

Behavior of Captive Allegheny Woodrats (*Neotoma magister*) in Virginia

Michael T. Mengak

Daniel B. Warnell School of Forest Resources
University of Georgia
Athens, Georgia 30602-2152

Andrew K. Zadnik¹

Life Science Division
Ferrum College
Ferrum, Virginia 24088

ABSTRACT

We studied two captive Allegheny Woodrats in order to observe their typical nocturnal habits and mating behavior. They spent most of their time (63%) resting and sleeping. The next greatest amount of time was spent exploring and grooming (10.3%), followed by feeding (9.6%) and, finally, defecating (1.5%). Their mating habits include sexual chases, boxing, and multiple matings over a short period of time. The pair mated many times without the female necessarily becoming pregnant.

Key words: Allegheny Woodrat, mating behavior, *Neotoma magister*, time budget.

INTRODUCTION

The social behavior of Allegheny Woodrats (*Neotoma magister*) has been studied in some depth as it pertains to hierarchical organization and population density. Kinsey (1976) studied various-sized groups of captive woodrats and recorded the type of organization, including individual social rank and the resulting behaviors, including agonistic interactions, injuries, and deaths. Kinsey (1977) also studied agonistic and male-female social status in captive breeding colonies. Newcombe (1933) and Poole (1940) discussed social behavior in wild populations and concluded that they are usually rather solitary animals and often quarrel with conspecifics. Fitch & Rainey (1956) noted that Eastern Woodrats (*N. floridana*) are somewhat territorial, defending their house and surrounding area from all intruders. However, none of these studies has really described what individual, solitary woodrats do

on a nightly basis.

Furthermore, few of these studies have described the courtship and mating habits of *N. magister* in detail. Kinsey (1976) provided some information, describing ritualized battles, as did Poole (1940), but both studies are missing a few aspects of this very interesting behavior. Our study attempted to fill in some of the gaps. We describe, in detail, the courtship and mating habits of one pair.

METHODS

Two Allegheny Woodrats, a male and female, were kept in a cage constructed of wood and hardware cloth, measuring 0.58 x 0.58 x 2.43 m. The cage was placed in a secure room in the Environmental Science Building, Ferrum College, Ferrum, Virginia. It was divided in half with a piece of plexiglass to keep the animals separated. Each rat was provided with bricks for cover, numerous sticks of various sizes, and nesting material such as hay, flax, and wool. They were fed a combination of rat chow, apples, and bananas, and

¹Present address: Virginia Department of Game and Inland Fisheries, 4010 West Broad Street, Richmond, Virginia 23230

provided water *ad libitum*. The lights were set on a timer with a 12L:12D cycle.

The two woodrats were observed at least once a week at night for up to two hours. The first few times they were observed under a dim red light but we later switched to using a pair of night vision goggles. Zervanos & Davis (1968) found that Allegheny Woodrats perceive red light like white light and reduce their activity. We recorded the activities of each woodrat while they were separated and then removed the divider, allowing them to interact. After they stopped showing much activity, we replaced the divider. We used a stopwatch to record the length of time that each rat engaged in specific behaviors. They were inactive most of the time. Data were recorded as minutes or fractions of minutes (to the nearest 15 seconds) that each individual engaged in an activity.

After the woodrats mated, we kept them separated in an attempt to accurately measure the length of gestation. We also monitored the female's weight after mating by trapping her in the cage about twice weekly.

When observed under a red light, woodrats normally showed little activity, especially the female. She just poked her head out from under the bricks, looked straight at the observer, and retreated back to the brick pile while thumping her feet in alarm. The male sometimes left his nest and explored a little, but this never continued for long. It seemed obvious that they could detect red light just as well as white light. When a pair of night vision goggles became available early in our study, our observations of the animals improved. The woodrats could still detect us watching them, but they seemed to go about their activity relatively undisturbed.

RESULTS

We observed the pair for a total of approximately 30 hours over 10 weeks. With the woodrats separated, we recorded their apparently typical nocturnal activities. These included grooming, exploring, feeding, and defecating. While the female spent most of her time under her bricks and basically out of view, the male constructed his nest alongside his bricks. Since he was much easier to watch and generally more active, most of our observations relate to quantifying his behavior. Based on our observations, we believe that the female's activities are generally similar to those exhibited by the male.

The male spent 68.4% of his time sleeping or resting in his nest. He spent the next greatest amount of time (10.3%) grooming and exploring. His grooming was typical of small mammals. He started by licking his front paws and rubbing his face and whiskers. Next, he

licked the rest of his body and legs. Often, he scratched himself using his hind legs. He also turned around and groomed his tail. He normally performed all of these behaviors before and after sleeping, as well as before and after feeding. This sequence usually lasted up to 10 minutes at a time and is obvious evidence as to the cleanliness of these animals.

While exploring his half of the enclosure, the male walked around its perimeter, often stopping to smell and look around (usually at the observer – AKZ). He also rearranged the sticks that had been placed in the cage. He cut them into manageable sizes and lifted them with his mouth while using his teeth for grip. The sticks were then placed around the nest, forming a type of barricade. The female also did this, a typical behavior of woodrats. Poole (1940) and Fitch & Rainey (1956) described how the passages to woodrat nests are frequently blocked by an assortment of sticks, stones, leaves, and other materials. This is consistent with our observations of wild Allegheny Woodrats that generally have a collection of leaves and sticks near the entrance to the crevice. We suggest that movement of this debris serves to alert the resident woodrat. Poole (1940) also noted that another miscellaneous pile of objects was stored next to the nest. Also, during his explorations around the cage, the male collected any of the softer materials placed there and added them to his nest.

The male was observed feeding about 9.6% of the time. He typically left his nest, grabbed a piece of apple with his front paws and began feeding. While feeding on a food pellet, he held it with his front paws and sat back on his hind legs. This feeding posture has been described previously (Newcombe 1933; Poole 1940). Feeding normally occurred away from his nest, although a few times the male carried food back to the nest with his teeth. Each feeding event normally lasted about 2-4 minutes.

The male defecated about 1.5% of the time. As is typical of woodrats, he created scat piles, which were used on a regular basis; in his case he normally used one corner of his cage. Poole (1940) also observed this very sanitary behavior of woodrats. We observed the male moving some of his scat farther into the corner, tucking it under the hardware cloth that lined the inside of the cage. We believe he also may have eaten some of his scat. This also was observed in one case by Poole (1940) but has not been reported elsewhere. Further study of captive woodrats would be necessary to determine the prevalence of this behavior. It may be restricted to an individual or an artifact of confinement.

The first several times we removed the divider, the rats stayed in their own nests as if they were not really sure how to behave. Generally, they remained inactive for almost an hour before approaching each other,

sniffing and with whiskers twitching rapidly. Then the male groomed his face and began to follow the female, all the while making what Kinsey (1976) described as a "low-pitched raspy sound, similar to heavy breathing." If he got too close to the female, often backing her into a corner, she squeaked loudly, seemingly distressed. The female also made a whimpering-like sound on occasion. At some point during these chases the two woodrats faced each other, stood on their hind feet while supporting themselves with their tails, and boxed, kicked, and scratched with their front feet. These behaviors have also been observed by Poole (1940) and Kinsey (1976). These matches lasted a few seconds and were repeated a few times throughout the observation period. The male was not observed scent marking, although this behavior has been described by Poole (1940) and Kinsey (1976) for *N. magister* and by Howe (1977) for several western species of *Neotoma*.

On the third night of observation, it only took about 15 minutes for activity to begin. The two animals began chasing each other; usually, the male chased the female. The male was continuously making the low-pitched raspy sound. They boxed several times throughout the chase and then finally mated. The male mounted the female, made a few rapid pelvic thrusts, and then stayed on her but did not grasp her with his paws. A few times the female dragged him for a short distance. Howell (1926) described how this dragging behavior was possible because the penis of the woodrat is equipped with recurved spines which expand in the vagina allowing the lock to be maintained. Copulation and dragging lasted up to 25 seconds. Kinsey (1976) reported that this behavior often lasted up to 90 seconds. During this time, we observed the two woodrats grooming themselves, the female even turning around to groom her genital region.

After mating was completed, the woodrats went to different areas of the cage and continued to groom themselves, especially around their face and genitals. Then they chased each other and boxed a little more, and then mated again, going through all the same actions. This sequence was repeated as often as 10 times in one half-hour interval. In a few of the resting and grooming periods between copulations, both woodrats laid on their stomachs with their legs extended. This can best be described by comparing them to what museum study skins look like. This prostrate behavior lasted from 10-20 seconds.

We began weighing the female at twelve days post-mating. Her initial weight increased steadily from 339.1 g on Day 12 to 362.5 g on Day 18. Her highest weight was 369.1 g on Day 28. However, her weight leveled out and even decreased slightly by Day 32. On

Day 34, the female brought considerable nesting material inside her bricks. Poole (1940) noted that the length of gestation for Allegheny Woodrats was between 30 and 36 days, but by Day 39 the female still had not given birth. Mengak (2002) reported that newborn Allegheny Woodrats weigh 18 g, with an average litter size of 2.3 in the wild. Poole (1940) reported birth weights of 15-17 g, so the weight gain we observed was consistent with a normal pregnancy.

Although it is possible the female was never pregnant, something may have occurred during her pregnancy to cause her to abort. We did not observe any evidence of parturition. Her final weight did not decline to her initial weight. Perhaps the weight gain was just a natural part of her maturation cycle. Our study took place in March and April. Rainey (1956) found that Eastern Woodrats (*N. floridana*) are normally their heaviest in late February or March.

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