



# Conserve O Gram

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## Identifying Mouse and Rat Damage in Museum Collections

Rodents, such as mice and rats, are common vertebrate pests that endanger human health and cause extensive damage to museum collections. This *Conserve O Gram (COG)* provides information on identifying mouse and rat activity and damage.

See *NPS Museum Handbook, Part I (MH I)*, Chapter 5: Biological Infestations for information on Integrated Pest Management (IPM), pest identification, inspection, monitoring, trapping, and rodent control action plans. See also *COG 3/11* Identifying Museum Insect Pest Damage and *COG 2/8* Hantavirus Disease Health and Safety Update.

### *Mouse and Rat Biology*

Mice can fit through spaces as small as 1/4 inch diameter and can jump one foot high. Rats are larger than mice but can fit through holes as small as 1/2 inch diameter and jump three feet high. They can chew through materials such as plaster, wood, concrete, and aluminum.

Mice and rats can readily climb, jump, burrow, and gnaw with front incisor teeth. The teeth grow continuously throughout the mouse or rat's lifetime and are sharpened by gnawing. These rodents are fertile and capable of breeding large litters throughout the year. Mice and rats are associated with human food, clutter, and trash, and are often found in spaces housing museum collections.

### *How to Detect Mice and Rat Activity*

Mouse and rat activity is often first discovered through sightings or hearing movement in walls and ceilings. Other evidence includes fecal matter (droppings), nests, urine stains, rub marks, hair, holes, chew marks, and the presence of concentrations of food and insect debris.

Work with an IPM Coordinator to conduct a safe rodent inspection. Wear gloves and a mask and use a flashlight, ultra-violet (UV) flashlight (urine fluoresces under UV), and a camera during inspection. In cases of extensive rodent activity, additional Personal Protective Equipment (PPE) requiring a fit test and medical examination may be needed.

### *Where to look*

Rodents prefer warmth, protection, quiet places to hide, and proximity to food and water. Look in secluded corners and other areas that provide harborage, including:

- Collection storage areas
- Collection preparation areas, such as box-making stations
- Equipment and supply storage areas
- Offices, including desk drawers and storage closets
- Food preparation areas such as kitchens and break rooms

- Garbage collection areas, especially if left overnight in buildings
- Water sources, including dripping air conditioning units and leaking pipes
- Structural features such as wall voids, electrical wiring holes, and false ceilings and floors

### *Evidence of Mouse and Rat Activity*

#### *Droppings*

Mouse excrement is smooth with a characteristic ovoid shape with at least one pointed end. Although color can vary based on what the animal was eating, droppings are usually dark and similar in size (1/8 to 1/4 inch) and appearance to small dark grains of rice (Figure 1). Rodent fecal matter can stain surfaces (Figure 2). A single house mouse can produce 50-75 fecal pellets per day. Rat droppings are slightly larger (1/2 to 3/4 inch), wider, and blunt at the ends. Do not confuse mice and rat droppings with those of the American Cockroach, which are also blunt-ended but have ridges and are smaller.



Figure 1. Mouse droppings. (Fran Ritchie, NPS)



Figure 2. Mouse fecal stains on basement perimeter. (Thomas Parker, PhD, MuseumPests.Net)

#### *Urine stains*

Accumulation of urine can stain soft and absorbent materials such as textiles and ceiling tiles made of mineral fibers. Urine splatters also darken and disrupt surfaces (Figures 3 and 4). Stained ceiling tiles located away from water sources present likely evidence of mouse or rat activity, rather than water damage (Figure 5).

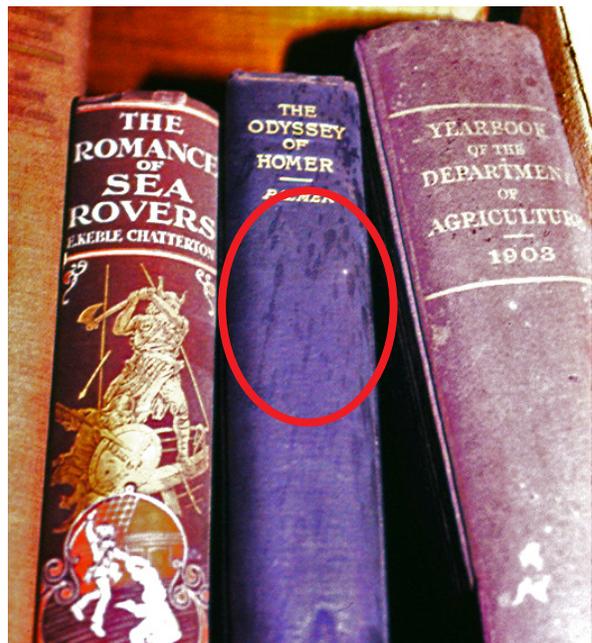


Figure 3. Mouse urine splatters on *The Odyssey of Homer*. (Thomas Parker, PhD, MuseumPests.Net)



Figure 4. Mouse or rat urine splatters on corner floor. (Thomas Parker, PhD, MuseumPests.Net)



Figure 5. Dark staining from mouse urine on drop ceiling tiles (Thomas Parker, PhD, MuseumPests.Net)

### *Rub marks*

Because of their keen sense of smell and poor eyesight, mice and rats mark their territory and routes of navigation (“rodent highways”) with secreted oils and urine. Highways are visible as smear marks on walls and through-holes, and around pipes and on electrical wiring (Figure 6). As mice and rats travel, they may stain floors with feces and shed hair. These areas can smell musky from the concentration of bodily fluids.



Figure 6. Dark rub marks (circled in red) on white electrical wire from mice using the wire to travel around the museum. (Thomas Parker, PhD, MuseumPests.Net)

### *Nests*

Mouse and rat nests are made from soft materials such as shredded paper, textiles, insulation, and other materials that are chewed and collected (Figure 7). They may be seen or smelled due to high concentration of urine and excrement.



Figure 7. Paper ripped from architectural drawings form a mouse nest in the rear of a drawer. (Thomas Parker, PhD, MuseumPests.Net)

*Feeding stations*

Mice and rats prefer feeding in protected places. These “feeding stations” can be identified by the presence of food crumbs, density of droppings and urine, and remains of eaten cockroach and other insect carcasses (Figure 8).



Figure 8. Mouse nest in stagecoach. (Curtis Sullivan, NPS)

*Damage to objects*

Mice and rats cause physical damage to a variety of museum objects, including fiber, leather, paper, textiles, and wood, as well as structural features. Examine the loss on an object for chew marks and irregular edges, as well as associated debris (Figures 9 - 13).



Figure 9. Chew marks on the edges of a leather saddle. (Fran Ritchie, NPS)



Figure 10. Loss on basket from mouse gnawing. Note irregular edges from incisors. (Thomas Parker, PhD, MuseumPests.Net)



Figure 11. Damage to upholstery from rat or mouse gnawing and seeking nest materials, harborage. (Thomas Parker, PhD, MuseumPests.Net)



Figure 12. Mouse gnawing leaves irregular edges on paper. (Thomas Parker, PhD, MuseumPests.Net)



Figure 13. Mouse hole in a wooden chest. (Thomas Parker, PhD, MuseumPests.Net)

### *Contribution to larger infestations*

The presence of rats and mice attracts other pests. Dead mouse or rat bodies, nests, and remains can host invertebrate pests, such as clothes moths and dermestid beetles that feed on their hair and carcasses (Figure 14). Remains can result in increased invertebrate activity in other areas of a building.



Figure 14. Decomposing mouse carcass caught in insect sticky trap, surrounded by dermestid larvae casings. (Thomas Parker, PhD, MuseumPests.Net)

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## ***Exclusion, Monitoring, Trapping, and Housekeeping***

Store collections in dedicated collections storage spaces within a well-sealed building envelope. Implement good housekeeping practices and regular and frequent inspection of all spaces housing collections.

If mouse or rat activity is suspected and/or identified, perform exclusion techniques on the building and surrounding environment to prevent access. Implement a humane rodent snap trapping program to eliminate those already in the structure. Routinely monitor traps so changes in activity are detected quickly.

## ***Selected References***

Eckstein, Amanda and Joan Bacharach. "Hantavirus Disease Health and Safety Update." *Conserve O Gram* 2/8. Washington, D.C.: National Park Service, 2014.

Klein, Denise. "Identifying Museum Insect Pest Damage." *Conserve O Gram* 3/11. Washington, DC. National Park Service. 2008.

MuseumPests Working Group (MP-WG) <[www.MuseumPests.net](http://www.MuseumPests.net)>

National Park Service. *Museum Handbook*, Part I. Chapter 5: Biological Infestations. Washington, DC.

\_\_\_\_\_ Chapter 13: Museum Housekeeping

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The series is distributed to all NPS units and is available to non-NPS institutions and interested individuals on line at <[http://www.nps.gov/museum/publications/conserveogram/cons\\_toc.html](http://www.nps.gov/museum/publications/conserveogram/cons_toc.html)>. For further information and guidance concerning any of the topics or procedures addressed in the series, contact NPS Museum Management Program, 1849 C Street NW (2265), Washington, DC 20240; (202) 354-2000.