



CAPTIVE PROPAGATION OF ALLEGHENY WOODRATS



Male woodrat emerging from nest box, spinning wheel in foreground.

Current Status

Second year of a three-year project

Funding Sources and Partners

DNR Division of Fish and Wildlife, Diversity Section;
and Purdue University

Project Personnel

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Research Technicians:

Savanna Niec, Captive woodrat husbandry,
January 2009–present

Jessica Rodkey, Captive woodrat husbandry,
November 2010–present

Brandon Haslick, Live-trapping population monitoring,
August–October 2009

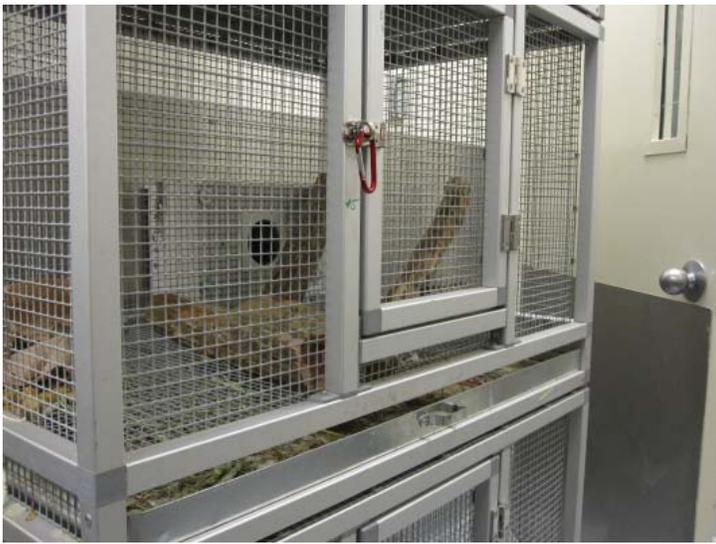
Jennifer Hoffman, Collection of woodrats from
Pennsylvania, October 2009

Kristen Bahleda, Captive woodrat husbandry,
October 2009–May 2010

Background and Objective(s)

Allegheny woodrats (*Neotoma magister*) are a species of conservation concern throughout their range with population declines attributed to habitat fragmentation, loss of hard-mast resources, mortality as a result of infection by raccoon roundworm (*Baylisascaris procyonis*), and loss of genetic diversity and inbreeding depression.

Recently, extensive management efforts have been taken through a partnership between Purdue University and the Indiana Department of Natural Resources to address some of these concerns for woodrat populations in Indiana. During the last four years, we have distributed



Close-up view of an enclosure in which the external nest box is visible in the back right corner and portions of the woodrats' "concealed" cache is visible in the back left corner.

medicated baits throughout woodrat habitats to passively deworm resident raccoons, thereby reducing or eliminating the threat of raccoon roundworm infection. Additionally, woodrat translocations were conducted in 2007 and 2008 in which individuals were captured from genetically diverse populations in Kentucky and Tennessee and released into suitable habitats in Indiana. Woodrats were either released into (1) previously occupied but currently vacant habitats to reestablish populations (reintroduction) or (2) genetically and numerically depressed populations (supplementation) to improve levels of genetic diversity and the likelihood of maintaining a viable population.

While these efforts did improve levels of genetic diversity in supplemented populations, spatial isolation of woodrat populations from one another continues to threaten the genetic vigor, and ultimately, long-term persistence of the species throughout the state. To address these concerns, a captive breeding program for Allegheny woodrats was established to:

- 1) Facilitate the retention of existing genetic diversity within core populations as well as that which was introduced into Indiana through recent translocation efforts.
- 2) Restore levels of genetic diversity among wild populations. Specifically, we will use optimized mate pairings among Indiana woodrats and individuals collected from other states to produce genetically diverse offspring. In a manner that simulates natural mechanisms for gene flow, woodrats produced in captivity will be returned to wild populations. Subsequent breeding of captively raised individuals with members of the wild populations will restore healthy levels of genetic diversity and provide for the long-term persistence of woodrat populations.



Tower of enclosures in which the male is in the middle position with potential female mates above and below.

Methods

Nine individuals (two males and seven females) were collected from Indiana in 2009 and six individuals (two males and four females) were collected in 2010. Additionally, four woodrats (three males and one female) were collected from genetically diverse populations in southwestern Pennsylvania in 2009.

Captive woodrats are housed independently in wire mesh enclosures (3 feet×2 feet×2 feet) with an external nest box (9 inches ×9 inches ×9 inches). Woodrats are fed daily with a mixed diet of lettuce, frozen mixed vegetables, a seed mix, acorns, mealworms gut-loaded with a high calcium diet, and rodent block. Water and timothy hay are provided ad lib.

Male and female enclosures are joined with wire mesh tubes (referred to as 'howdy tubes' or 'howdy doors'). A female has unrestricted access to the tube system but not the male's enclosures. This allows her to initiate interactions with the male at the entrance to his enclosure. When interactions indicate the female is sexually receptive, under the supervision of managers, a wire grate is lifted, allowing the woodrats to mate. After females give birth, they are housed with their pups until the pups reach independence at about 65 days old.

After weaning, juveniles are released into suitable



Daily provision of rodent block, acorns, mixed seeds, lettuce, mixed vegetables, and mealworms, along with water ad lib. Timothy hay disbursed throughout the enclosure provides a valuable source of fiber and nesting material. Eastern red cedar also provides nesting material and physical structure, and a spinning wheel (left, foreground) provides an opportunity for exercise.



Dependent juvenile begins to move throughout enclosure.



Breeding female returns to enclosure from howdy tube. Food cache is concealed under paper towels on left side of image.



Independent juvenile in holding box, in transport for release.

woodrat den sites within occupied habitat. At the time of release, each juvenile is provided about 1 pound of acorns and 1 pound of rodent block to ease the transition from captivity to the wild. Immediately before release, candidate den sites are trapped to ensure juveniles are released into vacant den sites. Identical methods are used to return adult woodrats that are leaving the captive population back into the wild.

Progress to Date

After the collection period and temporary housing at the Bloomington DNR office, woodrats were transferred to Purdue's Wildlife Animal Care Facility (WACF) in October 2009. All physical infrastructure used in the program was modeled after those used in Disney Animal Kingdom's Key Largo woodrat captive breeding program. In December 2009, woodrats were moved from the WACF to Biomedical Engineering's Potter Facility where we initi-

ated pairing activities in February 2010. Between early February and mid-June 2010, six of the eight females were bred by three different males, giving birth to a total of 15 pups. Of these pups, 14 were successfully weaned and eight were released between June and August 2010. The remaining six juveniles originated from a late-season litter and were retained in the captive program for release in spring 2011. After two deaths from the founding population, five adults were returned to the wild and the remaining six were retained.

In summer 2010, the woodrats were returned to the larger WACF which will allow for continued growth in the captive population. In the second year of breeding (August through December 2010), three of the females retained from the initial founding population have been bred, all of which have given birth. With the release of five founders, six adults collected across various populations in Indiana were added to the breeding population in fall 2010. These individuals are currently acclimating to the captive environment and are being observed for signs of sexual receptivity.

Challenges Encountered

We have encountered a number of challenges associated with the captive maintenance of Allegheny woodrats; however, we have learned through each of these experiences, improving accordingly the quality of care we provide to the captive woodrats. Specifically, the first male collected from Indiana in 2009 manifested a fatal intestinal intussusception. Consumption of polyfil, which had been introduced into the woodrat enclosure for nesting material and enrichment, may have contributed to the intussusception. We have since transitioned to alternative nesting materials that consist of aspen shavings, timothy hay, paper towels, and bark stripped from Eastern red cedar, a natural nest material used by woodrats in Indiana.

Additionally, during the initial transfer of woodrats from the Bloomington DNR office to Purdue, a male collected from Pennsylvania was injured in a trap-related incident. Radiographs taken at the Purdue Small Animal Veterinarian Teaching Hospital revealed that the woodrat suffered a complete fracture of the roof of his nasal sinus, resulting in a misalignment and overgrowth of his upper and lower

incisor teeth. Because this woodrat would require continued veterinarian care throughout his life to maintain a healthy tooth length, which was beyond our capacity, he was transferred to the Brookfield Zoo in Chicago in January 2010. Initial exams by its team of veterinarians were favorable, and Brookfield continued to provide the tooth maintenance the injured woodrat required for survival. After a quarantine period, this woodrat was placed on display at the Brookfield Zoo, providing an opportunity for the public to view this rare species while learning about factors that threaten the species throughout its range. Unfortunately, this individual died in July 2010 while still on display at the zoo.

Finally, a male collected from Indiana in September 2010 manifested similar symptoms to those observed in the male that encountered snout trauma while in captivity. Partners at the Purdue Small Animal Veterinarian Teaching Hospital determined this woodrat had significant issues associated with his incisors as a result of injuries suffered in the wild. These injuries certainly would have been fatal if the woodrat had remained in the wild, although this individual has adapted well to the captive environment. To date, this male has survived one surgery and is recovering well. Because additional surgeries will be required for this individual's long-term well being, he will never be returned to the wild but has the potential to contribute greatly to the captive population.



Savanna Niec (Purdue) releasing captive-reared juvenile into unoccupied den site.