

Final Report

Submitter:

Dr. Robert Harrison

Examiner:

Brad Swanson Ph.D
Cynthia Maddox M.S.

Agency:

Department of Biology
University of New Mexico

Purpose: Diet analysis from bobcat scat samples

Date: 2/26/07

Procedures conducted:

Species identification from hair, bones, and teeth cleaned from dried scat samples. Total number of samples cleaned and examined was 60.

Methods:

Scat sample were removed from bags and dissected using forceps. All bone fragments, teeth, beaks and feather materials were removed. As scat samples were being dissected distinct hairs were distinguished and removed to provide a representative sample of hairs from the scat. All contents of each scat sample were placed in labeled Petri dishes.

Species determination of hairs removed from scat samples was conducted via light microscopy. Selected guard hairs were used to create cuticular scale pattern impressions using clear nail polish and a standard microscope slide. Prior to making slides of hairs the Petri dish was examined under a dissecting scope (10X-63X) and 40X power of the light microscope to locate hairs with intact medulla. If hair with an intact and distinguishable medulla was located a slide was made from that hair or hair type if multiple hairs were present. The cuticular scale pattern and the medulla pattern of hair were examined under a light microscope. The cuticular scale patterns, medulla patterns, and a combination of general characteristics (i.e. length, color, banding) were used to identify source species of the hair. References for hair identification included actual hairs from museum specimen and "Identification of the Dorsal Guard Hairs of some Mammals of Wyoming" (Moore et al. 1974). Pictures of hair were taken using a camera mount on a light microscope.

Individual teeth and partial jawbones with teeth removed from scats were examined and compared to museum specimens to identify source species. Pictures were taken using a dissecting scope (10X-63X) with a camera mount and teeth/jawbones were set in putty to facilitate picture taking.

Results:

A total of nine species of prey were identified from the 60 bobcat scat samples cleaned and examined (Table 1). Additionally four samples were identified to the genus level, three samples contained feathers or feather shafts (sample 4, 36, 42) that could not be used to identify the species, and one sample contained lizard skin likely from horned lizard (*Phrynosoma*). Eighteen of the samples examined did not have any identifiable contents. Figures 1-7 show specimens found in the scat samples. We were unable to identify teeth found in two of the scat samples (sample 19, 76). The molar patterns or teeth type did not match the museum specimens (Figure 8).

Table 1. Summary of Prey items identified from bobcat scat and the sample where the specimen was found.

Scientific Name	Common Name	Specimen	Sample No.
<i>Ammospermophilus intepres</i>	Antelope squirrel	Hair	3, 4
<i>Callipepla gambelii</i>	Gambel's quail	Beak, hollow bones, feather shafts	18
<i>Chaetopipus penicillatus</i>	Desert pocket mouse	Hair	39, 42
<i>Dipodomys spp.</i>	Ord's or Merriam's Kangaroo Rat	Teeth	42, 59, 76
<i>Dipodomys spp.</i>	Ord's or Merriam's Kangaroo Rat	Hair	59, 76
<i>Lepus californicus</i>	Black-tailed jackrabbit	Teeth	73*, 82
<i>Neotoma albigula</i>	White-throated woodrat	Teeth	12, 25, 63
<i>Peromyscus eremicus</i>	Cactus mouse	Teeth	42
<i>Phrynosoma</i>	Horned lizard	Skin	36
<i>Sigmodon hispidus</i>	Hispid cotton rat	Teeth	26, 76
<i>Spermophilus variegates</i>	Rock squirrel	Teeth and Hair	37
<i>Sylvilagus aububonii</i>	Desert cottontail rabbit	Teeth	13, 24, 56, 62, 65, 67,
<i>Sylvilagus aububonii</i>	Desert cottontail rabbit	Hair	6, 20, 21, 44, 66, 68, 70, 78,
<i>Sylvilagus aububonii</i>	Desert cottontail rabbit	Teeth and Hair	30, 33, 43, 46, 47, 57, 58, 60, 71, 74, 72, 79
<i>Sigmodon fluviventer</i> ^ψ	Tawny-bellied cotton rat	Teeth	83

*Teeth identified as *L. californicus* were based on size and could potentially come from large *S. audubonii*.

^ψTeeth specimen have characteristic 'S' pattern of *Sigmodon spp.* but did not exactly match the museum samples of *S. hispidus* or *S. minimus*, therefore they were called *S. fluviventer* although not verified against a museum specimen.

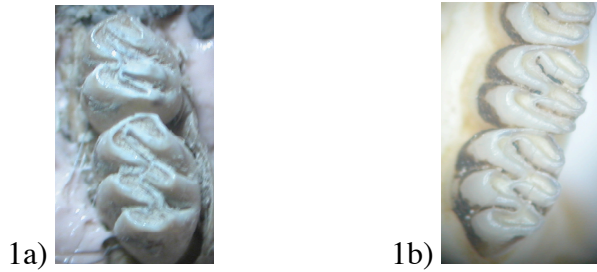


Figure 1. Occlusal surface of the upper left jaw (anterior down, lingual right) of *Sigmodon hispidus* from scat sample # 76 (1a, 10X magnification) and from a museum specimen (1b, 10X magnification).

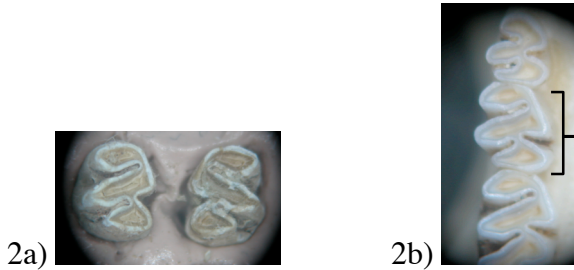


Figure 2. Occlusal surface of the upper left and right second molars of *Neotoma albigula* from scat sample # 76 (2a, 15X magnification) and the surface of the upper left jaw (anterior down, lingual right) from a museum specimen (2b, 10X magnification). The bracket highlights the second molar in the museum specimen.

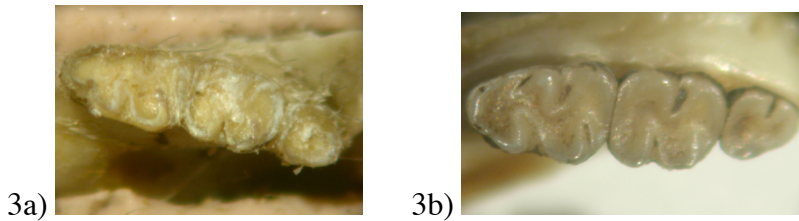
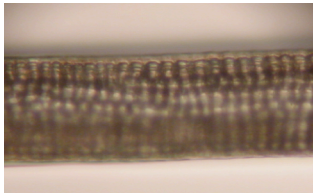


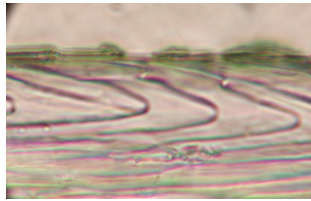
Figure 3. Occlusal surface of the lower right jaw (anterior left, lingual down) of *Peromyscus eremicus* from scat sample # 42 (3a, 35X magnification) and from a museum specimen (3b, 35X magnification).



Figure 4. The occlusal surface of the lower right jaw (anterior up, lingual right) of *Dipodomys spp.* from scat sample # 59 (18X magnification).

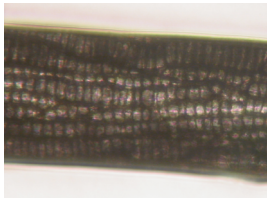


5a)



5b)

Figure 5. Medulla pattern (5a, 100x magnification) and cuticular scale impression (5b, 400x magnification) from unknown hair in Sample #6 identified as desert cottontail rabbit.

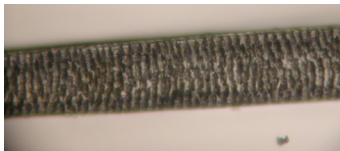


6a)

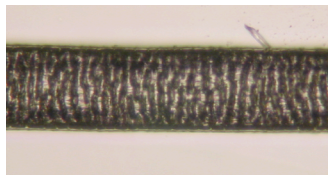


6b)

Figure 6. Medulla pattern (6a, 100x magnification) from eastern cottontail rabbit and scanned image of the cuticular scale impression (6b) of desert cottontail rabbit (Moore et al. 1974)



7a)



7b)

Figure 7. Medulla pattern (7a, 100x magnification) from *Chaetodipus penicillatus* hair found in scat #39 (7a, 100X magnification) and from a museum skin (7b, 100X magnification).



8a)



8b)

Figure 8. Occlusal surface of molars from an unknown species (8a, 20X magnification; 8b, 50X magnification).

Discussion:

The majority of scat samples cleaned were comprised of densely packed hair, but some had very small amounts of hair. The samples with very little hair also had few bone fragments. In most cases the bone fragments found in samples were not enough to identify the prey source, but provided a rough size estimate of the prey. However, bones and bone fragments were used to differentiate between bird and mammal prey, as bird bones are hollow. Species identification from teeth proved to be the easiest method to identify species. Identification of species from hair alone was difficult for two reasons, the poor hair medulla quality and broken hairs. Hair identification is much more difficult and time consuming as the medulla in many of the hairs was degraded or infiltrated, therefore no distinct pattern was discernable. This medullar degradation could be due to the hairs passing through the digestive track of the bobcat. The combination of age of the samples, very dry conditions, and exposure are likely the reason for the poor medulla structure. The broken hairs made it difficult to determine the exact length of the hair, an important characteristic for differentiation of some species.

The New Mexico bobcats diet consists of a variety of small mammal species, some birds, and potentially lizards. The dominant prey species identified in these bobcat scats was desert cottontail rabbit (*Sylvilagus audubonii*), which was found in 42.6% (26 of 60 samples) of the samples cleaned (Figure 8). The additional prey items were found much less frequently (1.6% - 4.9%). Of the rabbit teeth and hair identified two samples were classified as black-tailed jackrabbit (*Lepus californicus*), not cottontail because of the size of the teeth found, as there are no notable differences of teeth or hair patterns. The grooved incisor found in sample #73 measured 3-4mm wide and 19mm long and the upper incisor of jackrabbit museum skull measured 4mm wide and approximately (teeth still in jaw could not directly measure full length) 20mm long. The cottontail incisor measured 2mm wide and approximately 15mm long. The molar found in sample #82 was the first right lower molar and measured just over 4 mm wide. The size of the jackrabbit molar is 5mm and the cottontail molar is 3mm.

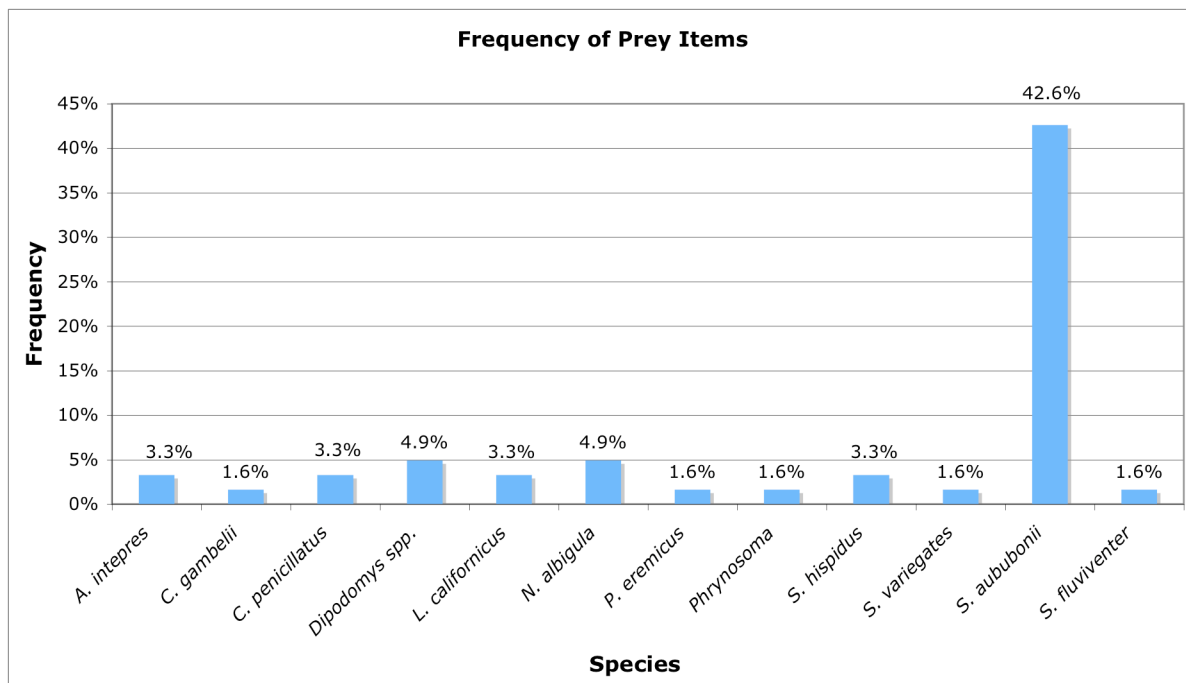


Figure 9. The frequency prey item occurrence in the scat samples examined (n=60).

Scat sample #82 along with sample #80 and #83 were labeled as questionable bobcat scat samples. The size and general composition of sample #82 was consistent with the remainder of the samples and was likely bobcat. Sample #80 and #83 were larger in diameter (approximately 1.0 cm) and there was more (longer) scat pieces. The prey species identified in sample #80 and #83 was *Lepus californicus* was identified in scat #82 so the scat could have come from a larger carnivore such as a cougar.

The majority of the teeth found were identified by comparison to the museum specimens, but teeth were found in two samples that we could not identify. The teeth that were found in sample #19 were extremely small, approximately 1mm in length, and had a unique pattern of cusps. The single molar found in sample #19 had a highly convoluted occlusal surface. The inability to identify by comparison could be due to the wear of the individual teeth, which would alter the surfaces making matching difficult.

Cost:

Item	Units	Cost	Total
Person-hours	105	\$50.00	\$5,250
Total			

Please make checks payable to:

Central Michigan University

Remit payment to:

Dr. Brad Swanson
Department of Biology
Central Michigan University
Mt. Pleasant, MI 48859
Tel. 989.774.3377
Fax. 989.774.3462
brad.swanson@cmich.edu

Dr. Brad Swanson
ATCG Laboratory Director
Brooks 190
Central Michigan University
Mt. Pleasant, MI 48859
Tel. 989.774.3377
Fax. 989.774.3462
brad.swanson@cmich.edu

Cynthia Maddox
ATCG Laboratory Manager
Brooks 228
Central Michigan University
Mt. Pleasant, MI 48859
Tel. 989.774.2388
Fax. 989.774.3462
maddolck@cmich.edu

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