Fur, Four Legs and a Tail:
Update from the MuseumPests ~~Rodent~~ Vertebrate Group

Illustrated Guide to House Mouse Exclusion and Monitoring

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All images are donated by Thomas A. Parker, PhD. except where noted.

House Mouse: *Mus musculus*

QUICK FACTS

- In one year, a house mouse can have five-to-ten litters, with five-to-six babies (“pups”) in each litter: approx. 60 mouse pups per year
- A house mouse is ready to procreate at six weeks old
- A house mouse’s gestation period is about three weeks
- Average life expectancy is six months to two years
- Mice don’t need standing water to survive, the water content of their food suffices
- To survive and thrive, the house mouse needs only food, a safe space, and nesting material
- The house mouse is a thigmotropic creature: it loves to be touched on all sides
- Because the house mouse is thigmotropic, it will seek small, tight, cozy spaces when traveling and making a home

House mouse nest in an old box

House Mouse: *Mus musculus*
GENERAL GUIDELINES FOR EXCLUSION

Copper wool gauze

Strategic trap set near door gap

- Mice can flatten out to get through holes/gaps as little as ¼ inch in size
- To plug gaps/holes, use firestop material in conjunction with copper wool (steel wool will rust/fail, so use copper!)
- To plug larger openings, use galvanized hardware cloth and flashing
- Do NOT use foams (expanding or otherwise) to plug gaps/holes: rodents will chew through it and/or use it for nesting material
- Where exclusion isn't possible, place traps near points of entry (eg: can't use door sweeps? Set glue traps on either side of the door)

House Mouse: *Mus musculus*

GENERAL GUIDELINES FOR MONITORING

- Establish and follow an inspection and monitoring schedule
- Check traps monthly (or quarterly at a minimum)
- Track/chart/graph monitoring data
- Look for mouse trails: discoloration/staining that looks like grime along baseboards, wire chases, or near rodent entry points
- Rodent urine will fluoresce in UV light: blue-white to yellow-white depending on how fresh it is (keep in mind, though: many things fluoresce)
- Mice urinate in one spot while rats urinate as they walk
- Watch for droppings (oblong pellets with one pointed end and a smooth surface) in suspect locations:
  - Under sinks
  - Near pipe/wire chases
  - In dark, cozy corners

Staining from mice on electrical wiring

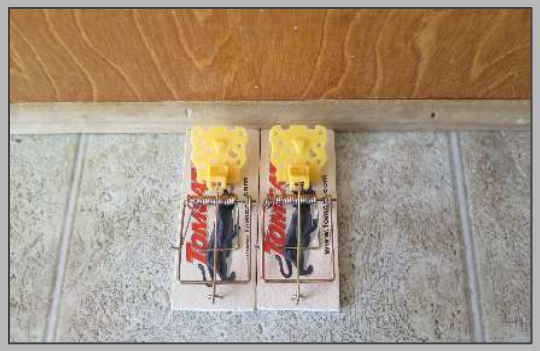
House mouse droppings

House Mouse: *Mus musculus*

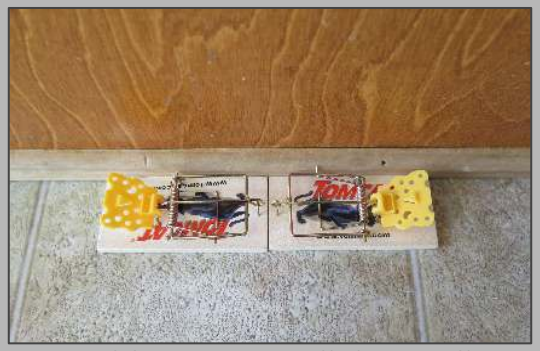
TRAPPING AND BAITING: ***PLACEMENT***

Follow the walls mice run along and find
quiet corners to catch them while slowing to round a bend

Single trap with trigger against wall



Two traps increases success rate



Double traps parallel to wall with triggers to the outside

Wrong - trigger not against wall

Wrong - double traps with triggers on the inside

Wrong - trap too far from wall

(F. Ritchie, NPS)

House Mouse: *Mus musculus*

IDENTIFYING MOUSE DROPPINGS

House mouse droppings can be confused with those of the American cockroach- even by professional pest managers. Tips to differentiate:

- *Mouse droppings:* an oblong pellet with one (sometimes both) ends pointed or pinched, and a smooth surface
- *American cockroach droppings:* an oblong pellet with blunt ends and long ridges running down the surface
- *Rat droppings:* smooth, ends are not pinched
- Mouse, rat, and roach droppings are usually black, but may be colored based on what they have eaten (eg: pale after eating banana peels, green after eating bait, any color after eating carpet)

Images from: NY State IPM

House mouse

American cockroach

Rat

House Mouse: *Mus musculus*

EXCLUSION: EXTERIORS ***WEEP HOLES***

Examples of weep holes: first 3 images are open and the last is closed with an exclusion cover

- Mice can enter weep holes (gaps between bricks and cinder blocks that allow condensation to escape from the interstitial space between the exterior masonry and interior wall) within a foot of the ground
- Additional gaps may be present in masonry where mortar has been lost, or in the first row of shingles at the junction between the wooden part of the building and the foundation
- Weep hole covers, like those produced by Tamlyn,™ pressure-fit into the holes to allow drainage, but prevent rodent entry
- Weep holes and gaps can also be closed using copper wool gauze, which can be stuffed tightly into place using a putty knife or similar tool

House Mouse: *Mus musculus*

EXCLUSION: INTERIORS ***ATTICS 1 of 2***

Evidence of mice in the attic insulation and floorboards

- Attics are frequently used for long-term storage, but can be inconvenient to access for inspection and exclusion.
- Often technicians do not check attics and ceiling areas.
- In the absence of a sturdy floor, one may need to lay down plywood in order to lay traps above insulation and facilitate access for regular inspection and exclusion.
- Attics tend to be warm and they often contain insulation materials. These conditions provide an attractive environment for mice to nest.
- Stains on ceilings are often mistaken for leaks, when in fact they are mouse urine.
    - Water leaks usually result concentric tide lines.
    - Mice like to urinate in corners, and use same spot over and over again, creating more irregular stains.

House Mouse: *Mus musculus*

EXCLUSION: INTERIORS ***OFFICE SPACES 1 of 2***

- Rodents can get into voids and interstices behind and inside cabinets, drawers, and counters.
- Electrical runways in the base of hollow cubicle walls provide runways for mice to hide or travel.
- Inspect where you can, place traps, and close gaps.
- Close any wall perforations behind cabinets.
- Remove shelves and drawers to access voids underneath.
- Clean and place traps as necessary. These areas collect debris that can sustain mice.

Evidence of mice in the office:, holes and urine staining on floors, a cable chase that acts as a mouse passageway, and paper in an unused drawer serving as nesting material

House Mouse: *Mus musculus*

TRAPPING AND BAITING: ***EXTERIOR BAITING***

- Exterior baiting has to be managed by a PMP (Pest Management Professional)
- Monitor/work with your PMP to ensure:
  - Correct baits/traps are used and they are well-located
  - That the PMP regularly maintains the baits/traps
  - That the PMP monitors baits/traps meaningfully
  - That technicians actually unlock, open, and check each box
- Check local ordinances regarding allowable uses of rodenticide baits
- Do not use bait in or near buildings if mice may enter afterwards
- Check outdoor traps quarterly, if not monthly

Exterior bait stations

House Mouse: *Mus musculus*
TRAPPING AND BAITING: ***INTERIOR BAITING***

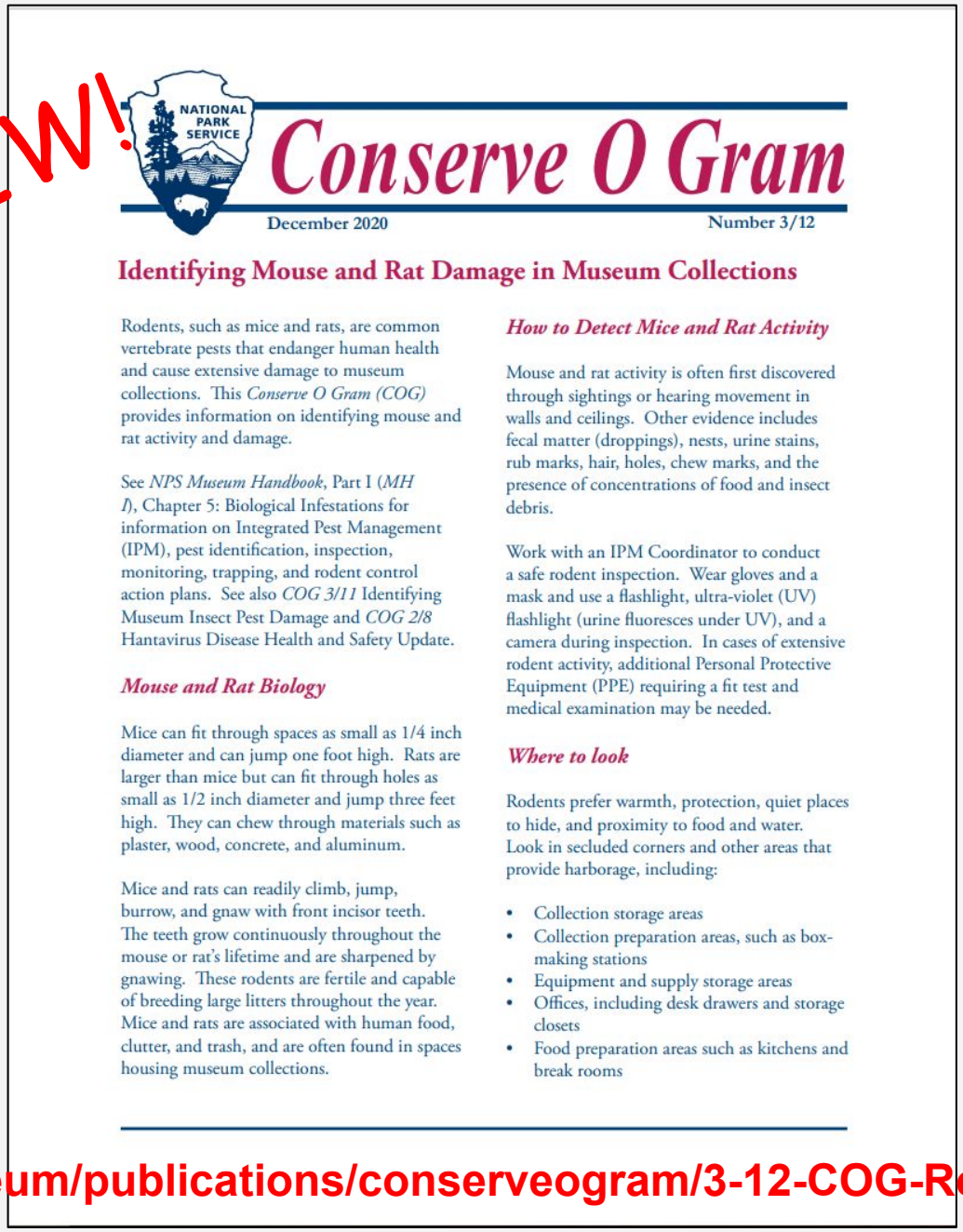
NEVER USE RODENT BAIT inside museums historic houses, libraries, or archives!

- Poisoned rodents often die in hidden voids (behind walls, under floorboards, etc.) leaving carcasses that are difficult to find/remove
- Hidden carcasses attract flies, hide beetles, carpet beetles, clothes moths, and other pests that will attack collections when the carcass is finished
- Many commercial rodent baits come unintentionally pre-tainted with dermestid eggs, which will soon hatch and attack collections

Interior bait stations and Dermestids in a rodent bait tray

More help in identification:

NEW!



NATIONAL PARK SERVICE

Conserve O Gram

December 2020 Number 3/12

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.

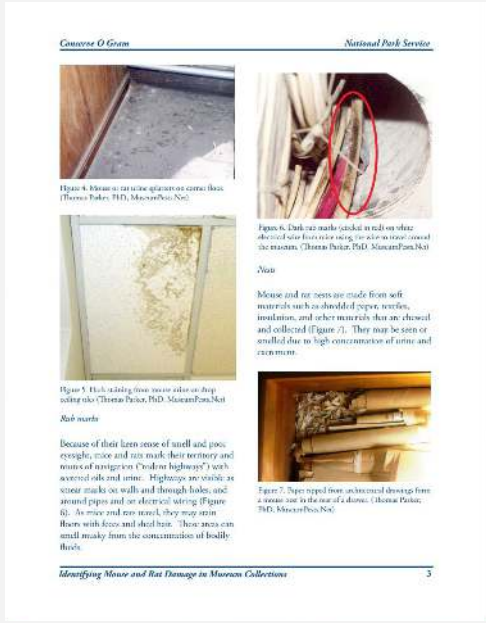
Work with an IPM Coordinator to conduct a safe rodent inspection. Wear gloves and a mask and use a flashlight, ultra-violet (UV) flashlight (urine fluoresces under UV), and a camera during inspection. In cases of extensive rodent activity, additional Personal Protective Equipment (PPE) requiring a fit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

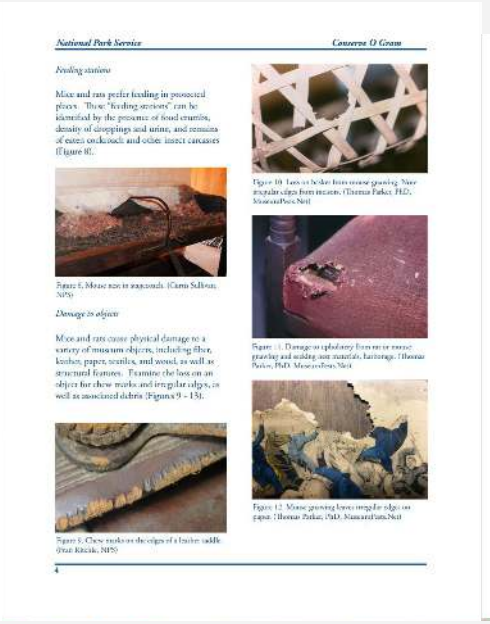
Where to look

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

www.nps.gov/museum/publications/conserveogram/3-12-COG-Rodent-Damage.pdf





Topics:

- Mouse and Rat Biology
- How to Detect Mice and Rat Activity
- Where to Look
- Evidence of Mouse and Rat Activity
- Exclusion, Monitoring, Trapping, and Housekeeping

www.nps.gov/museum/publications/conserveogram/3-12-COG-Rodent-Damage.pdf

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SOLUTIONS

This portion of the site contains information and resources on how to treat infestations that have been confirmed as active. Some of the treatments are also used preventatively. Treatment options for rooms and buildings will differ greatly from solutions for item level infestations.

It cannot be stressed enough that treatment of an active pest infestation without getting to the root cause of the problem is of limited value. Personnel at cultural heritage institutions must determine the source of an infestation, the reasons an infestation exists, and then address permanent, non-chemical solutions to these problems – this is the basis for integrated pest management. *Please check our Prevention Resources for assistance.*

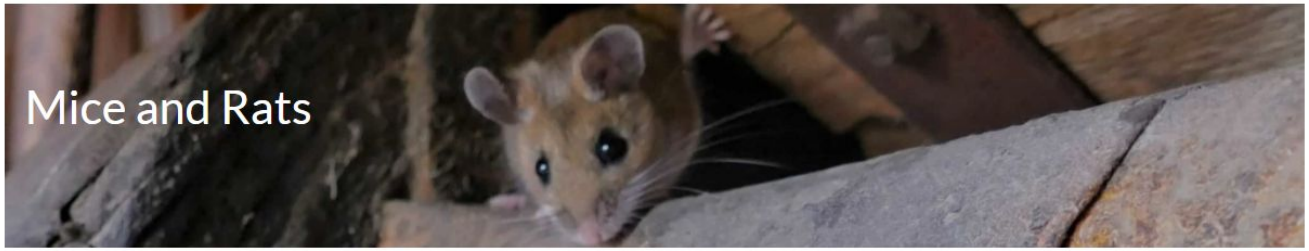
If you have an active infestation and are not sure where to start, visit our page Dealing With An Active Infestation.

Vertebrate Pests Treatment (mice & rats, etc.)

The documents listed above apply to invertebrate (insect) pests. A different range of actions and solutions is necessary for dealing with vertebrate pests such as **commensal rodents (mice and rats), other rodents and nuisance mammals (squirrels, raccoons, woodchucks, opossums, skunks, bats, etc.), birds, snakes, lizards,** etc. See the Solutions for Treating Vertebrate Pests page.

House Mouse (Patrick J. Kelley, Insects Limited, Inc.)

SOLUTIONS FOR VERTEBRATE PESTS



Mouse on museum stagecoach (C. Sullivan, NPS)

<u>Resources provided to answer the following questions:</u>

How do I know if I have a mouse or rat infestation?

How do I pest-proof my environment to prevent a mouse or rat infestation?

Where can I find guidance about rodent exclusion for new construction?

How do I set up a trapping program to monitor for mice and rats?

What do I need to know to protect my health and safety when handling mouse- or rat-infested materials?

Where can I find solid general guidance on IPM and rodent control?

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SOLUTIONS FOR VERTEBRATE PESTS

Mouse on museum stagecoach (C. Sullivan, NPS)

House Mouse (P. J. Kelley, Insects Limited, Inc.)

Mouse droppings (F. Ritchie NPS)

Rat chew marks and leather saddle (F. Ritchie NPS)

Key resources for prevention and mitigation of mouse and rat infestation are provided here. Although there are other types of rodents that can wreak havoc on buildings and grounds, mice and rats are the primary rodents that will consistently seek harborage inside buildings and storage spaces. Information on other types of rodents, such as squirrels, is forthcoming.

How do I know if I have a mouse or rat infestation?

- *NPS Conserve O gram 3/12, Identifying Mouse and Rat Damage in Museum Collections,* National Park Service

How do I pest-proof my facility to prevent a mouse or rat infestation?

- *Illustrated Guide to House Mouse Exclusion and Monitoring,* Museum Pests Working Group
- *NPS Rodent Exclusion Manual, National Park Service, Mechanical Rodent-Proofing Techniques,* National Park Service
- *Pest Proofing Tips for Building Owners, Managers and Staff,* NYC Health – NYC.gov

Where can I find guidance about rodent exclusion for new construction?

- *NebGuide G1530, Rodent-Proof Construction – Structural,* University of Nebraska, Lincoln Extension – In-

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Evidence of mice feeding on linden seeds (T. Parker)

- *NebGuide G1530, Rodent-Proof Construction – Structural,* University of Nebraska, Lincoln Extension – Institute of Agriculture and Natural Resources
- *NebGuide G2017, Rodent-Proof Construction – Drains and Feeding Equipment,* University of Nebraska, Linco
  In Extension – Institute of Agriculture and Natural Resources

How do I set up a trapping program to monitor for mice and rats?

- *Rodent Trapping Tip Sheet,* Museum Pests Working Group
- *Trap Placement Diagram* for mouse snap traps, Museum Pests Working Group
- *NPS Museum Handbook, Part I, Museum Collections. Chapter 5: Biological Infestations,* National Park Service
- Visit the Monitoring — Trapping for Rodents section of this site for more information.

What do I need to know to protect my health and safety when handling mouse- or rat-infested materials?

- *NPS Conserve O gram 2/8, Hantavirus Disease Health And Safety Update,* National Park Service
- *Cleaning Up After Rodents,* Centers for Disease Control and Prevention

Where can I find general guidance on IPM for rodent control?

- Corrigan, Robert M. *Rodent control: a practical guide for pest management professionals. 2001.*

There are multiple species of squirrels that can be nuisance pests. **In some locations, certain species are protected. Be sure to work with the appropriate wildlife or other agencies to ensure that you follow legal laws.**

Identification

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Eastern Grey Squirrel

The Eastern Grey Squirrel may be grey, reddish-grey, or black in color. it is diurnal (active during the day). They measure 16-20 inches long and 1.25 to 1.75 pounds. The Eastern Grey Squirrel occupies a range of 2 to 7 acres. Eastern Grey Squirrels are known to do damage to electrical wiring, fascia and soffits, and to leave rub marks.

Red Squirrel

Red squirrels are smaller than grey squirrels, and diurnal (active during the day). They have a red coat and prefer pine forests.

Southern Flying Squirrel

Southern Flying Squirrels are 8 to 10 inches long with a membrane of skin stretched between front and rear legs, a line of demarcation between upper and lower coat, and a flattened tail. They are nocturnal. In some areas flying squirrels are protected, so it is important to verify species and check local laws pertaining to what actions are legal.

Delmarva Fox Squirrel

At 18 to 27 inches and 1.75 to 2.25 pounds, the silver grey Delmarva Fox Squirrel is larger and more terrestrial than the Eastern Grey Squirrel. It was delisted from the Endangered Species list in 2015, so check local laws to determine whether it is still be protected in your area.

Squirrel Nuisance Prevention

- Exclude at entrances/exits
- Consider removing bird feeders or using feeders that have squirrel deterrents
- Post "Do Not Feed the Squirrels" signage
- Pick up fruit/seeds/acorns from and/or around trees
- Cut tree limbs away from structures

Trapping

- Trap size: 18"x5"x5"
- Baits: Cereal, grains, nuts (peanuts), sunflower seeds, shelled corn, mixed peanut butter and oatmeal, or mixed peanut butter and molasses
- Traps must be checked daily
- Please check locality for any trapping laws

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Thanks!
Enjoy the Resources!