this area. Only a qualitative assessment of the vegetation in the areas was made. All plant names were taken from Booth (1950) and from Booth and Wright (1966). All statistical analyses used in the paper were taken from Li (1964).

It was early found that the most practical way of capturing the lizards in the Norris area was by hand. Because of the terrain and the speed and agility of the lizards, especially on warm days, two people could accomplish the task much more efficiently than could one. When the lizards were captured, their cloacal temperatures were immediately taken with a Schultheis rapid-reading cloacal thermometer. The air temperature was taken at the same time about one foot above the ground with the thermometer shaded, and the temperature of the ground or rock on which the lizard had initially been seen was also taken. Snouth-vent lengths were taken at this time, and

the lizard was classified as an adult male or female, juvenile male or female (about one year old), or as a young-of-the-year (not seen until about the middle of August). The lizards were marked on the dorsal side with a dab of brightly colored Testors model paint so they could be easily spotted in subsequent population estimate counts. Estimates of population sizes were determined by use of the Lincoln Index method, (Dasmann and Taber, 1955). Different colors of paint were used in the three areas so that if any migration occurred between the populations it could readily be determined. The first marking period each year was in June, followed by several subsequent periods in July and August. A different color of paint was used for each marking period. In this way the marking periods could be separated, and also it could be estimated about how long the paint remained on the lizards.

In one of the areas a recording potentiometer was used during the second summer of the study to record selected environmental temperatures. A small a-c generator provided power for the operation of the potentiometer. Six leads of 16 gauge, iron-constantan thermocouple wire were run from the potentiometer to six sites selected for temperature measurement. To insure that the ends of the thermocouple wires would not become corroded and give false readings they were coated with epoxy resin. The thermocouple sensing elements were 3-4 mm in diameter and were an opaque white in color due to the epoxy resin coating. The distribution of the leads and the temperatures recorded were as follows:

Siliceous sinter area

Thermocouple 1 - ground temperature

Common juniper (Juniperus communis) and lodgepole pine (Pinus contorta) basin area

Thermocouple 2 - air temperature

Thermocouple 3 - ground temperature

Easterly exposed rhyolite hillside

Thermocouple 4 - air temperature

Thermocouple 5 - rock surface temperature

Thermocouple 6 - ground temperature under a rock

Thermocouple 1 was covered with several mm of siliceous sinter so that it would not be in the direct rays of the sun. Thermocouples 2, 3, 4 and 6 were shaded so that temperatures recorded would not be in direct sunlight. Thermocouple 5 was placed on a rock in direct sunlight, because lizards were often observed sunning themselves on this rock. All air temperatures taken were recorded at approximately one foot above the ground. No really satisfactory method was developed for obtaining rock surface temperatures. Geiger (1957) showed that surface temperatures taken with a mercury thermometer are not completely accurate. Not enough of the thermocouple sensing element could be placed in contact with the rock surface, and probably all readings were somewhat low. However, all rock temperatures were taken in the same manner, so at least the error should be relatively the same. The potentiometer was used daily whenever possible and temperatures were recorded for a 15-minute period

for each of the six locations. In conjunction with this a maximum-minimum thermometer was used to record daily air temperature extremes in the area.

DISTRIBUTION OF THE SAGEBRUSH LIZARD IN YELLOWSTONE PARK

The distribution of the sagebrush lizard in Yellowstone National Park is seemingly limited to areas of thermal activity (Figure 1). The fact that an area has thermal features does not mean that it supports lizards, however. Those areas which do not have sufficient cover in the form of trees, shrubs, logs and rocks apparently do not have lizard populations present.

The Norris Geyser Basin (elevation 7,524 feet), Shoshone Geyser Basin (7,800 feet), and Heart Lake Geyser Basin (7,600 feet) appear to support the largest lizard populations, and all these areas are similar in appearance. All have rhyolite boulder-covered hillsides on which common juniper and stands of lodgepole pine trees are present in varying amounts (Figure 2).

Black Sand Basin, a thermal area along the road to Mary Lake, a small thermal area near Mary Lake, and the Artist Paint Pot areas support some lizards, but they do not appear to be as abundant there as in the aforementioned areas. The Artist Paint Pot area supported some lizards in 1964, but none were found there in 1965. It was felt that the area was, in general, wetter in 1965 than it had been in 1964 due to the presence of several new cold water springs. As a result of these springs the ground was damp, and the area in which the lizards had been found in 1964 had been changed from a dry area to one which was wet and supported a heavy growth of mat-like mosses. The population in the Black Sand Basin had apparently decreased since they were initially reported in the area in 1929. The largest number of lizards the author ever saw in a

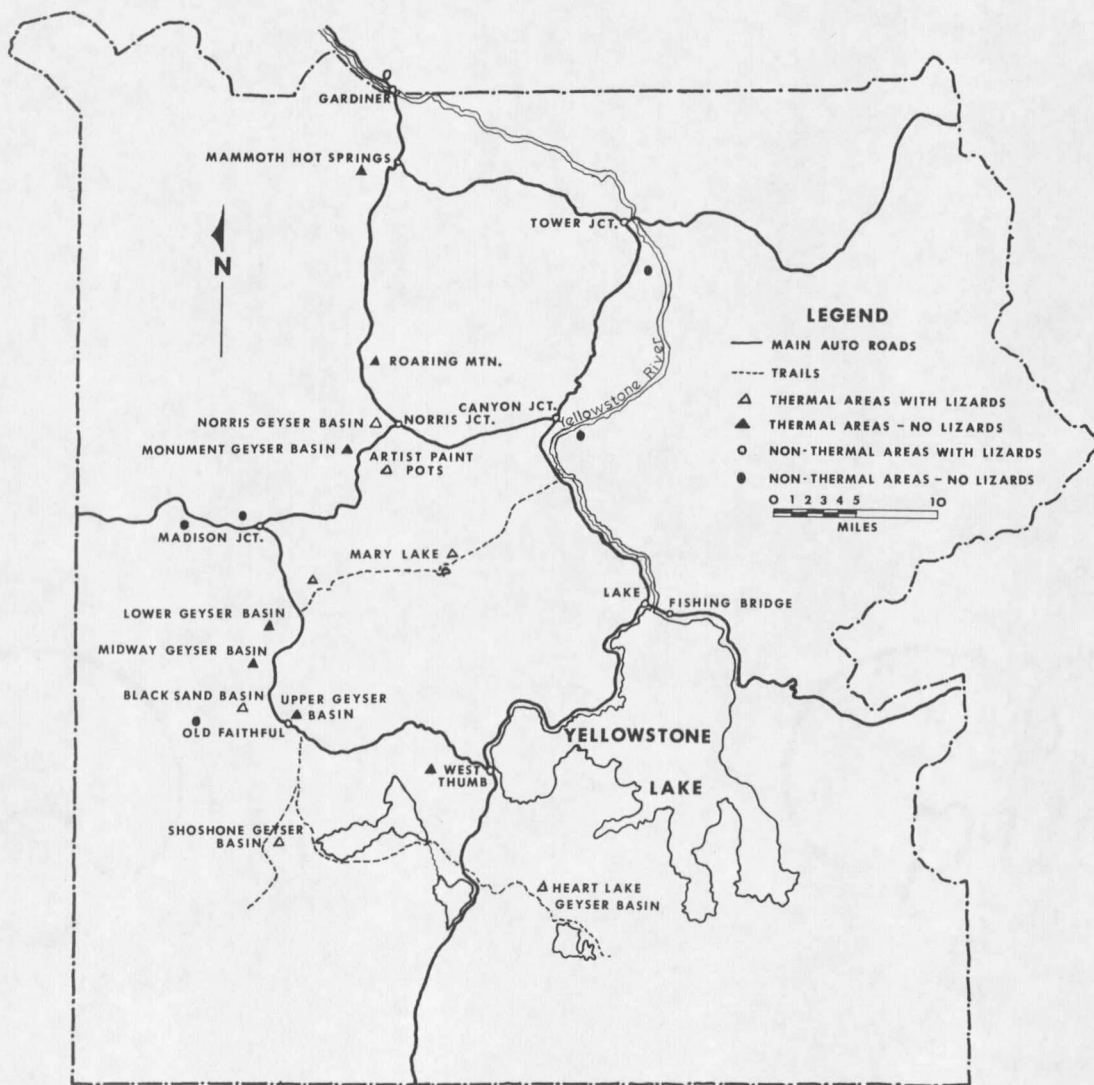


Figure 1. Map of the distribution of *Sceloporus graciosus* in Yellowstone Park.

