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## **Prey Remains Found in Pellets of Mexican Spotted Owls (*Strix occidentalis lucida*) from Los Alamos, New Mexico**

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**Abstract:** From 48 pellets collected from three sites during 2005 nearly 20 taxonomically identifiable groups were recognized as prey of the Mexican spotted owl. The majority of prey items were from either woodrats (*Neotoma* spp.) or gophers (*Thomomys* spp.). Compared with other studies from the same site, we found that these new areas closely agree in prey species composition. Regional published studies determined that predominant prey species include the woodrats and peromyscid mice (*Peromyscus* spp.). Owls from the Los Alamos area perform generally in a similar way as other southwestern owls that have been studied, but, based on our prey analysis, are dependent upon open and semi-forested areas to secure a sufficient prey base.

### **Introduction**

The Mexican spotted owl (*Strix occidentalis lucida*) is found in northern Arizona, southeastern Utah, and southwestern Colorado south through New Mexico, west Texas, and into Mexico. It is the only subspecies of spotted owl recognized in New Mexico (USFWS 1995). The Mexican spotted owl generally inhabits mixed conifer and ponderosa pine-Gambel oak forests in mountains and canyons. High canopy closure, high stand diversity, multilayered canopy resulting from an uneven-aged stand, large mature trees, downed logs, snags, and stand decadence as indicated by the presence of mistletoe are characteristic of Mexican spotted owl habitat. Some spotted owls have been found in second-growth forests, i.e., younger forests that have been logged; however, these areas were found to contain characteristics typical of old-growth forests. No spotted owls were

found in forests less than 36 years of age (USFWS 1995). Mexican spotted owls in the Jemez Mountains seem to prefer cliff faces in canyons for their nest sites (Johnson and Johnson 1985). The recovery plan for the Mexican spotted owl recommends that mixed conifer and pine-oak woodland types on slopes greater than 40 percent be protected for the conservation of this owl (USFWS 1995). Although seasonal movements vary among owls, most adults remain within their summer home ranges throughout the year.

The subspecies of this owl was listed as federally threatened in 1993. With this listing federal agencies and forest managers have been obligated to understand the ecology of this owl. Most studies have been focused on nest and roost requirements, density estimates, and habitat preferences, but there has not been much research focus on prey selection or prey abundance (Block et al. 2005, Ganey et al. 1992). Food habits have been studied in the Mexican spotted owl in Mexico and Arizona (e.g., Ganey 1992; Young et al. 1997, USFWS 1995) as well as in other parts of its range. Although populations of Mexican spotted owls are of high interest to agency managers in New Mexico, few long-term efforts have been initiated. The Los Alamos National Laboratory (LANL) has had several studies of their owl populations that include annual presence/absence monitoring of all suitable habitat, nest location monitoring, and pellet collection to determine prey choice (Keller 2006).

In fall 2005, the Museum of Southwestern Biology at the University Of New Mexico was provided 46 owl pellets from known Mexican spotted owl roosts in the vicinity of LANL by biologist David C. Keller, Ecology and Air Quality Group. Material included both intact and fragmented pellets collected from three locations. The purpose of examining this material was to provide LANL ecologists identified prey remains from

pellets and then to return the processed material to LANL for further heavy metal or other contamination analysis of the remaining bone material at a later date.

### **Methods and Materials**

Each pellet was processed, studied, and identified individually. The method used for examining the dry pellets followed Zabel et al. (1995) and consisted of soaking pellets in warm water to break up the pellet matrix. Bone fragments and other materials were sorted for identification. Soaking time for each pellet varied depending on the compactness of the individual pellet. Materials were teased apart, sorted, dried, labeled, and stored in separate containers for closer analysis and identification.

### **Results**

An analysis of the identifiable bone material collected revealed the following 17 taxonomic groups of mammals and three more general classifications (see the Appendix). These included the following: *Lasionycteris noctivagans*, 1; *Sylvilagus* species, 6; *Spermophilus variegatus*, 1; *Thomomys bottae*, 13; *Thomomys talpoides*, 4; *Thomomys* species, 1; *Peromyscus boylii*, 5; *Peromyscus truei*, 5; *Peromyscus maniculatus*, 5; *Peromyscus nasutus*, 1; *Peromyscus* species, 3; *Onychomys leucogaster*, 1; *Neotoma albigula*, 1; *Neotoma cinerea*, 1; *Neotoma mexicana*, 16; *Neotoma* species, 5; *Microtus* species, 1; Medium mammal, 1; Large mammal, 1; and Unknown mammals, 2.

There were bones in three pellets that included bird (Class Aves) material, categorized as small, medium, and large. Also, numerous feathers were found and were identified as Western bluebird (*Sialis mexicana*). Insect remains were abundant in six pellets, and ants were identified as *Pogonomyrmex* from *Myrmicinae*. Two unidentifiable molar teeth set within a mandible or maxilla remained as “unknown” (M4L; Fig. 1).



Fig. 1:  
Unknown  
molars.

Not all identifications of material found in pellets were made from the dental arcade. Morphological differences of isolated elements or fragments were noted to be species specific in some cases. The individual bones that showed identifiable differences included the humerus, ulna, pelvic, femur, tibia, fibula, and calcanus. Figure 2 depicts

morphological differences between *Peromyscus maniculatus*, *Peromyscus truei*, and *Peromyscus boylii*.

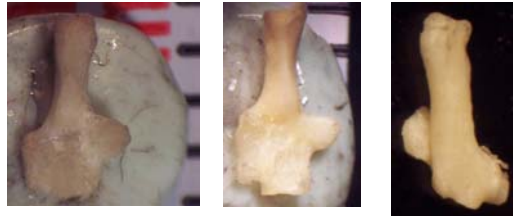


Fig. 2: Femurs from  
*P. maniculatus*, *P. truei*, and *P. boylii*

The numbers that fall under the unidentified category are from pellets that contained no identifiable bones.

**Discussion**

From analysis of 48 pellets from three sites at LANL (Figure 3; Table 1), we determined that owls caught and consumed a variety of mammalian species. Bats (*Lasionycteris noctivagans*) consumed by Mexican spotted owls are migratory, tree-roosting, insectivorous species that are abundant from June through September. Other mammals were small rabbits (*Sylvilagus*), medium-sized squirrels (*Spermophilus*), two species of gophers (*Thomomys*), at least six species of small mammals (*Peromyscus*, *Onychomys*, *Microtus*), and woodrats (*Neotoma*). Most of these species are common in open, clear forest habitat (meadows), secondary growth (fire recovering areas), or in edge (meadow, primary forest interface) sorts of habitat. These areas would be easily accessed by predatory birds operating at night.

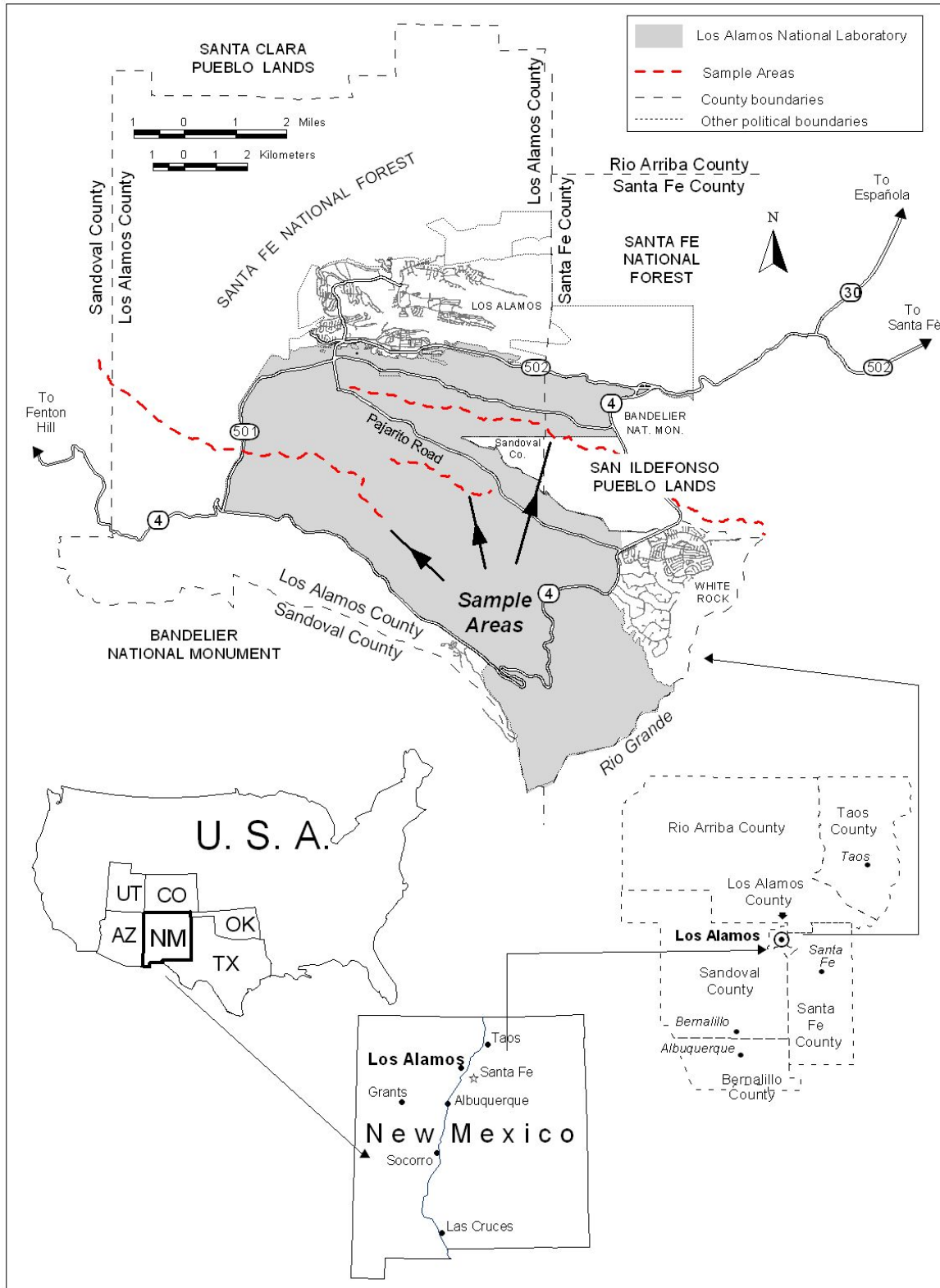


Figure 3: Owl pellet collection locations.

**Table 1: Results from Analysis of Owl Pellets**

| <b>Common Name</b>         | <b>Species Code</b> | <b>Mortandad Canyon</b> | <b>Three-mile Canyon</b> | <b>Cañon de Valle</b> | <b>TOTAL</b> | <b>Relative Abundance</b> |
|----------------------------|---------------------|-------------------------|--------------------------|-----------------------|--------------|---------------------------|
| Mexican Woodrat            | NEME                | 7                       | 8                        | 3                     | 18           | <b>20.93%</b>             |
| Botta's Pocket Gopher      | THBO                |                         | 11                       | 2                     | 13           | <b>15.12%</b>             |
| Deer Mouse                 | PEMA                | 3                       | 5                        |                       | 8            | <b>9.30%</b>              |
| Cottontail Rabbit          | SYSP                |                         | 6                        |                       | 6            | <b>6.98%</b>              |
| Insect                     | INSECT              | 4                       | 2                        |                       | 6            | <b>6.98%</b>              |
| Brush Mouse                | PEBO                | 1                       | 2                        | 2                     | 5            | <b>5.81%</b>              |
| Unknown Woodrat            | NESP                | 2                       | 1                        | 2                     | 5            | <b>5.81%</b>              |
| Northern Pocket Gopher     | THAT                | 1                       | 1                        | 1                     | 3            | <b>3.49%</b>              |
| Unknown Peromyscid Mice    | PESP                | 1                       | 2                        |                       | 3            | <b>3.49%</b>              |
| Piñon Mouse                | PETR                |                         | 2                        |                       | 2            | <b>2.33%</b>              |
| Unknown Large Mammal       | LMAM                | 1                       | 1                        |                       | 2            | <b>2.33%</b>              |
| Unknown Mammals            | UMAM                | 2                       |                          |                       | 2            | <b>2.33%</b>              |
| Rock Squirrel              | SPVA                |                         |                          | 2                     | 2            | <b>2.33%</b>              |
| Silver-haired Bat          | LANO                |                         |                          | 1                     | 1            | <b>1.16%</b>              |
| Pocket Gopher              | THSP                |                         |                          | 1                     | 1            | <b>1.16%</b>              |
| Northern Rock Mouse        | PENA                | 1                       |                          |                       | 1            | <b>1.16%</b>              |
| White-throated Woodrat     | NEAL                |                         |                          | 1                     | 1            | <b>1.16%</b>              |
| Bushy-tailed Woodrat       | NECI                | 1                       |                          |                       | 1            | <b>1.16%</b>              |
| Unknown Small Mammal       | SMAM                | 1                       |                          |                       | 1            | <b>1.16%</b>              |
| Unknown Medium Mammal      | MMAM                | 1                       |                          |                       | 1            | <b>1.16%</b>              |
| Unknown Small Bird         | SMAV                |                         | 1                        |                       | 1            | <b>1.16%</b>              |
| Unknown Medium Bird        | MDAV                |                         | 1                        |                       | 1            | <b>1.16%</b>              |
| Unknown Large Bird         | LGAV                |                         | 1                        |                       | 1            | <b>1.16%</b>              |
| Northern Grasshopper Mouse | ONCY                |                         |                          | 1                     | 1            | <b>1.16%</b>              |
| <b>TOTAL</b>               |                     | <b>26</b>               | <b>44</b>                | <b>16</b>             | <b>86</b>    | <b>100.00%</b>            |



Pellet numbers results show that site Three-Mile Canyon (TM) is dominated by gophers (*Thomomys*), rabbits, and woodrats (*Neotoma*). The TM location near the confluence of Pajarito Canyon is an active foraging area for the Mexican spotted owl and the great horned owl (*Bubo virginianus*), and the pellets from this location were likely from both species. Overall, 13 groups, including nine mammal species, insects, and a variety of birds, dominate this site. Cañon de Valle (COO) had the fewest samples where eight groups were described, but were dominated by *Neotoma*. The majority of the pellets at COO were produced from the resident Mexican spotted owls in this canyon system. Mortandad Canyon (M) contained 14 groups also dominated by *Neotoma*. Location M was, like location COO, predominantly used by at least one Mexican spotted owl.

Overall, totals and trends of spotted owl food habits, based on 48 pellets from three sites, are dominated by *Neotoma* and *Thomomys*. Gophers were found mostly in area TM and woodrats mostly from M. This study generated a good amount of species diversity considering the low number of pellets provided for analysis. This might indicate that owls are generalist sorts of foragers. However, it appears that owls may prefer a particular size of prey at about 100 g (4.0 oz). Combining these data and results with those of other studies will allow a better idea of the depth and breadth of the sorts and numbers of species that owls prefer. A large photo-gallery digital reference collection was generated from the LANL material and supplemented by the reference material from the Museum of southwestern Biology, Mammal Division. This collection should be further formalized and developed such that it is commonly available for further pellet analysis.

### Acknowledgments

Andy Johnson, Division of Birds, Museum of Southwestern Biology confirmed bird identifications. Sandy Brantley, Division of Arthropods, and Elizabeth Milford, the Natural Heritage Program, confirmed arthropod identifications. Thanks are especially noted to David Keller at LANL for providing the material and support to complete the examination of owl pellet material. The Museum of Southwestern Biology, Division of Mammals curator, Joe Cook, also provided additional financial support for this project in the form of additional staff time, materials and supplies, computing time, layout and preparation space, and access to the divisional reference collection.

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**Appendix: List of Species Included in Analysis**

|                            |                                  |               |
|----------------------------|----------------------------------|---------------|
| Silver-haired Bat          | <i>Lasionycteris noctivagans</i> | <b>(LANO)</b> |
| Cottontail Rabbit          | <i>Sylvilagus</i> species        | <b>(SYSP)</b> |
| Rock Squirrel              | <i>Spermophilus variegatus</i>   | <b>(SPVA)</b> |
| Botta's Pocket Gopher      | <i>Thomomys bottae</i>           | <b>(THBO)</b> |
| Northern Pocket Gopher     | <i>Thomomys talpoides</i>        | <b>(THAT)</b> |
| Pocket Gopher              | <i>Thomomys</i> species          | <b>(THSP)</b> |
| Brush Mouse                | <i>Peromyscus boylii</i>         | <b>(PEBO)</b> |
| Piñon Mouse                | <i>Peromyscus truei</i>          | <b>(PETR)</b> |
| Deer Mouse                 | <i>Peromyscus maniculatus</i>    | <b>(PEMA)</b> |
| Northern Rock Mouse        | <i>Peromyscus nasutus</i>        | <b>(PENA)</b> |
| Unknown Peromyscid Mice    | <i>Peromyscus</i> species        | <b>(PESP)</b> |
| Northern Grasshopper Mouse | <i>Onychomys leucogaster</i>     | <b>(ONCY)</b> |
| White-throated Woodrat     | <i>Neotoma albigula</i>          | <b>(NEAL)</b> |
| Bushy-tailed Woodrat       | <i>Neotoma cinerea</i>           | <b>(NECI)</b> |
| Mexican Woodrat            | <i>Neotoma mexicana</i>          | <b>(NEME)</b> |
| Unknown Woodrat            | <i>Neotoma</i> species           | <b>(NESP)</b> |
| Unknown Vole               | <i>Microtus</i> species          | <b>(MISP)</b> |
| Unknown Small Mammal       |                                  | <b>(SMAM)</b> |
| Unknown Medium Mammal      |                                  | <b>(MMAM)</b> |
| Unknown Large Mammal       |                                  | <b>(LMAM)</b> |
| Unknown Mammals            |                                  | <b>(UMAM)</b> |
| Unknown Small Bird         |                                  | <b>(SMAV)</b> |
| Unknown Medium Bird        |                                  | <b>(MDAV)</b> |
| Unknown Large Bird         |                                  | <b>(LAAV)</b> |

