SECTION 3: INTEGRATED PEST MANAGEMENT/EXCLUSION

Annual Rodent Control Issue

Exclusion Fundamentals

©n_u_t | stock.adobe.com

Editor's note: This article originally appeared in a PCT e-newsletter titled "Smart Exclusion Solutions," which was sponsored by Xcluder.

Find the source, treat the source. Here are some areas in residences to focus on for exclusion efforts, based on input from a number of PMPs who provide exclusion services:

- Utility line penetrations in and around the structure, including gas lines, plumbing, electric, cable and air conditioning lines.
- Roof lines and roof intersections, particularly those with a pitch change.
- Unique building styles that leave openings under eaves for ventilation.
- Gutters.
- Attic and ridge vents.
- Doors and entryways, particularly sill plate and exterior utility doors without thresholds.
- Garage doors.
- Random holes left open during construction. (These can be the most challenging to identify.)
- Broken wastewater pipes under structures and in walls.

In addition to access points in common with residential structures, such as roof lines and utility line penetration, here are some additional pest entry points to consider that are unique to commercial buildings:

- Customer entry doors.
- Roll-up and overhead doors.
- Dock doors.
- Dock leveler plates.
- Roof-top air conditioning units.
- Floor-to-floor utility line chases, including gas lines, plumbing, electric and cabling.

IMPORTANT CONSIDERATIONS. Doors are obvious entrances for people and pests. Use door sweeps with strong exterior covers and interiors filled with rodent-resistant materials to prevent rodents from gnawing through. Ensure the gaskets are intact around the sides of doors and that astragal seals adequately close the gap between doors.

Although all exterior doors are important, ground-level doors and those associated with ramps are even more important as they're easy access points.

EXCLUSION IS ONGOING. There's wear and tear of materials. Doors are constantly being opened and closed and may come out of alignment, expand or contract due to temperature, and door frames may expand at different rates, all of which contribute to creating gaps. Regular inspections are recommended.

- In addition to installing new, rodent-resistant garage or overhead door seals, add weather stripping on either side as a "vertical rodent guard."
- Rail doors, where cars come into an unloading shed or building, are particularly difficult to seal, yet one where mice commonly enter.
- Be sure to use proper materials for exclusion. Also, exclude to the tolerances of the target pest — note gap and hole sizes that may permit pest entry.
- Use the proper materials. Using insulation products, such as expanding foam (exclusively) and other soft products, are generally ineffective.
- Use stainless-steel mesh products for excluding pests from small openings.
- Birds can be problematic. There are a number of factors that may contribute to bird activity, including bright white roofs, solar panels and simply the location of the building. Solutions should be chosen on a case-by-case basis.

MISTAKES TO AVOID. Be sure to train employees on these exclusion "don'ts":

- Using only foam to fill gaps and holes isn't an exclusion strategy; it's a recipe for disaster. It's easy to apply, butineffective and can cause more problems than solutions. It makes future exclusion more difficult, as foam needs to be cut away and removed. Foam can be messy, making it difficult to see where a rodent originally chewed.

- Installing standard, rubber or vinyl door sweeps and seals won't work. Rodents may gnaw through to create a new access point. Use rodent-resistant products.
- Don't partially seal entryways. Ensure entryways are *completely* sealed.
- Remember to investigate fireproofing requirements as it relates to exclusion.

LANDSCAPE EXCLUSION. Alert customers to landscaping that may contribute to pest infestations. Suggest they avoid using plants that attract and harbor pests and those that will accumulate trash. Keeping exterior areas clean inhibits pest activity.

Landscape rodent exclusion often involves subsurface barrier installations. In landscapes, use non-decaying materials, such as galvanized hardware cloth or stainless steel screening, high-density cement product and appropriate, long-lasting liquid sealants. There are also newer products on the market, such as stainless-steel mesh "carpet" to prevent burrowing around commercial buildings.

CUSTOMER INVOLVEMENT. There are some exclusion strategies you can't address, but your customer can. A few examples:

- Trailers that are backed up to dock doors and used for storage can be problematic. The trailers may be used to store everything from pallets and cardboard bales to animal feed. It's more of a problem when the dock doors are open and there isn't a tight trailer-to-building seal. You may not be able to provide exclusion services in this case, but you can alert the customer to the issue and explain why it's important to keep the doors closed.
- If automatic door closure timing mechanisms aren't set correctly, they may allow pests to enter. It's important to point this out to customers with doors that open slowly or stick while open. Resetting the automatic door mechanisms is something they can do as part of the pest exclusion process. In some cases pests may actually trigger a door to open.
- Success happens when store employees realize sanitation is part of the pest control solution. Keeping up with employee training is important so staff understands proper trash disposal and to close doors when not in use.

SENSITIVE COMMERCIAL SETTINGS: PET STORES

©choja | iStock

Some commercial settings are more sensitive than others. The impact of a potential pest infestation could be devastating in terms of physical damage, by negatively impacting customer perception or by damaging the brand. One example is a pet store. Pest exclusion is absolutely the best option in a commercial setting like a pet store.

This unique setting provides ample food sources as well as live animals. Common techniques for eradicating pests aren't safe to use here, including baits, bombs or fogs, making exclusion even more critical.

Proactive exclusion is essential. The primary way to address the risk of pest activity is by proper exclusion and sanitation. Reactive exclusion is OK — better late than never — but proactive exclusion is the ideal. It's easier and more cost effective to prevent a pest problem before it begins. No matter the type of facility, there are so many places pests can hide once they're in, making it much more difficult to remove them.

Regarding exclusion services, urgency is of the utmost importance. Pests don't take nights, weekends or holidays off. Pest management is not an 8-to-5 job. Pest issues have to be resolved immediately — pests reproduce so quickly, and the potential damage to product and the business is far too great. Successful PMPs will understand the customer's sensitivity to the issue and realize the time to resolve a pest problem was yesterday.

‹ Previous
Rats: Ultimate Survivors (/article/august-2018/rats-ultimate-survivors.aspx)

Next ›
The Rise of the Rats (/article/august-2018/the-rise-of-the-rats.aspx)

Exclusion Essentials

Bobby Corrigan explains that not only is rodent exclusion important, it's perhaps the most important aspect of controlling rodents.

June 26, 2017
Christopher Cushing (/author/11771)

Smart Exclusion Solutions, Sponsored by Xcluder (/news/category/exclusions-solutions)

The most important element of rodent management is exclusion. If a structure is fully protected, whether by sealing holes or fixing weather stripping, it often alleviates the need for catching, trapping or baiting. The industry's most well-known rodentologist, Bobby Corrigan, knows that it's this aspect of the battle against rodents that the layperson is less tuned in to, and more often negligent in considering. Corrigan offers the essential fundamentals of exclusion while providing important tips on how PMPs can fine-tune their exclusion skills.

CAPABLE ADVERSARY. "It's amazing how intelligent rats are in figuring things out," Corrigan says. "We're learning more and more that these animals are clever explorers and once they lock on to food by smelling it, or they find a good harborage, they become highly skilled gymnasts."

Corrigan says, that unlike many pests, rodents have the smarts to not only utilize tools, but also make decisions. This is due not only to their innate cleverness by design, but also by their biology and anatomy. But despite their skills as explorers, Corrigan is quick to remind technicians that rodents do indeed leave behind evidence that can help thorough PMPs locate weaknesses in a structure that provide rodents entry and clues to how those weaknesses are exploited. But one cannot expect the customer to see what a technician is trained to spot.

"I'm always stressing in my training that since we're hired and we're the professional we have to have vision that obviously the public does not have," Corrigan says. He offers the example of a restaurant's gnawed-away weather stripping, where rats have created a point of entry and how in most cases it will go unnoticed by building custodians. "The rats are gaining access there, going in, getting what they want and then going back to the sewer. We are trained to see it. They are not."

This is not a problem exclusive to the United States, but all over the world, Corrigan explains. "Human beings are not able to grasp that if you keep them out in the first place, then you don't have to catch, bait, trap and so forth later."

TROUBLE SPOTS. Corrigan offers what he says are the four primary trouble areas rats and other rodents are expertly adept at exploiting. "First, any gaps at the ground level," he says. Those are the areas most overlooked by the layman and amateur technicians. But a good PMP knows to look high as well as low, because, as Corrigan explains, rooftops are another common point of entry.

"Rats, of any species by the way, are adept at climbing buildings and getting up on roofs where they can come in from the top down, rather than from the ground up," he says.

Doors, also at ground level, are often obvious culprits for allowing rodent entry, usually because they've either not been pest proofed, or they're being left propped open by residents or employees.

The fourth possible trouble area covers a wide range of ways in which a structure's integrity has been compromised. "Who knows how many points of penetration we have in commercial buildings or homes," Corrigan says. "These can be any hole that goes right through a wall that's not sealed correctly. Rodents are going to find that, and they're going to take advantage of it and enter."

TOOLS AND TRAITS. A rodent's anatomy not only gives it the ability to explore and infiltrate small obscured places, but is also responsible for providing the trained eye of a technician the evidence they're looking for when tracking the possible invaders. Corrigan explains rodents' most helpful characteristics, anatomically speaking, are their pointed muzzles and their body shape.
"Their muzzle comes to a long point, and tapers down," Corrigan says. "And at the edge of that are very sensitive 'nerve hairs' if you will, that help them determine what they're going to do — how to proceed."

In addition to whiskers, Corrigan says rodents also have more nerve hairs growing out of the top of their heads behind their ears. They also help rodents make “decisions.” He’s quick to point out that this should not be dismissed as simple animal instinct. “We’ve learned that it’s more than instinct that tells them to decide when to go forth or not go forth into a hole, crevice or crack. We now know it’s something beyond instinct.”

So, the muzzle of a rat has more utility than that of a sensory area. It’s also, Corrigan explains, a tool to assist in choices for burrowing. “In the wild rodents use the muzzle to locate workable spaces beneath something heavy such as a rock,” he says. “They bring this same ability to everyday doors where they might be able to gain access beneath.

“In the wild rodents use the muzzle to create a space beneath something heavy such as a rock,” he says. “They bring this same ability to the city where there are structures they can get under. They try to burrow beneath heavy objects because of the protection they offer.”

But if a rodent can’t find a way under, to gain access to an area, they have other powerful tools, their incisors, that they use to find alternate entrances. Corrigan explains that a rodent’s incisors are powerful and can create access where access didn’t previously exist. For example, in a space around a structure where wood or other building material meets pavement, it’s impossible to burrow down beneath the structure to get in. In this case, the incisors can be used to gnaw away at the building material where it touches the ground, chewing to create a hole big enough to accommodate its passage.

Jody Gangloff-Kaufmann, NY State IPM Program

Inspect areas where pipes and wires enter buildings to determine whether pests can enter around them.

And as Corrigan points out, those holes need not be big or even rat-sized, because of how the rodent’s anatomy allows it to squeeze its way into areas much smaller than its full body size.

“They have flexible tube-shaped bodies,” Corrigan says. “Their shape and flexibility allows them to squeeze through tight areas you wouldn’t expect. However, this is not to say that rats can “flatten” themselves out to squeeze under doors or other shallow horizontal spaces. “Because they’re flexible in the same way we are. Their backbones allow them to twist and turn and get the job done.

“The rule of thumb is, if the head can get through, the rat can get the rest of its body through.”

EVIDENCE OF INTRUSION. Once a PMP has trained his or her eye to identify a rat’s point of entry, there are other clues to be sniffed out, which can provide evidence of activity.

“Someone might see a hole and say, ‘How do you know that hole is still active? What if [the rats] built it there four years ago?’ Well, there are other signs that will point to whether or not the hole is in current use.

One, perhaps subtle, clue can be found in the area around the hole. If the hole is gnawed out of wood where it meets pavement, Corrigan advises to look closely at the color of the pavement around the hole as it compares to the rest of the pavement. “You might see a dark color around the hole — a dark, smoky-colored area on the pavement. That’s a sure sign the hole is active now,” he says.

It’s sebum, an oily grease excreted from the underside of a rodent, that accounts for the discoloration. “Once they’re pressed down against the ground to get into that hole, it rubs the sebum off of them and onto the ground,” Corrigan says, suggesting that a PMP might take a photo of the sebum-stained area to show the client. “Then you can say — look, you need our services.”

More intel can be gathered with a close look at the gnawed-away area. Corrigan suggests looking around the hole for the rodent’s incisor impressions to help you identify what kind of pest you’re dealing with. “Then, a pest professional should actually measure the width of the impressions. If they’re close to 4 millimeters across, it’s absolutely a rat. If 2 millimeters, it’s mice.”

MATT FRYE

Openings around utility lines often provide access to buildings and wall voids.

WHY EXCLUSION? “Rodent proofing doors, and holes and gaps — is a job for professionals. But for us, once we agree to rodent-proof a door, we have to make sure we know what we’re doing,” Corrigan says.

Corrigan explains that not only is rodent exclusion important, it’s perhaps the *most* important aspect of controlling rodents, because whether it’s a big or small infestation, all it takes is one rat to bring much more unwanted things with it.

“Once they’re in, everybody is in,” Corrigan says. “They’re carrying fleas, ticks, lice and bacteria on them, so even though you may kill the rodent, anything of these things they brought in with them are still there. If a rodent is carrying a virus or a bacteria, of what logic is it to let them in your house or food plant or warehouse or restaurant, and to then try to control them after the fact?”

So even if a PMP manages to trap or poison the offending rodent, the question remains, how does one catch or contain any associated ectoparasites and pathogenic microbes that came in with the rodent?

Indoor infestations, for example, will still require careful cleanup, because even if the rodent is gone, droppings, urine, rodent hairs and decaying carcasses are still left behind. This, Corrigan explains, is why sanitation and pest control go hand in hand.

“Pest proofing is actually pest prevention and sanitation is pest control,” he says. “So if we keep things clean and clutter free it helps keep control.”

RIGHT & WRONG TOOLS. The tools of exclusion can be very effective if used properly, but as Corrigan explains you have to know what the right tools are before you get started. This might take some research on the part of the technician, but suffice to say that one key point to remember is that weather stripping and pest proofing are not the same thing.

"It's amazing how people will just weather-proof doors as a way to keep out pests," Corrigan says. "Weatherproofing materials are not made for this purpose, so they are completely inappropriate for this job."

One commonly made mistake Corrigan cites is the use of heavy-duty vinyl weather stripping used as an exclusionary tool. A maintenance person is not trained to know these things, but Corrigan explains that simple vinyl used in even the strongest weather strips can still be easily chewed through by rodents. That's why Corrigan suggests two specific types of rodent-proofing door seals: high-density nylon bristles and rubber-encased steel fabric (or RESF). "Nylon bristles are most effective for small infestations of mice," Corrigan says. "But if it's rats and mice, the rats will get through the bristles with no problem."

Maintenance crews are not trained in pests. Even a heavy-duty strip of vinyl used as weather stripping can be chewed through by rodents. RESF sweeps, on the other hand, create several layers of challenges to the rodent which will effectively keep them out.

But even the best exclusionary tools are useless if not installed properly, Corrigan says. This means taking careful, accurate measurements of everything including any holes, entry points, door thresholds and piping hole gaps. A simple depth measurement of the opening in question can reveal whether the rodent being dealt with is a rat or mouse.

"On average, the depth measurement for a mouse is about 6 millimeters. For a rat, it's 12 millimeters," Corrigan says.

Foams are another material often misused by those who don't know better. While they are ineffective for several reasons, they can be part of a bigger exclusionary strategy. Foam "plugs," however, are terrible for exclusion when used alone because they're not cleanable and their micro-crevices harbor germs, they're porous, they degrade quickly, they're easily gnawed by rodents and the expansion of foam blows out narrow board holes, widening them.

To use foam properly, Corrigan suggests this three-part strategy for holes in stone or cement walls of commercial accounts: "Put just a small amount of quality foam into the hole and then add a wad of stainless steel fabric so it's enmeshed into the foam. Then finish with a dollop of quality sealant matched to that substrate."

Pest proofing walls, holes, cracks and crevices requires that the PMP fill the hole. A heavy-duty sealant is what Corrigan recommends, though he is quick to point out that simple hardware-store caulk is not a sealant (even if it might say so on the label).

"Do your homework and know the difference," he says.

The author is an Ohio-based freelance writer.

Stainless steel mesh fabric is the most effective material to keep rodents from entering through building holes and penetrations.

Rodents (/search?searchTerm=Rodents)

RELATED

Commercial Communication (/commercial-communication-advice.aspx)

Pest Exclusion Services Increases Revenue, Boosts Customer Retention (/pest-exclusion-increase-revenue-boosts-retention.aspx)

A Primer on Selling and Providing Exclusion Services (/sell-provide-exclusion-services.aspx)

MOST SHARED

Rentokil Acquires VDA, a $47 Million U.S. Vector Control Company (/article/Rentokil-Acquires-VDA/#at_pco=cfd-1.0)

Target Specialty Products Makes Debut as PestWorld Exhibitor (/article/Target-PestWorld-debut/#at_pco=cfd-1.0)

Bed Bugs Found at Sixteen Public Locations in Phoenix (/article/bed-bugs-sixteen-Phoenix-public-locations/#at_pco=cfd-1.0)

COMMENTS

Rodent IPM in Restaurants

Bobby Corrigan*

Introduction

Restaurants are prone to rodent invasions due to the obvious association with relatively large amounts of food and food refuse, multiples of daily deliveries, frequently-opened doors and the like. Thus, to effectively control rodents in food serving establishments, there is an **essential** need for on-going surveillance on both the part of the restaurant and a contracted pest professional.

In 2007, the U-Tube of *Rats Gone Wild* in a New York city restaurant went viral across all media aspects; TV, U-tube, newspapers, and all over the internet. *Rats Gone Wild* also demonstrated how the "public jury" will judge pests around the places they dine. Rodents-- even one-- inside a restaurant is unacceptable. Obviously then, restaurants must minimize their vulnerability to rodents. But to achieve this goal, a high priority must be placed on *preventing* rodent infestations from occurring in the first place (i.e., individual rodents arriving with deliveries, entering beneath doors, etc.). Certainly, a priority on prevention should originate with the client, but because the general public does not understand pests and pest management, the professional that services the food serving facility has the responsibility to inform and educate a restaurant manager as to what and how prevention can be achieved.

To illustrate this point, consider the typical scenario of how a mouse infestation originates and develops in most food serving establishments. A mouse or two entering from the exterior (or arriving in a delivery) might remain undetected for weeks. These rodents often foraging and nest in the out-of-sight areas of the facility such as in ceiling voids, along the dark sill plates in basements, behind storage clutter, below low storage shelves, or behind the compressor void of a refrigerators, ice machines and similar areas. After a relatively short while, rodent families are born and reared in these out-of-sight zones.

Moreover, in many of the largest (i.e., high human density) cities in the world (New York, London, Paris, Singapore, San Paulo, etc.) many buildings are connected to one another via wall, ceiling and floor conduits, pipes, sewers, and HVACs . Rodents routinely travel back and forth among different buildings via all these routes.

So when attempting to be pro-active in rodent pest management program inside a restaurant, the goal is to employ programs that are effective in maximizing the exclusion of rodents in the first place, and then use pest control programs that achieve two key goals: (1) **alert** the food manager quickly to the arrival of any new incoming rodents and, (2) **maximize** the chances of eliminating any new arrivals before they can multiply.

* Adapted from: Corrigan, R.M. 2007. Rodent Control Inside Restaurants. Parts 1 and 2. Pest Control Technology. Vol. 35: (7/8): 67-74.

NYC Rodent Academy

Preventative Programs:

1. Rodent Proofing.

All doors, and ventilation louvers, cable entries, to any food establishment restaurants must be rodent proof. This is especially true of a restaurant's delivery doors. Although, this concept is elementary to most pest professionals, it is rare to find the restaurant that rodent proofs correctly. Or , many facilities confuse weather stripping doors and windows with pest proofing, but of course, these are not the same operation.

For instance pest proofing doors should involve the use heavy duty pest brushes such as is offered by companies like Sealeze (or similar products of good quality). (www.sealezecom).

When looking at a door to see if it is properly rodent proofed, look from the inside at the door during the day. Any light seen beneath or between the doors the size of a 1/4 inch (6 mm), will permit mouse entry, while openings of ½ inch (12mm) allows rats.

2. Minimize Clutter

Both rats and mice use clutter for nesting sites and harborage. Due to the typical space constraints of many restaurants (especially in the downtown zones of the large cities where real estate is in high demand), many back rooms and basements of restaurants especially in the downtown areas become cluttered.
Once boxes are placed on floor and against the wall, rodents then begin to hide behind and /or nest in the boxes. These rodents become resident rodents and store personnel may not even be aware of their presence. All back rooms should be kept as clutter-free as possible. Boxes/supplies should never be stored for prolonged periods on top of cooler boxes or in out of sight ceiling areas.

3. **Use the Correct Storage Racking**
All items should be stored off of floor: a minimum of 12 inches, and preferably 16 inches. The space should allow easy access by cleaning staff to pick up spills, clean with brooms and mops, etc. The best racks are heavy-duty stainless steel, gravity feed /height-adjustable shelf construction.

4. **All holes in walls and other structural elements must be sealed (not caulked) properly to deny rodents nesting and travel paths.**

All utility penetrations into walls, ceilings or floors must be sealed completely. It is common in restaurants to find gaps around pipes and utility conduits. Rodents climb these lines and access structural voids when these penetrations are not sealed.

Merely stuffing steel wool or copper mesh into the openings is not sufficient rodent exclusion.

5. Refuse rooms and exterior dumpsters must be kept *very* clean and all spillage must be cleaned up as it occurs.

By far, food waste is one of the most important contributing factors for bringing rats and mice to a restaurant's premises and then allowing them to proliferate on, inside or nearby the premises.
Refuse zones among fast food restaurants in cities are often kept only marginally clean. The truth is rats and mice thrive on these "marginally clean" refuse handling and storage areas.

a. All food refuse must be totally contained in a receptacle, and the receptacle must be closed against rodents (and birds, yellow jackets, etc.).

b. Any refuse spillage around dumpsters, cans, etc., must be swept up several times each day. Ideally as soon as they occur.

c. And food refuse or spillage should NEVER be allowed to remain on the ground overnight. Rats require only about one ounce of food each day to survive. A mouse only 3 grams. Moreover, if rodents find more food than they can eat on a given night, they will collect and store food in their nests. In this manner they can survive for up to a week and more without access to new foods, until the next un-cleaned spillage event occurs.

6. Restaurant Rodent IPM Service Recommendations:
Again, preventative programs must be emphasized.

(1) Any ceiling voids should be visually inspected in the key zones of the ceilings (e.g. above heat sources, or along the concrete hollow block walls in areas where lines lead up into the ceilings.

(2) Above a heat sources (1-2 locales) maintain EITHER:
A "tin cat" style trap (e.g., Kness Pro-Katch, Eaton's Repeater Woodstream's Tin Cats, Bells's 24/7, etc.) containing a glue trap on the inside floor of the trap.

or

A rat size bait station or Kness Stick-all Depot Box, containing two Snap-E traps ; a Max Force cockroach bait puck and a fold up sticky trap .

b. If a restaurant is subject to rats, then, the above set up should be with rat traps secured within bait boxes (e.g., T-Rex traps installed into Protecta Stations).

c. Note that glue traps should NOT be the sole and primary rodent control device used for preventative rodents control. These types of traps are by far the least expensive device, and they do capture some rodents (mostly juveniles). But they are not as effective as snap traps, and there is the risk of "conditioning" rodents to avoid these devices all together.

d. When baiting programs <u>in addition to</u> traps is necessary:

1. In restaurants that are experiencing routine or ongoing rodent activity (mouse or rats), it is suggested that **IN ADDITION** to trap stations, two tamper-resistant bait stations area installed into the ceiling **IN THOSE specific spots** where rodent droppings have been noted.

2. Into the tamper-resistant bait stations ONLY BLOCK formulation bait (i.e., no packets, no loose pellets) are used, and the blocks secured on rods or, if the rodent pest is mice, within RTUs.

3. Under no circumstances should rodenticide tracking powders be used inside or around any restaurant at any time. This is because where ever a rodent goes with rodent tracking powder on its body, so goes the contamination threat to food, dishes, countertops, boxes, utensils and the like.

d. <u>For areas and situations of low or non-existent rodent activity</u>

Depending on location, history, structural designs, utility system layout and the specific environment of a ceiling, some restaurant ceilings may not be conducive to rodent activity.

1. In restaurants that have no prior rodent history, the installation of monitoring stations and bait stations into ceilings may not be necessary.

2. However, if a restaurant contains a suspended ceiling, the ceiling void should **<u>always</u>** be part of a pest inspection during the routine servicing, and the negative or positive results recorded on the restaurant's service sheet.

3. It is not pro-active operation by the restaurant, nor pro-active service by a pest control contractor to "wait" and respond until after rodents move into these spaces. By then, the service is merely reactive, and will now need to conduct rodent elimination efforts in the ceiling and the other parts of the restaurant. Obviously, this increases the chances of rodents foraging about and being seen by customers.

f. Additional comments and suggestions regarding pest control services

1. All floor and ceiling rodent control equipment should be inspected during each service visit.

2. All equipment should have date labels for recording dates, technician (or bar coding).
3. With wind up traps avoid over-winding and check to make sure all panels of the trap are closed tight.
4. For the teeter-totter trap door style traps (Tin Cat, Pro-Ketch, Repeater), the lid must be checked carefully to ensure it "snaps" down into position around the three sides of the trap base.

NYC Rodent Control Academy

Mouse trapping techniques

1. Program Pauses and Trap Shuffles
   Every 2-3 days of trapping in severe infestations, the mouse traps should be closed down for a few days. Otherwise, the capture rates drop off dramatically even though there are typically many mice still active.

   Pausing in the trapping program helps accelerate the capture rate upon re-start. When the re-start occurs, the traps should now be shuffled into different positions up, down, or sideways 5-10 ft/ 1.5-3.5m away from the original positions. It is important to ensure that each shuffle results in a different trap baited.

2. Utilize trap models with expanded triggers.
   In field trials using large numbers of traps against severe infestations of mice, the expanded trigger traps produced capture higher rates as compared the non-expanded trigger models

3. Utilize nesting materials for baits in addition to food baits. Small pieces of thread or cloth that mice use for nesting materials may also make for good baits (e.g. dental floss is convenient to use and carry). Female mice exhibit intensive nest building activity just prior to the onset of the cold weather, and within a day or two of birthing a new litter. Nesting material will not spoil, nor will it be consumed by ants. With nesting materials, it may be helpful, to place a piece of the selected material on the ground next to both sides of the trap.

4. Install unbaited runway traps using expanded trigger traps in addition to baited traps. With expanded trigger traps rodents can be trapped without using bait by positioning the trigger next to the wall where the rodents kinesthetically run (see glue trap discussion below). Allow one or two inches of space between the wall (or other surface) and the snap trap.

[Vertebrate Pests] Pest-proofing small holes

May 31, 2005

In elementary level pest management classes, we learn that we should advise our clients to keep holes in buildings with diameters of 6mm/¼ inch and larger sealed to exclude rodents. Certainly, pest proofing is the best method of pest control. In fact, ideally, all holes of any size should be sealed to exclude not only rodents, but invading insects as well.

But what do we actually mean when we advise our clients (or perform the work ourselves) to repair the holes, cracks and crevices of buildings? "Plugging a hole" to keep pests out may be a menial job, but it is important that it be done correctly. Too often, this seemingly simple task is not given the attention it deserves.

"Pest-proofing" small holes ranges from the simple stuffing of some metal mesh into a hole to a more detailed process of selecting a specific sealant for the particular hole or opening and then ensuring the sealant is applied with attention to detail and good workmanship. This column addresses pest-proofing small holes from simple to the more elaborate situations to keep rodent (and insect) pests out in a manner that offers cost-effective permanency for your clients.

CAULKS VS. SEALANTS. The terms "caulk" and "sealant" are sometimes used interchangeably, but they are actually two different materials. Both caulk and sealant have their place in structural repairs (and thus in pest-proofing). Unfortunately, it is common to hear from the lay public and pest professionals alike the generic phrase of "caulking up" holes and cracks. But for persons involved in building maintenance (e.g., contractors, maintenance personnel, building supers, pest professionals), using the correct material and terminology is important.

With one of my pharmaceutical clients, for example, their pest management professional recommended the pharmaceutical company "caulk" up a large wall to keep clover mites from entering the filling room. The pharmaceutical company followed the pest professional’s direction and caulked a large section of an exterior wall. The result: clover mites later contaminated a significant amount of their product because the mites penetrated beneath the brand new caulk bead. This was a very, very expensive mistake in terminology.

The key to using either a caulk or a sealant to repair a break lies with the word "elastomericness." This technical word simply refers to whether or not a material will return to its original size and shape after being stretched or compressed.

Most caulks or caulking compounds are non-elastomeric. Caulk materials are used for filling small joints (¼ inch [6 mm] or less) where little or no movement is expected. Thus, for many pest-proofing situations, caulking compounds are not appropriate materials.

Sealants, on the other hand, are elastomeric materials used to seal joints where movement between the elements ranging from 25 to 50 percent is expected. (Sometimes, a "sealant" is confused with a "sealer," another material that is occasionally used for certain types of pest exclusion. A sealer, however, is a liquid coating applied to surfaces for filling pores and hairline cracks.)

But there are differences among sealants and selecting the right sealant for the job is important. The factors that should be considered when choosing a sealant include: 1) the amount of movement expected at the joint; 2) compatibility between the surface and the sealant materials; 3) durability (e.g., resistance to moisture, wear, oxidation, high temperatures and UV light); 4) temperature ranges; 5) appearance (especially paintability); and 6) ease of application.

Sealants that contain siliconized acrylic latex or ethylene copolymers rate high for the above factors and thus are excellent choices when high-quality pest exclusion work is necessary.

For example, both of these sealant groups allow for up 25 percent movement between joints, can last up to 30 years and maintain their seals within temperatures ranging from -20 to 180°F. These sealants also can be painted and they are compatible with nearly all surfaces except plastics. Some of the common label brands of high quality sealants in these groups include: NP-1™; Geocel™; and Rustoleum’s Industrial-Grade Sealant Compound. But there are others; a little Web surfing will offer up other name brands.

FOAM FILLERS. One of the more common materials used for "plugging a hole" by both the public and by many pest professionals is expanding foam fillers. Because these foams are applied directly from a can and they expand into a gap right before the user’s eyes, foam fillers are popular. But foam fillers do not provide for much elastomericness, nor due to the nature of their chemistry do they provide complete seals as can true sealants.

Nevertheless, foam fillers have their place for some types of pest-proofing. They can be used where the more permanent pest-proofing of a hole may not be necessary. Or they can be used where the area to be filled is not visible or is not in a sensitive building or area.

For example, if incoming rodents and large insects are using a hole around a plumbing fixture below the kitchen or bathroom sink cabinet, or via some similar gaps in basements, utility rooms and other out-of-sight areas, a quick foam plug or filling of a hole may be the most cost-efficient approach. Foams also can be used to fill in large holes before finishing the job off with an appropriate sealant.

But foam fillers should not be used when the job calls for a sealant, especially for sensitive accounts, such as food-handling establishments, health-care facilities, zoological gardens, pharmaceutical operations and similar facilities.

The disadvantages of using foam fillers include:

1) Foam fills are not cleanable. Once dry, the foam bead or plug creates hundreds, possibly thousands, of microscopic nooks and crannies in which dirt, dust, food dust

and a range of other materials might become lodged. If the foam gets wet, the recipe exists for the growth of bacteria, fungi and/or mold.

2) Rodents and those inspect pests with chewing mouthparts (e.g., ants, cockroaches) can chew through and penetrate foam plugs and fills.

3) A true seal between two elements is not formed with foam. Expanding foams will fill a hole enough to exclude a rodent and some larger insects. But expanding foam is often not complete enough to exclude small arthropods such as mites, ants, psocids and other small insects pests from all areas.

4) If care is not exercised when applying expanding foams behind moldings, baseboards, fascia boards and similar structural elements, the foam can warp the structural elements out of shape. This in turn negates the primary function of these structural elements (which is to serve as closers of the gaps that are created where walls meet floors or roofs).

5) Urethane foam degrades with constant exposure to sunlight and thus should not be used for exterior holes and gaps.

Some contend that a foam "plug" can be used as a temporary plug until the hole can be sealed properly later. Possibly. But the foam plug will eventually have to be removed and the hole prepared properly (i.e., completely scraping out the foam residue) to hold a more permanent sealant. This makes for twice as much work as it would take to seal the hole using the proper materials in the first place.

METAL MESH PLUGS. Metal mesh plugs, such as copper mesh or steel wool, are commonly used by pest professionals to plug small holes in walls and around plumbing fixtures.

These materials are appropriate when the prevention of pest movement is desired, but moisture and air movement through the hole is also desired (e.g., weep holes in brick veneer walls). Construction adhesive or mortar can be used to "glue" plugs in place if rodents are removing them. In locations where high humidity or exposure to water is expected, steel wool will rust, which both reduces its effectiveness and causes rust stains. In these locations, copper mesh is the best choice of material.

But inside buildings, where holes exist in concrete, wood and masonry, metal mesh plugs should be used only as temporary plugs. Depending on the situation, a copper mesh plug stuffed tight into a hole beneath a cabinet may last anywhere from days to years depending on movement between the elements. Determined rodents can work out mesh plugs by pulling and/or gnawing on them. When a temporary plug is needed until a good sealant can be used, the use of copper mesh is a wiser choice than using a foam filler plug (i.e., the mesh plug can be cleaned and quickly removed).

DO IT RIGHT THE FIRST TIME. When a hole needs to be pest-proofed, it is best for a pest professional to err on the side of completeness and efficiency. Relative to the on-the-job costs, a high-quality sealant is not really more expensive than a low-quality caulk. And, a sealant will always suffice wherever a caulk could be used, but a caulk cannot suffice where a sealant is needed.

SECTION 4: RODENTICIDES

NYC Rodent Control Academy

Rodenticides

Dr. Bobby Corrigan

Introduction

Rodenticide baits comprise the primary thrust of pest management operations against rodent infestations.

The second-generation anticoagulants are the primary group of rodenticides used by pest professionals.

Block baits offer good to excellent palatability, placement versatility, and securement options for minimizing bait availability hazards.

Recent technology has also produced novel and improved tamper-resistant bait stations, that when coupled with block bait formulations offer highly professional baiting strategies. Regardless of the baits and bait stations however, the most essential key to infestation reductions is via effective bait placements into the high activity areas of the specific rodent species as determined from thorough inspections.

When rodenticides are used according to label directions, and the safety precautions adhered to, rodenticides present little hazard to non-target animals or to the environment. However, primary poisoning due to unprofessional bait application is the leading cause by which companion animals and other non targets are hurt by rodenticides.

NYC Rodent Control Academy

Regardless of the bait's brand and formulation selected for a particular baiting program, no brand can compensate for improper baiting technique as a result of incomplete inspections.

Rodenticides must be used correctly to provide the most benefit with the least risk to non-targets.

Chemicals (i.e., rodenticides) play a role in IPM, but must be used very carefully keeping in mind children, pets, and urban wildlife such as birds, squirrels, and others species.

How do rodenticides work?

Anticoagulants

Active ingredients in commonly used anticoagulants

The older active ingredients: warfarin.

Brodifacoum at 50 parts per million

Bromadiolone at 50 parts per million

Difethialone at 25 parts per million

Non-anticoagulants Rodent Baits

Zinc Phosphide

Cholecalciferol (Vit D3)

The best formulations to use and where

Blocks, pellets and meal

Are rodents developing resistance to the baits?

Thus far, resistance to second-generation anticoagulants in the US has not been formally recorded. Pockets of second-generation resistance to at least certain compounds may exist, but remain undetected or unrecorded.

Rodenticide resistance is often used as an excuse for obtaining poor results. However, several factors other than resistance are usually responsible for baiting failures.

NYC Rodent Control Academy

Rodenticide Baits: FAQs

The following are frequently-asked-questions regarding on-the-job use of rodent baits.

Question: How important is it for the rodent baits in the service vehicle or on the shelf in the storeroom to be protected from chemical (insecticidal, cleaning agents, etc.) odors?

Answer: In some cases, it may be crucial. In infestations where rodents may have readily available food sources to them, they have the option of rejecting new-appearing foods that have chemical tastes. It makes sense to maximize the palatability of the grain-based baits. Thus it is smart to prevent rodenticides from becoming contaminated with chemical odors.

Question: Using the pellet formulation as an example, how many pellets of the second generation anticoagulants does it take to kill a mouse, and a rat?

Answer: Usually only a few pellets will kill a mouse. In some cases, only a pellet or two may be effective. For rats, usually 6-30 pellets depending on the brand are required. Both rats and mice will continue to feed for several days until they succumb to the effects of the poisons.

Question: What does it mean to see droppings the color of the bait in the bait station if the bait is supposed to be killing the rodents?

Answer: Colored droppings indicate a rodent has ingested and digested the bait and its active ingredient. It takes several days for most baits to kill a rodent. Mice produce upwards of 50 or more droppings every day, rats 30-40. Thus, some droppings will be passed through the body containing the green, blue or red dye of the rodent bait. The rodents that produced the colored droppings are usually dead by the time the colored droppings are noted inside the bait station, or they area likely to be near death.

Question: Once applied, how long will rodent bait stay attractive to rodents?

Answer: Most recommendations suggest changing out rodent baits on a 4-6 week schedule on a need-it-or not basis. In cases of maintenance baiting, and in low risk situations if the bait has remained undisturbed by dirt, dust, or moisture, change-out periods may be extended to slightly longer periods as determined on a case by case basis.

Question: Will mice or rats dying from the affects of the bait leave the building to die?

Answer: Poisoned rodents may die anywhere, including in some very inconvenient areas. There is no evidence the rodents exit buildings "seeking water" and die outside (although this would be very convenient for all parties). Most times, poisoned rodents die in their nests. It is also common to find rodents dead or near death in bait boxes.

Question: What is the typical length of time required for a second generation anticoagulant bait (brodifacoum, bromadiolone, difethialone) to kill a rodent?

Answer: Several factors may affect the time to death, but it varies from rats and mice, and from the particular active ingredient involved. Rodents subjected to those compounds with the lowest LD50 values tend to die sooner than those with higher values. But it also depends on specific colony factors as well. In general, anticoagulant baits can produce death as early as 3 days, but in some cases it may take up to 18 days.
For practical purposes , it is best to be conservative and inform clients that it could take 7-10 days before the first rodents succumb and cease their activity in the building or areas. Severe infestations may require 3-4 weeks to achieve a high level of control.

Question: If a cat or dog consumes two or three mice that died as a result of any of the popular rodenticides being currently used (second generation anticoagulants or non-anticoagulants), what is the likelihood of the pet dying of secondary poisoning?

Answer: Almost nil. The dead mice have already assimilated the poison baits, and from a practical perspective, there are no secondary poisoning characteristics with the anticoagulants. Secondary ingestions of undigested baits that still remain within the mouse's stomach can occur, but there is not nearly enough bait in these few rodents to kill, or even render a cat or dog sick.

Question: If the same anticoagulant bait has been used on one route for the past three years, can it be assumed the rodents in that area may be developing resistance to the baits?

Answer: Many factors are involved beyond just the constant use of the same baits over long periods of time; thus, there is no reason to assume resistance is developing. Nevertheless, encouraging sanitation in commercial accounts, good placements of baits, and rotating bait every several months between the anticoagulants and non-anticoagulants or, using the more powerful anticoagulants are important strategies in resistance management.

Question: Will switching from one brand of bait to another, delay resistance from developing within the rodent population?

Answer: To obtain the maximal chance of delaying rodenticide resistance, it is most effective to switch between classes of rodenticides. In other words, switching from an anticoagulant to a non-anticoagulant product. There may also be some benefit gained by changing from the first generation anticoagulants to the more powerful of the second-generation anticoagulants (e.g., brodifacoum or difethialone).

Question: What is wrong with tossing "packet-style baits" into the hard-to-reach ceiling or floor voids where it is suspected the mice or rats are running?

Answer: In general, a pest professional should never "lose control" over the pesticides they apply. Rodents can move packet baits tossed into "inaccessible areas" to areas accessible by children, pets or wildlife. Baits tossed and abandoned into inaccessible voids may also cause future grain insect infestations. Additionally, most rodenticide labels clearly direct the user to not broadcast baits and to retrieve unconsumed baits.

New York City
Department of Health and Mental Hygiene
Pest Control Services

Best Practice Procedure NO. 1

Baiting Rat Burrows

Introduction

In general, baiting rodent burrows can be done relatively easily, quickly, and inexpensively. But because burrow baiting appears so easy, the procedure can also lead to some problems if the appropriate precautions are overlooked. As this Best Practice Procedure discusses, there is more to correctly baiting rat burrows than stuffing a packet or pouring meal bait down a rat hole and then caving in the burrow.

The correct baiting & monitoring of rat burrows is important for three reasons: 1) to maximize safety to people and non-target wildlife; 2) to maximize the eradication of the rats living within the burrows; and 3) to allow for accurate follow-up and monitoring of the burrow system long term, which in turn provides a guideline for timely follow-up treatments.

From a safety aspect, it must be kept in mind that hundreds of thousands of New Yorkers walk dogs; inquisitive children play in parks, yards, and empty lots; and millions enjoy watching New York's urban wildlife such as tree squirrels and birds of all kinds. All of these animals inhabit parks as well as the smallest yards and lots. Incorrectly baited burrows can potentially harm all of these non-target groups and the environment. Finally, from an operational standpoint, incorrect baiting does not allow for the necessary monitoring post-baiting in order to determine whether or not the burrow is still active, and results in a waste of time and money, and an unnecessary introduction of pesticide in the environment.

The following is a best practices procedure for safely and correctly baiting rat burrows to achieve maximal effect.

Bait formulation

Technically, each of the rodenticide formulations (pellets, packets, blocks, meals, seeds) can provide good rat control. But certain bait formulations are better suited for burrow baiting efforts and non-target safety than others. In general, rodents have more of a tendency to translocate (i.e., carry away and move the bait) a bait back out of their burrow if the bait is large in size and easily movable.

Importantly, packet-style baits and whole bait blocks can be easily moved, carried, or pushed about by rats. **Bulk loose pellets** (i.e., not in packets) offer both small size, and good "weatherability." Some professionals crumble their bait blocks into smaller sizes, and then pour these into burrows, which is apt to achieve the same goal as using the pellets. (NOTE: Simply crumbling bait blocks does NOT constitute a reformulation of the bait and is therefore permitted under label regulations. This is the case as long as no additional substances are mixed with or added to the bait.)

Considering the dampness of the ground associated with burrows, some believe that the packet-style baits and "waxy" blocks offer the best resistance to weather and moisture. But loose pellets when inserted correctly into a burrow are likely to be consumed by rats long before they would be subject to deterioration from the ground moisture found within an active burrow.

Applying bait to burrows

The key to successful burrow baiting is to deliver the bait with as little disturbance to the rat's home as possible. This is because Norway rats are sensitive to changes in their environments. Often they react towards changes by avoiding or rejecting new items that are associated with any disturbances to their daily routine.

Thus, perhaps the most effective way to bait a Norway rat's burrow is to mimic Mother Nature. In the rat's natural life in fields and open areas the wind blows seeds, berries, nuts and other edible items across the ground. These items tend to roll into and down the burrows. Thus, carefully placed bait pellets inserted directly down into a rat's burrow system are rarely translocated out of the burrow compared to packets or big bait blocks.

The following steps are recommended:

1. Burrows should be baited with bulk-style pellets using a long-handled (3-4 ft.) scoop applicator or via a hose-and-funnel technique.

2. For the hose and funnel technique, a plastic funnel can be attached to a 2-3 ft. section of garden hose (3/4 inch or more diameter to allow for good pellet flow). This technique will allow for a quick pour and ensure good penetration of the bait into the burrow. The hose and funnel technique also helps to save on the physical exertion of constantly bending over when many burrows need to be treated. (Before applying bait, ensure the hose is not stopped up with soil.)

3. To provide adequate protection against non-target animals gaining access to bait, <u>all baits should be placed down into the burrow so the bait is not visible from the entrance. Depending on the construction of the burrow, this will mean the bait will be inserted down from about 1-3 feet into the burrow</u>.

4. The amount of bait applied should be done according to label directions. For severe infestations, use the maximal amount of bait recommended. Use the minimal dosages for minor infestations. In most cases, each active burrow hole should receive about 4-5 ounces of bait. Assuming there may be 2-3 burrow entrances per rat family, this amounts to the correct amount of bait per bait point.

5. After baiting a burrow, **<u>do not</u> cave in the burrow with soil or paper.** Correctly baited burrows should remain open and undisturbed for at least one—and preferably two—weeks. There are several reasons for this. First, it usually takes about 5-7 days for poison bait to kill or immobilize a rat so there is little use of caving in the burrow immediately after baiting. Active rats will continue to come and go from the burrow system for several nights, conducting their daily forays for water, food or to conduct other behavioral routines; rats will re-open any caved-in burrows until they succumb to the effects of the bait. Second—and most important from a hazard exposure point of view—is that with a rat's re-opening of their "disturbed" burrow, any object that is new and unfamiliar to the rat that arrived with the cave-in (i.e. your bait) may be pushed back out on top of the ground along with the soil they are excavating. This allows for potential exposure to humans and wildlife from bait that is pushed back above ground. This has been documented in countless instances around parks, zoos, yards and farms throughout the country. **In summary, when pest control professionals cave burrows in immediately after baiting in an attempt to protect against unintended bait exposure to non-target animals, they are unwittingly creating a situation that increases the chances of exposure.**

6. Place a flag[1] or other notifying device nearby the treated burrow areas. One flag can be used for a general area (i.e., a flag is not needed for each burrow system).

7. On data sheets, record the location, day, and time the burrows were treated.

<u>Monitoring and Closing the Burrows</u>

1. One to two weeks (e.g., between 7-14 days) after the initial baiting, cave in the previously baited burrows with soil, or if soil is not easily available use wads of paper.

2. Re-inspect the closed burrows 1-3 days later.

[1] This is in addition to legally required signage. As an example, a small plastic colored marking flags (24" tall) can be used. The flags can be worded: "This area being treated by the NYC Health Department [or appropriate agency]". A date can be written on the flag using a permanent marker pen.

3. Re-opened burrows demonstrate that the burrows are still active and should be re-baited. Re-bait any reopened (i.e. still active) burrows. The applicator should assume that there are fewer rats per burrow, so about one-half as much bait as was used on the initial baiting can be used per burrow for the follow-up baiting.

4. Again, 7-14 days later, repeat the process until control of the rat colony is complete.

5. Once control has been achieved all flags can be removed from the area.

Using this procedure, especially revisiting infested areas repeatedly until the local rodent population is eliminated (or very nearly so) ensures that you are not simply reducing the population by a few rats after a single baiting, but are effectively knocking down and eliminating the population and preventing it from rebounding quickly. A single baiting in an infested area may **reduce** the population by as much as 40% of the rodents. However, **that is not nearly enough to eliminate** it. A 40% reduction after a single baiting, without follow-up baiting in still-active burrows, can allow the population to rebound to its original size (or greater) in a matter of weeks.

Done properly, repeat bait application can eliminate or reduces the target population by 90-95 percent. This means it might take any surviving rats many months to rebound to original numbers, or they may never be able to rebound at all (Of course, sanitation in the target area, reduces the rodents' food sources, to help ensure that long term control is maintained.)

Just as it is important to leave the burrows open during the baiting program, it is equally important to stress that all burrows following successful control should be filled in as best as possible with soil. In this way, community-level rat infestations can be monitored for any new or surviving infestations. Additionally, old rat burrows are attractive harborage sites for any incoming new rats, as well as for stinging yellow jackets and other ground-nesting pests to build their nests.

Using this Best Practices Procedure will provide for fresh attractive bait to be delivered directly to the rats while simultaneously reducing exposure to non-targets animals. With pesticide applications, everyone has a responsibility towards the environment and non-target animals. For baiting New York rats, the professionalism lies in the details.

NYC Rodent Academy

Baiting active rat burrows: Some tips and guidelines.

1. The rodent bait labels for **the different brands**: Contrac, Maki, Talon allow for sufficient amounts of bait for even the most severe infestations.
2. **These labels allow for 3-16 ounces of bait at intervals of 15-30 ft. The lower amounts are used for light infestations; the larger dosages for the heavy infestations.**
3. Even though one adult rat will eat 1 ounce of food over 24 hrs., it only takes about one dose of only 6-8 pellets of bromadiolone (e.g., Contrac or Maki) to kill a rat about a week later.
4. One ounce of bait poured down into a burrow (or installed in to bait boxes) will usually be fed upon by several rats the same evening.
5. Only active burrows should receive bait. In most cases, correct baiting of each **active burrow hole** requires between 1 to 5 ounces, but not to exceed the label directions (No. 2 above).
6. Keep in mind, it is possible to have as many as 20-30 burrow holes (some active; some not) along a 30ft. stretch.
7. In a light infestation of rats (e.g., 1 burrow system with 3 holes), 1 ounce of bait into each holes will very likely eliminate this infestation.
8. But, large holes, with lots of rat signs, activity, well worn trails, etc., may necessitate as much as 3-5 ounces of bait per **active** hole (but again not to exceed 16 oz every 15 to 30 ft.
9. Always follow label directions: filling rat holes with too much bait is illegal and a waste of bait and time.
10. Controlling severe infestations of rats burrowing in an area, is not so much a matter of how MUCH BAIT per hole, RATHER, making the correct number of trips to finish the rats off properly (a minor infestation usually requires a minimum of 3 visits; more severe infestations; 5-6 visits as per the above recommendations).
11. The bolt holes (escape holes) of a burrow system need not be baited. Bolt holes are the holes with leaves, rocks, twigs, etc., over them, and a lack of smooth trails leading down into them.

Point of reference: (e.g., a typical packet of bait = about one ounce).

Rodenticide Tracking Powders

When and where do tracking powders have a place in city rodent control programs?

What are the special safety issues associated with the use of tracking powders?

See Best Practices Section

New York City
Department of Health and Mental Hygiene
Pest Control Services

Best Practice Procedure NO. 2

The Safe Use of Rodenticide Tracking Powders

Introduction

Rodenticide tracking powders contain the same toxic active ingredient as typical block and meal formulations of bait, except that it's blended into a powder carrier (e.g., finely ground talc). However, ***the active ingredient in tracking powers is many times more concentrated than in other bait formulations,*** making it a particularly effective rodenticide, but with a great deal more potential for non-target species—including humans—to become sick if it is improperly placed and accidentally ingested. Tracking powder applied to a rodent burrow is designed to be picked up on rodents' foot pads, fur, and/or tail of the rodents during their travels. The powder is then ingested when the rodent licks its body during grooming.

Occasionally, tracking powders are incorrectly referred to as "dusts", but this term should be avoided because a pesticidal "dust" is legally different than a "powder".

In most situations, tracking powder should be considered a specialized tool used only when baits and/or traps fail due to finicky rodents that are either trap shy, or are uninterested in baits because of an abundance of alternative food.

Special precautions must be taken when tracking powders are used. Otherwise, people, pets, urban wildlife and/or the environment can be harmed. In general, this rodenticide should be considered a ***last resort*** after all other approaches have been correctly implemented, but have failed.

Different types of tracking powders

The tracking powders used for rat control contain a toxic anticoagulant—the same as is used in the grain rodenticide baits. One of the more common tracking powders used currently for treating exterior rat burrows is the Ditrac® brand containing the anticoagulant *diphacinone*. Another brand, RoZol® contains the anticoagulant *chlorophacinone*. Both of these active ingredients belong to the same chemical class of anticoagulants.

It is important to note that all tracking powders are restricted use pesticides.

For mouse control, another tracking powder contains the acute rodenticide, zinc phosphide, and has the trade name ZP Tracking Powder®. This product is labeled only for indoor uses and only against mice. In nearly all cases, ZP powder is used only by private contracted pest management companies for specialized situations.

How tracking powders work

Tracking powders work by sticking to a rodent's feet or fur after a rodent runs through the material. The powder is not absorbed through the rodent's body, nor is it inhaled. It is ingested when the rodent is grooming and cleaning itself with its tongue. Generally, only a small amount of tracking powder is picked up. To compensate for this, the concentrations of the poison in tracking powders are much greater than those used in baits containing the same active ingredient.

For example in tracking powders, the *diphacinone* toxicant is mixed at a 0.2% concentration. This concentration is ***40 times stronger*** than the *diphacinone* mixed into baits (0.005%).

Once a rodent grooms and ingests the powder, the time to death varies according to the active ingredient. With diphacinone and *cholorophacinone* powders, it can take from 5 to 10 days for a rat to succumb. With the acute tracking powder zinc phosphide, death can occur as quickly as a few hours.

When and How to use Tracking Powders

Remember that tracking powders are ***restricted use*** pesticides. Therefore, there are special concerns with their use.

1. The approval of a program director must be obtained before applying tracking powder.

2. Tracking powders should be considered only when all other efforts have been correctly implemented, but have failed.

3. Re-read the product label each time before using a tracking powder to ensure the site being considering is allowed by law. It also ensures that you are reminded of, and follow, all safety and personal protection guidelines.

4. Note that exterior use of tracking powders is restricted to: "only rat burrows that are located along the periphery of buildings and that are likely to serve as routes of entry into these structures."

5. A typical situation where tracking powders might be used would be an abandoned lot next to an old buildings where perhaps food trash is a constant battle and the rats are not responding to baits.

6. When applying tracking powders, always wear gloves and a MSHA/NIOSH approved dust/mist (N95) respirator.

7. Do not use tracking powders in city or community parks where rats may be traveling along the same paths or are active on the same surfaces that people might use, or on which pets or wildlife might travel. Rats might carry the powder on their feet or body to these areas when leaving a treated burrow.

8. When treating burrows next to building foundations, check to ensure air intake or exhaust ventilators or duct openings are not nearby. Powders applied in these situations could be sucked into the building or blown about.

9. When just a few burrows need to be treated, a hand held bulb duster can be used.

10. Tracking powder labels dictate that each burrow should receive about 5 grams, or approximately 1/6 of an ounce, of powder. Tip: One ounce of tracking powder is about six level teaspoons of powder, so approximately 1 teaspoon is needed per burrow.

11. When treating multiple burrows, foot dusters can be used and the powder applied according to label directions.

12. Do not apply tracking powder into burrows on rainy days, or before heavy rain is expected because the moisture will not allow the powder to be properly applied in the burrow.

13. Place a flag or other appropriate notification device nearby the treated burrow areas.

14. On data sheets, per PCS protocols, record the location, day, and time the burrows were treated.

Follow-up Monitoring and Burrow Closures

The treatment of rodent burrows after the use of tracking powders is similar to the methods used for burrow baiting operations.

1. 5-7 days after the initial treatment, cave in the treated burrows with dirt, leaves, or wads of paper.

2. Re-inspect the closed burrows 1-3 days later.

3. Re-treat any re-opened (i.e. still active) burrows as described above and according to label restrictions.

4. Repeat the process until control of the rat colony is complete.

5. Once control has been achieved remove posted notices from the area.

After control of the rats is achieved, all burrows should be filled in. In this way, community-level rat infestations can be monitored for any new or surviving infestations. Additionally, old rat burrows are attractive harborage sites for any new rats that move into the area. During the springtime and early summer, stinging yellow jackets may also use old rat burrows for nest sites.

Remember, professional (i.e., safe and effective) pesticide applications is your job! Following this and other Best Practices Procedures will protect people, pets, wildlife and the environment, while effectively controlling rodents.

RODENTICIDES
TOPIC FACT SHEET

npic
NATIONAL PESTICIDE INFORMATION CENTER
1.800.858.7378

What are rodenticides?

Rodenticides are pesticides that kill ***rodents***. Rodents include not only rats and mice, but also squirrels, woodchucks, chipmunks, and other animals. Although rodents play important roles in nature, they may sometimes require control. They can damage crops, violate housing codes, transmit disease, and in some cases cause ecological damage.[1]

Rodents, humans, dogs and cats are all mammals, so our bodies work in very similar ways. Rodenticides may have the same type of effect when eaten by any mammal. They can also affect birds. Rodenticides are usually formulated as baits, which are designed to attract animals. Flavorings may include fish oil, molasses or peanut butter. Baits used in agriculture and natural areas may contain ground meat, vegetables, grains, or fruits.[2] These may be attractive to ***children*** and ***pets***, so they should never be used or stored within their reach. Tamper-resistant bait stations make it even more difficult for accidents to happen. For ways to prevent exposures to children, pets, and wildlife, see the information below about what you can do to reduce risks.

How many kinds of rodenticides are there?

There are many different ***active ingredients*** registered as rodenticides in the United States. They can be grouped together according to how they work. Many rodenticides stop normal blood clotting; these are called anticoagulants. Bromadiolone, chlorophacinone, difethialone, diphacinone, brodifacoum, and warfarin are all anticoagulants. There are a number of rodenticides that are not anticoagulants, and these work in different ways. This fact sheet will discuss ***zinc phosphide***, bromethalin, cholecalciferol, and strychnine.

How toxic are rodenticides?

All rodenticides can be toxic when eaten.[3,4,5,6] See Table 1 on page 2. Most rodenticides are also toxic when inhaled and when they come into contact with skin. The exceptions include warfarin, which is low in toxicity when inhaled or if skin contact occurs.[6] Strychnine, cholecalciferol, and zinc phosphide are relatively low in toxicity upon skin contact.[3,5,7] Bromethalin is moderately toxic for dermal exposure.[4]

How do anticoagulants work?

Our livers make a special enzyme that allows our bodies to recycle Vitamin K. Our bodies need Vitamin K to make the blood clotting agents that protect us from bleeding too much. Anticoagulants stop this enzyme from doing its job. Our bodies store an extra supply, but if we are exposed to enough anticoagulant, the supply will run out and internal bleeding may begin.[8]

NPIC fact sheets are designed to answer questions that are commonly asked by the general public about pesticides that are regulated by the U.S. Environmental Protection Agency (US EPA). This document is intended to be educational in nature and helpful to consumers for making decisions about pesticide use.

npic
NATIONAL PESTICIDE INFORMATION CENTER
1.800.858.7378

Table 1. ACUTE TOXICITY CLASSIFICATION - RODENTICIDES

	Oral	Inhalation	Dermal	Primary Eye Irritation	Primary Skin Irritation
Warfarin[3,6]	Moderate - High toxicity	Not significant	Not significant	**No data**	**No data**
Chlorphacinone[4]	High toxicity	High toxicity	High toxicity	**Non-irritating**	**Non-irritating**
Diphacinone[4]	High toxicity	High toxicity	High toxicity	**Moderate irritation**	**Slight irritation**
Bromadiolone[4]	High toxicity	High toxicity	High toxicity	**Low irritation**	**Minimally irritating**
Difethialone[3]	High toxicity	High toxicity	High toxicity	Mild irritant	Non-irritating
Brodifacoum[4]	High toxicity	High toxicity	High toxicity	Minor irritation	Mild irritant
Bromethalin[4]	High toxicity	High toxicity	**Moderate toxicity**	Slight irritation	Non-irritating
Cholecalciferol[3]	High toxicity	Very low toxicity	**Low toxicity**	No data	No data
Zinc phosphide[5]	High toxicity	High toxicity	**Low toxicity**	Slight irritation	Non-irritating
Strychnine[7]	High toxicity	High toxicity	**Low toxicity**	Highly irritating	Non-irritating

Classification categories were modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Labeling. http://www.epa.gov/oppfead1/labeling/lrm/chap-07.pdf

Warfarin was the first anticoagulant rodenticide.[1] It was registered for use in 1950.[4] Warfarin was discovered in moldy sweet clover that had made a herd of cattle sick. Researchers found that a fungus had converted a chemical that occurs naturally in the clover to a more toxic chemical.[9] Warfarin was the most widely used rodenticide until many rodents began to become resistant to it. This led to the development of new rodenticides.[9]

Which anticoagulants require more feedings to work?

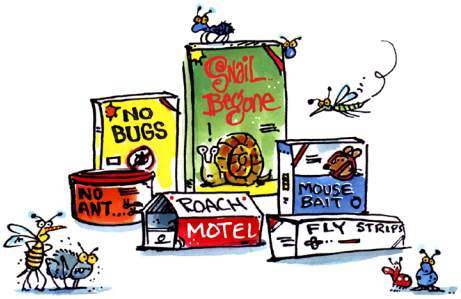
Warfarin, chlorophacinone, and diphacinone generally require that an animal eat multiple doses of the bait over several days. These are known as multiple-dose anticoagulants. Single-dose anticoagulants, such as brodifacoum, bromadiolone, and difethialone are more toxic. One day's feeding can deliver a toxic dose.[4]

Table 2. Summary of common rodenticides

Rodenticide	Type	Chemical class	Days of feeding needed
Warfarin	Anticoagulant	Hydroxycoumarin	multiple
Chlorphacinone	Anticoagulant	Indandione	multiple
Diphacinone	Anticoagulant	Indandione	multiple
Bromadiolone	Anticoagulant	Hydroxycoumarin	single
Difethialone	Anticoagulant	Hydroxycoumarin	single
Brodifacoum	Anticoagulant	Hydroxycoumarin	single
Bromethalin	Non-anticoagulant	other	single
Cholecalciferol	Non-anticoagulant	Vitamin D3	multiple or single
Zinc phosphide	Non-anticoagulant	other	single
Strychnine	Non-anticoagulant	other	single

Single-dose anticoagulants are more toxic because they bind more tightly to the enzyme that makes blood-clotting agents. They can also interfere with other steps in Vitamin K recycling. Second-generation, or single-dose anticoagulants, are not easily excreted from the body, and they can be stored in the liver.[10] Most of these rodenticides are not allowed to be marketed to non-licensed applicators for residential use.[11] Instead of classifying anticoagulants into "first generation" or "second generation", many sources refer to them as multiple-dose or single-dose rodenticides because it is less confusing.

What are some of the other rodenticides?



There are a number of rodenticides that work differently than anticoagulants. These are currently used within the United States: bromethalin, cholecalciferol, zinc phosphide, and strychnine. Each of these pesticides works in a different way.

Bromethalin was first registered by the U.S. Environmental Protection Agency (EPA) in 1984.[4] It stops the cells in the central nervous system from producing energy. The nerve cells swell, this puts pressure on the brain, and paralysis and death soon follow.[12] The major breakdown product of bromethalin is more toxic than bromethalin itself. The varying ability of different species to break down bromethalin may explain why it is more toxic to some animals than others. [12] Bromethalin is considered a single-dose rodenticide.[4]

Cholecalciferol was first registered as a rodenticide in the United States in 1984.[4] Cholecalciferol is vitamin D_3.[13] Vitamin D helps the body maintain calcium balance by enhancing absorption of calcium from the gut and kidneys.[13] Toxic doses of cholecalciferol lead to too much calcium in the blood, which can affect the central nervous system, muscles, the gastrointestinal tract, cardiovascular system, and the kidneys.[13] The body's ability to maintain proper calcium levels must be overwhelmed before cholecalciferol becomes toxic. Rodents must eat several doses of this rodenticide.[4] This causes a time lag between exposure and signs of toxicity.[13] Although pets have gotten sick from eating cholecalciferol, poisonings of people are very rare.[14]

Zinc phosphide was first registered in 1947.[1] It changes into phosphine gas in the presence of water and acid. The phosphine gas is very toxic; it blocks the body's cells from making energy, and the cells die.[15] Phosphine exposure is particularly damaging to the heart, brain, kidney, and liver.[15]

Strychnine was first registered in 1947, but it was used for many years before then.[16] It can only be used below ground. Products with more than 0.5% strychnine are restricted; they are only sold to certified applicators.[16] Strychnine comes from the seeds of certain plants, *Strychnos nux-vomica* and *Strychnos ignatii*.[17] It affects the cells in the spinal cord by causing nerve cells to fire more readily, which leads to muscle spasms. Given a sufficient dose, the spasms cause breathing paralysis and death.[17]

What are signs of rodenticide poisoning?

Always follow label instructions and take steps to minimize exposure. If any exposure occurs, be sure to follow the First Aid instructions on the product label carefully. Some products contain blue or green dye that helps determine whether a child or pet has handled or eaten the product.[4,18] For additional treatment advice, contact the Poison Control Center at 1-800-222-1222. If you wish to report an incident to the ***National Pesticide Information Center***, please call 1-800-858-7378.

npic
NATIONAL PESTICIDE INFORMATION CENTER
1.800.858.7378

Anticoagulant rodenticide exposure can lead to uncontrolled bleeding in any part of the body, but this is not always obvious. Difficulty breathing, weakness, and lethargy have been seen in animals poisoned with anticoagulant rodenticides. Less common signs include coughing, vomiting, stools marked with blackened, tarry blood, paleness, bleeding from the gums, seizures, bruising, shaking, abdominal distention and pain.[9] Because the stored clotting agents have to run out, signs may be delayed for up to five days following exposure.[8] Children usually eat small amounts and may never show signs of poisoning. Signs in people include sudden bleeding from the nose, gums, or skin. Internal bleeding can also occur.[10]

Bromethalin ingestion causes muscle tremors, seizures, heightened sensitivity to light or noise, and hyperexcitability if the animal eats more than a lethal dose. The onset of signs depends on the dose. If a lethal dose is eaten, signs may develop 8 to 12 hours or several days after ingestion and progress over a period of a week or longer. In this case, animals lose their ability to control their hind legs or sense where their hind legs are. Animals may also vomit, lose interest in food, or adopt strange postures. They may fall into a coma.[12,19] People may also have altered mental status.[20]

Cholecalciferol can be toxic from routine or one-time exposure.[13] Signs in animals include weakness, depression, and loss of appetite. Signs progress to include vomiting, increased thirst, more frequent urination, dehydration, and constipation.[13] Vomiting, diarrhea, loss of appetite, and depression may develop within 12 to 36 hours after exposure and the kidneys may fail within one or two days. Survivors may have permanent damage to kidneys and muscles. Signs of poisoning may last for weeks because cholecalciferol can be stored in the body and its breakdown products are removed slowly.[21] Exposed people experience unusual thirst and increased urination. They may suffer heart and kidney damage if the increase in calcium levels lasts long enough.[14]

Zinc phosphide may cause vomiting within an hour of ingestion. However, signs of toxicity may be delayed for 4 hours and in some cases longer than 18 hours. The vomit may smell like garlic and may contain blood. Other signs of toxicity include anxiety, discomfort leading to frantic pacing, staggering and weakness, difficulty breathing, and convulsions.[15,22] Humans also experience vomiting, excitement, chills, shortness of breath and coughing, delirium, convulsions, and coma. Breathing in zinc phosphide dust or phosphine gas given off by zinc phosphide may cause anxiousness and extreme difficulty breathing.[14]

Strychnine poisoning causes involuntary muscle spasms in both people and animals. These spasms can be severe, and include extreme extension of the limbs. Signs can begin within 15 minutes in people and within two hours in animals after eating strychnine. Death is caused by impaired breathing.[14,17]

What if pets and wildlife eat rodents that have been poisoned?

Rodenticide baits are made to attract animals. Pets and wildlife may take the bait if they find it. When an animal eats the bait directly, it is called primary poisoning. Secondary poisoning is caused by eating poisoned prey. It may also be called relay toxicosis. See the fact sheet on ***Ecotoxicology***. For ways to prevent exposures, see the information about what you can do to reduce risks.

The rodenticides with high secondary poisoning risks to birds such as hawks and owls include difethialone and brodifacoum (see Table 2).[23] The rodenticides that pose the greatest secondary poisoning risks for wild mammals, dogs and cats include chlorophacinone, diphacinone, and all of the single dose rodenticides. Bromethalin and cholecalciferol may pose secondary risks but these risks have not been studied as extensively.[2]

npic
NATIONAL PESTICIDE INFORMATION CENTER
1.800.858.7378

Table 3. Secondary poisoning risks to birds and mammals[2]		
Rodenticide	**Secondary risk to birds**	**Secondary risk to mammals**
Warfarin	slight risk	low risk
Chlorophacinone	slight risk	high risk
Diphacinone	moderate risk	high risk
Bromadiolone	moderate risk	high risk
Difethialone	high risk	high risk
Brodifacoum	high risk	high risk
Bromethalin	possible (insufficient data)	low risk
Cholecalciferol	low risk	low risk
Zinc phosphide	low risk	slight risk
Strychnine[17,24]	possible (insufficient data)	possible (insufficient data)

Single-dose anticoagulants pose a greater risk to animals that eat poisoned rodents.[25] If the rodent continues to feed on the single-dose anticoagulant after it eats a toxic dose during the first day, it may build up more than a lethal dose in its body before the clotting factors run out and the animal dies. Residues of single-dose anticoagulants may remain in liver tissue for many weeks, so a predator that eats many poisoned rodents may build up a toxic dose over time.[26] However, even the multiple-dose anticoagulants may be poisonous to animals who eat poisoned rodents.[2]

Strychnine has caused secondary poisoning in pets that ate poisoned rodents.[17] Zinc phosphide may cause secondary poisoning in pets, but only when the stomach of the rodent still contains intact pellets of the rodenticide. Zinc phosphide breaks down quickly so the rodent must be very recently dead or just dying in order for the zinc phosphide to pose a secondary poisoning risk.[15]

What can I do to reduce the risks?

Always follow label instructions and take steps to avoid exposure. Keep all rodenticides out of the reach of children and pets, whether they are in use or in storage. Because of the flavorings and attractive odors in these products, dogs may ***dig them up***, working hard to get to them. ***Choose the right bait station*** for your needs around the home. Some of them are resistant only to children. Some are resistant to children and pets; others are resistant to children, pets and the weather. The EPA has been taking action to reduce risk by requiring bait stations in sensitive areas and by limiting the most toxic active ingredients available on the homeowner market.[11]

Many rodenticide baits can be toxic to wildlife if they are eaten, or if an animal eats a rodent that was recently poisoned. If you choose to use a rodenticide outdoors, always follow label instructions. To reduce risks of secondary poisoning for pets and wildlife, search for, collect, and dispose of poisoned rodents. Use gloves when disposing of dead rodents to avoid contact and secure trashcan lids to minimize pet or wildlife access to poisoned rodents. If you suspect an ***animal may have been poisoned***, please contact NPIC at 1-800-858-7378 to talk with a Pesticide Specialist.

npic
NATIONAL PESTICIDE INFORMATION CENTER
1.800.858.7378

You may find that there are other things you can do to control rodents, in addition to using rodenticides. Find out what kind of rodent you have and ***learn*** about its habits, abilities, likes and dislikes. Consider trapping, try to block entry points, and remove any food and water sources. This is called ***Integrated Pest Management (IPM)***.

Date Reviewed: December 2011; revised: March 2016

References

1. *Analysis of rodenticide bait use*; U.S Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, U.S. Govenrment Printing Office: Washington, DC, 2004.
2. Erickson, W.; Urban, D. *Potential Risks of Nine Rodenticides to Birds and Nontarget Mammals: a Comparative Approach*; U.S Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs, U.S. Govenrment Printing Office: Washington, DC, 2004.
3. Tomlin, C. D. S. *The Pesticide Manual: A World Compendium*, 13th ed.; British Crop Protection Council: Alton, UK, 2003; pp 307-308, 1028-130.
4. *Reregistration Elegibility Decision (RED) Rodenticide cluster*; EPA 738-R-98-007; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Progams, U.S. Government Printing Office: Washington, DC, 1998.
5. *Reregistration Elegibility Decision (RED) Zinc Phosphide*; EPA 738-R-98-006; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 1998.
6. *R.E.D. Facts Warafin*; EPA 738-F-91-111; U. S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 1991.
7. *Reregistration Elegibility Decision (RED) Strychnine*; EPA 738-R-96-033; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 1996.
8. Campbell, A. ; Chapman, M. Anticoagulant rodenticides. *Handbook of poisoning in dogs and cats*; Blackwell Science: Oxford, England, 2000; pp 64-73.
9. Murphy, M. J.; Talcott, P. A. Anticoagulant rodenticides. *Small Animal Toxicology*, 2nd ed.; Elsevier Saunders: St. Louis, MO, 2006; pp 565, 570-571.
10. Watt, B. E.; Proudfoot, A. T.; Bradberry, S. M.; Vale, J. A. Anticoagulant rodenticides. *Toxicol. Rev.* 2005, 24 (4), 259-269.
11. *Rodenticide Products for Consumers*; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs. http://www.epa.gov/pesticides/reregistration/rodenticides/consumer-prod.html (accessed June 2011), updated June 2011.

12. Roder, J. D. *Veterinary Toxicology*; Butterworth Heinemann: Boston, 2001; pp 84, 106-108, 123.
13. Rumbeiha, W. K. Cholecalciferol. *Small Animal Toxicology*, 2nd ed.; Peterson, M. E.; Talcott, P. A., Eds.; Elsevier Saunders: St. Louis, MO, 2006; pp 629-642.
14. Reigart, J. R.; Roberts, J. R. Miscellaneous rodenticides: Red squill and cholecalciferol. *Recognition and Management of Pesticide Poisonings*, 5th ed.; EPA 735-R-98-003; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 1999; pp 179-180.
15. Albretsen, J. C. Zinc phosphide. *Clinical Veterinary Toxicology*; Plumlee, K. H., Ed.; Mosby, Inc.: St. Louis, MO, 2004; pp 456-459.
16. *R.E.D Facts Strychnine*; EPA 738-F-96-033; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC,, 1996.
17. Talcott, P. A. Strychnine. *Small Animal Toxicology*, 2nd ed.; Peterson, M. E.; Talcott, P. A., Eds.; Elsevier Saunders: St. Louis, MO, 2006; pp 1076-1082.
18. Means, C. Anticoagulant rodenticides. *Clinical Veterinary Toxicology*; Plumlee, K. H., Ed.; Mosby, Inc.: St. Louis, MO, 2004; pp 444-446.
19. Dorman, D. C. Bromethalin. *Small Animal Toxicology*; Peterson, M. E.; Talcott, P. A., Eds.; Elsevier Saunders: St. Louis, MO, 2006; pp 609-618.
20. Pasquale-Styles, M. A.; Sochaski, M. A.; Dorman, D. C.; Krell, W. S.; Shah, A. K.; Schmidt, C. J. Fatal bromethalin poisoning. *J. Forensic Sci.* 2006, 51 (5), 1154-1157.
21. Morrow, C. K.; Volmer, P. A. Cholecalciferol. *Clinical Veterinary Toxicology*; Plumlee, K. H., Ed.; Mosby, Inc.: St. Louis, MO, 2004; pp 448-451.
22. Knight, M. W. Zinc phosphide. *Small Animal Toxicology*; Peterson, M. E.; Talcott, P. A., Eds.; Elsevier Saunders: St. Louis, MO, 2006; pp 1101-1118.
23. Saravanan, K.; Kanakasabai, R. Evaluation of secondary poisoning of difethialone, a new second-generation anticoagulant rodenticide to barn owl, *Tyto alba* Hartert under captivity. *Indian J. Exp. Biol.* 2004, 42, 1013-1016.
24. Schmutz, J. K.; Rose, K. A.; Johnson, R. G. Hazards to raptors from strychnine poisoned ground squirrels. *J. Raptor Res.* 1989, 23 (4), 147-151.
25. *Risk Mitigation Decision for Ten Rodenticides*; U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Office of Pesticide Programs, U.S. Government Printing Office: Washington, DC, 2008.
26. Eason, C. T.; Murphy, E. C.; Wright, G. R. G.; Spurr, E. B. Assessment of risks of brodifacoum to non-target birds and mammals in New Zealand. *Ecotoxicology* 2002, 11, 35-48.

NPIC is a cooperative agreement between Oregon State University and the U.S. Environmental Protection Agency (U.S. EPA, cooperative agreement # X8-83458501). The information in this publication does not in any way replace or supercede the restrictions, precautions, directions, or other information on the pesticide label or any other regulatory requirements, nor does it necessarily reflect the position of the U.S. EPA.

The Use of Non-Toxic Monitoring Baits For Use In City Rat IPM Programs
NYC Rodent Academy

Bobby Corrigan, Ph.D.

Products:

Bell Labs: Detex with Bio-marker
Lipha Tech: No-Tox Mini Blocks

Key Points

The unique colors of the new rodent monitoring baits (fluorescent green for Detex; and bright red for No-Tox) can provide pest professionals and municipality professionals important area information about local rat populations and their profile.
These baits can assist in analyzing neighborhood rat infestations, and thus help us and help us to coordinate the work of other agencies in their role in rat management.

1. By installing inside of stations, burrows, etc. (with or without regular toxic rodenticide), the professional can gain some insight into where rats may be traveling, nesting, resting, and feeding.

2. By installing these baits within catch basins, (with or without regular toxic rodenticide), it can be noted if a sewer rat population may be affecting a property, street or areas nearby the catch basin.

3. By installing monitoring baits in some specific locations, home ranges and/or secret zones of rats can be revealed (e.g., within a Subway).

4. The size of droppings and numbers of different sizes can inform us as to the makeup of a population (is it growing?).

5. Active burrows nearby the monitor-baited areas may be identified and their path of travel from the burrow to the feeding zones or bait stations.

6. When used inside parks, pest staff are able to identify which litter baskets or other areas are being hit. In turn, rat-active baskets can then be targeted for replacements, repairs, collection frequency changes, etc.

7. With the Detex product containing the bio-fluorescent marker, feces will glow under black light. However, black lights are necessary; the blocks do not fluoresce or glow under normal flashlights (even the brightest flashlight).

8. Because these products are brand new, no doubt pest professionals will devise additional applications for these innovative IPM tools.

Leading US rodent control expert, Dr Bobby Corrigan

This article first appeared in the the leading pest contol magazine in the United States, PCT (*Pest Control Technology*). Whilst some of the recommendations and products referred to are US brands and therefore not available here (most notably the Liphatech products), the strategies and practical hints given apply equally well.

Biomonitoring for rodents

by Bobby Corrigan

Non-toxic rodent monitoring bait blocks can help bolster Integrated Pest Management (IPM) programmes, reduce call-backs and provide another dimension of service. They also meet today's changing times — when the world seems to be clamouring for 'green' services.

Early in 2009, Bell Laboratories launched a new version of its Detex non-toxic monitoring rodent bait: Detex with Biomarker. Not too long after, Liphatech also released a non-toxic monitoring bait called No-Tox. Detex and No-Tox are largely the equivalents of their toxic bait block counterparts, but without any active ingredient. In other words, think of Contrac and Maki (respectively) without their anticoagulant active ingredient, bromadiolone.

Non-toxic baits are not new...

Non-toxic rodent monitoring bait blocks are not new. In 1995, Zeneca Professional Products launched a non-toxic monitoring bait, Census, as tool for rodent IPM. Census was similar to Talon WeatherBlok without the brodifacoum. The industry's reception for Census ranged from applause, to confusion and to disregard. Apparently, disregard won out as Census failed to attract the industry's interest and Zeneca discontinued the product.

A couple of years later, Bell Labs introduced Detex (i.e. detecting rodents), the firm's offering of a non-toxic monitoring bait. But similar to Census, Detex also did not sell and was discontinued. It seemed the structural pest management industry 15 years ago had little interest in the concept of proactively monitoring for rodent pests. But perhaps with the arrival of these two new monitoring bait products, combined with other technology, it's a new day for this concept.

A field researcher uses a UV torch to inspect for rat activity under a pavement

The purpose of this article is to re-examine the use of these new and more novel non-toxic rodent monitoring/ tracking baits and to consider the numerous ways these baits can assist you in solving rodent infestations. These baits can help bolster IPM programmes, reduce call-backs and provide another dimension of service. They certainly also meet the changing times when the world seems to be clamouring for 'green' services.

...but biomarkers & UV torches add a new dimension

With the new Detex product, Bell Laboratories added a bio-fluorescent marker into the bait. When rodents consume Detex, they pass the bio-fluorescent marker in their scats (droppings). The addition of this bio-fluorescent changes everything in the concept of using these non-toxic baits. As you know, fluorescent materials are readily seen with a UV torch. When captured in a UV torch's glow, the scats contoining a bio-fluorescent marker become brilliant 'glowscats'. Consequently, the biomarker within Detex now enables the monitoring bait to also serve as a tracking bait (MTB).

What makes the concept of a bio-fluorescent monitoring/tracking bait so exciting and so promising is that just recently several new UV torches using LED technology have emerged within the industry (perhaps Bell Laboratories saw this coming?).

These are small (10 cm by 1.25 cm) and fit conveniently into shirt pockets or tool belts. But they are powerful. One model I tested to field-trial the bio-fluorescent baits (the Microlite UV by Falcon Innovations) is powerful enough to emit waves in the 370 nanometer range. But because of this light's unique design, only items or spots that fluoresce under UV light appear. In other words, other surrounding items that would be illuminated under normal light (as produced with a normal torch) do not show. Even the faintest crumbles of the Detex Biomarker fluoresced brightly with this new UV technology. This one-two punch of MTB and UVL can reveal a whole new look into the world of structural rodent control.

Coloured dies also effective

Liphatech's No-Tox bait also con be used as tracking bait although No-Tox does not contain a biofluorescent marker. Instead, No-Tox employs a reddish-pink dye additive. The colour marker is passed in the rodent scats following feeding. In cases where scats are deposited in well-lit and/or exterior areas during the daylight hours, the red marker works well.

For cases of night-time evaluations, or inspections for scats in shadowy corners, behind and underneath pallets and other low-lying objects, or in the dark basements of buildings and warehouses, the use of the UV torches will locate and identify the glowscats even from a distance.

Regardless of fluorescent or red dye markers, both of these non-toxic baits are highly palatable to foraging rodents. I have installed them into bait stations in a few areas around New York City, both as stand-alones (i.e. just the MTBs) as well as installing them into bait stations containing conventional toxic baits. The rodents of NYC ripped the MTBs.

By installing highly palatable baits into bait stations (with or without the conventional toxic baits), once the rodents enter the stations, they are likely to feed. Of course, they begin scenting the station with their scats, urine and uro-genital secretions. Research has shown such scents may attract other local rodents to those 'marked' bait stations, thereby enhancing or accelerating the take of toxic baits.

On-the-job tips

When new technologies 'find one another', specialised tools and techniques often emerge. And this is true here with tracking baits and UV equipment offering potential help to analyse those occasional complex (and also the simple) rodent jobs.

Consider the questions of the everyday on-the-job service professional conducting rodent work:

- Along what paths are the rodents travelling from nests to food sources?
- What are their ranges?
- Are the rodents coming from the outside and invading the building along a particular wall, or through a specific opening?

The following is a list of the potential uses of MTBs for exterior and interior uses. It's a good bet that as innovative professionals use MTBs, additional applications will be discovered.

1. Rodent scats that are 'marked' help pest management professionals discover three critical items:

   a) the high-activity trails of the rodents;

   b) the distances the rodents are travelling, and;

   c) possible zones in which the nests are located.

   In short, MTB scats provide the road maps for where to install traps and bait stations for maximum on-the -job efficiency.

2. By installing MTBs into bait stations on exterior areas (fences/walls), any MTB-marked scats seen in interior areas of a facility confirm the pressure of exterior rodents causing interior infestations. By installing MTBs in strategic placements, you can trace back the specific location or building direction from which the rodents may be originating. Suppose, for example, two different MTBs are used in two different areas around the exterior of a food plant or warehouse (i.e. Detex on the north and east walls; No-Tox on the south and west walls). Any MTB scats found inside the buildings, or within any interior mouse traps, can assist in pinpointing the possible origin of the rodents. Corresponding wall and/or door areas can be inspected to check for any structural breaches allowing rodents entry.

3. The areas around warehouses and food plants containing property line fence-rows at significant distances away from the building perimeter might or might not be home to commensal rats or mice — but they still must be monitored. With routine bait stations containing toxic baits, the baits will kill whatever small mammal happens upon the stations and feeds on the bait within. Many non-target small mammals (rodents and non-rodents) are important in the balance of those natural environments that can exist nearby our buildings (especially as we 'urban sprawl' into undeveloped areas). Moreover, these same non-targets may be food to hawks, owls, foxes and other wildlife species within the food chain. With non-toxic MTBs we con evaluate whether or not these mammals are making their way to the nearby structures, or remaining within their own 'ecosystems' in their fields and other undeveloped areas. If it's the latter, these non-target animals should not be victims of poorly designed rodent control programmes that over-extend the zones requiring protection.

4. One of the best indoor utilities of MTBs is their installation into apartment complexes and large office buildings for mouse Integrated Pest Management (IPM) programmes. By installing MTBs into strategic floors or office areas (basements, suspended ceilings, suspect cubicles, etc.) and using UV torches during subsequent service visits, the mouse population sources and reservoirs can be profiled. By focussing on these areas, call-backs can be reduced.

   Recently, I installed MTB baits into the basement of a 12-story apartment complex in Manhattan. During the follow-up inspection three weeks later, I located a few 'glowscats' in apartments on the first and third floors above the basement. Obviously, this confirms that the basement is serving as a possible mouse entry zone or replenishing source for the building. In such cases, property owners need to be shown such 'smoking gun confirmation' to facilitate mouse-proofing the basement ceiling zones and wall penetrations from the outside leading into the basement. Or, at a minimum, the pest management professional should implement the most intensive mouse control efforts in the basement to stem-off the severity of the upward migration.

5. The Detex BM product is particularly useful for confirming the activity of structural rodent burrows such as wall voids, floor voids and, in the case of Norway rats, exterior pavement and foundation wall burrows. For house mice in warehouses, Detex can be dropped into sub-slab cracks and crevices to determine whether or not mice are using

Non-toxic monitoring baits available in the US include Liphatech's NoTox and Bell's Detex with Biomarker

these zones for harbourage. During the spring of 2010, I was able to track the Norway rats' use and movements below the pavements of Manhattan using Detex MTB.

Similarly, the Detex MTB can be installed into overhead ceiling spaces to allow for monitoring and tracking of the rodents' use of the ceiling void. These voids are often overlooked in chronic indoor rodent infestations, which in turn results in expensive recurring call-backs.

Monitoring/tracking baits are a perfect fit for sensitive accounts when pesticides are not desired or allowed, but where proactive rodent IPM programmes are necessary. Consider the usefulness of MTBs in zoological gardens, pharmaceutical plants, animal-rearing facilities, schools, biotech firms and the like.

As more of the mega-corporate firms wish to increase their 'green profile', the concept of using MTBs in those accounts fits this need perfectly.

Bell's Detex with Biomarker is available in the UK. Under UV light, the blocks (as seen above right) fluoresce in comparison to a normal block. When eaten by rats their droppings can be picked out easily with a UV torch

Other uses

The Detex Biomarker product also has uses against other cryptobiotic pests such as American cockroaches. This is because even the small faeces of cockroaches are illuminated under new UV torches.

Often times, it is challenging to zero-in to where *Periplaneta* cockroaches are originating, or the location of their travel pathways (which if we knew, we could bait or treat). Are they coming from the attached sewer lines, or from basement chases near steam pipes? By installing monitor/tracking baits in these areas, any cockroach frass that fluoresces in follow-up services can be used to trace-back to areas needing to be treated. Some real-world research might indeed be exciting as to how the fluorescing MTBs have applications for this and other urban insect pests.

Summary

By using MTBs in routine pest management (i.e. installing MTBs in bait stations in many facilities), new insight into the behaviour of the resident pest populations could be gathered. In short, monitering/tracking baits can help us to be better detectives. Against the clever urban rodent pests, we need every detective tool and clue-gathering technique we can get.

The author is president of RMC Consulting, Richmond, Indiana 47374 USA and can be contacted via email at cityrats@mac.com

Available in the UK

As for the UK, the non-toxic monitoring product, Detex, has been on sale in Europe since 1996 and in November 2009 Bell added the florescent biomarker, making the product equal to its American counterpart. In fact, Detex with Biomarker was one of the products nominated and voted for, by readers in the ***Pest*** Best Product 2010 awards.

Working along the same fluorescing principle is Flouro Bait from Killgerm. Again this is a non-toxic, food grade rodent bait available in either green or orange coloured pellets combined with a fluorescent pigment. When eaten by rodents their urine and droppings become more readily detected using a UV torch.

The concept itself of UV tracking is far from a new idea, as the use of fluorescent tracking dusts goes back at least 30 years. Which readers can remember Shake and Track? The idea is the tracking dust is laid down to establish the activity of rodents – where they are entering a building and where they are going in it. Once laid the site is revisited and activity revealed with the UV torch.

Fluorescent tracking dusts are available from Barrettine, SX Environmental Supplies and Killgerm, as are UV tracking torches.

Some of the fluorescent monitoring/tracking products available from UK distributors

pest test? Take the Pest Test

BASIS has made two PROMPT CPD points available if you can demonstrate that you have improved your knowledge, understanding and technical know-how by passing the ***Pest* Test** and answering all our questions correctly. So read through our articles on RRAG meeting in London, the request for rat tails and biomonitoring for rodents and complete the questions below.

Try to answer them all in one sitting and without referring back to the articles. **Take care as some questions may have more than one correct answer so tick all the answers you believe are correct.**

SEND COMPLETED QUESTIONS to:
Pest Magazine, Foxhill, Stanford on Soar, Loughborough, Leicestershire LE12 5PZ. We will contact you with your result and, if all your answers are correct, we will credit the CPD points to you.

1 A rat submitted for DNA testing must have been killed by?

- a) Shooting ☐
- b) Trapping ☐
- c) Rodenticide ☐
- d) Dogs ☐

2 Which of these rodenticides can only be used indoors?

- a) Difenacoum ☐
- b) Flocoumafen ☐
- c) Brodifacoum ☐
- d) Bromadiolone ☐

3 The product types covered by the Biocidal Products Directive include?

- a) Embalming fluids ☐
- b) Agricultural weedkillers ☐
- c) Oils and lubricants ☐
- d) Rodenticides ☐

4 In the EU, rodenticides are included on Annex I for how many years?

- a) 20 ☐
- b) 5 ☐
- c) 10 ☐
- d) 15 ☐

5 Fluorescent bio-markers are added to non-toxic rodent bait because?

- a) It makes the bait taste better ☐
- b) The manufacturers thought the colour was pretty ☐
- c) When eaten, rodent scats glow under UV light ☐
- d) Rats prefer the colour of the bait ☐

6 Fluorescent rodent scats enable PCOs to establish?

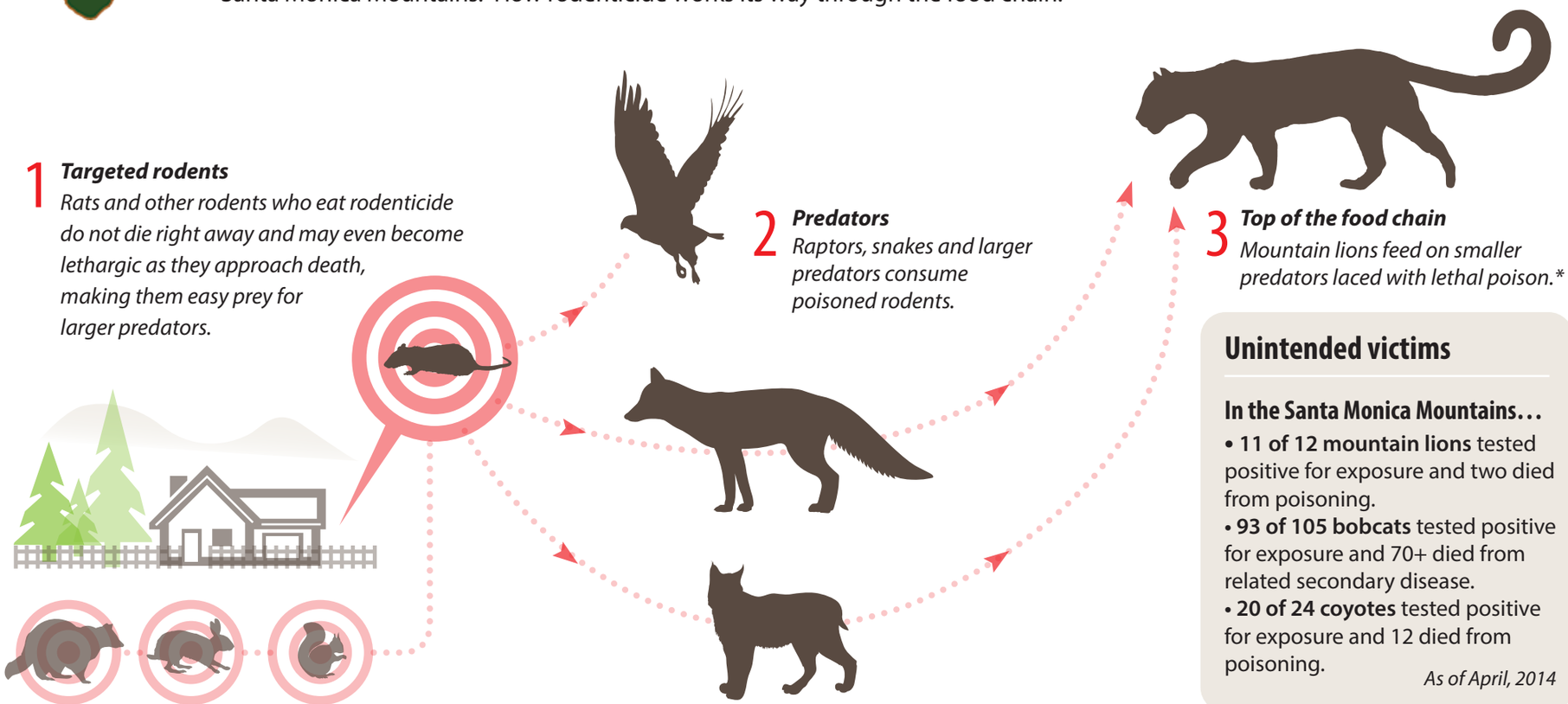
- a) The distance the rodents are travelling ☐
- b) Possible areas where their nests may be located ☐
- c) If the rodents are resistant to commonly used rodenticides ☐
- d) The main trails they are using ☐

Name: Tel: PROMPT registration number:

Email:

Lethal Dose: Rat Poison & Local Wildlife

Local residents may inadvertently be poisoning wildlife. National Park Service researchers have found a direct link between exposure to anticoagulant rodenticides, commonly known as rat poison, and the deaths of wildlife in and around the Santa Monica Mountains. How rodenticide works its way through the food chain:



1 *Targeted rodents*
Rats and other rodents who eat rodenticide do not die right away and may even become lethargic as they approach death, making them easy prey for larger predators.

2 *Predators*
Raptors, snakes and larger predators consume poisoned rodents.

3 *Top of the food chain*
*Mountain lions feed on smaller predators laced with lethal poison.**

Unintended victims

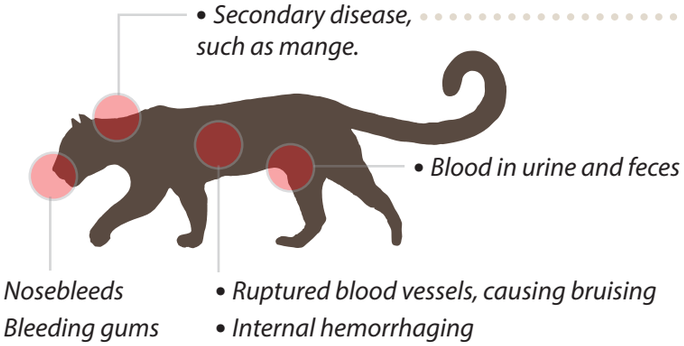
In the Santa Monica Mountains…

- **11 of 12 mountain lions** tested positive for exposure and two died from poisoning.
- **93 of 105 bobcats** tested positive for exposure and 70+ died from related secondary disease.
- **20 of 24 coyotes** tested positive for exposure and 12 died from poisoning.

As of April, 2014

How anticoagulant rodenticide kills

These compounds interrupt blood-clotting, which leads to uncontrolled bleeding and death. They may also suppress the animal's immune system, making it susceptible to other diseases. **Symptoms include:**



What is mange?

A microscopic mite that burrows into the skin and causes...

1. Extreme itchiness and skin lesions.

2. Fluid and nutrient loss through the skin.

3. Infection, starvation, hypothermia or other complications, eventually leading to death.

Check the label

Here are the most common anticoagulant compounds:

- ***Bromadiolone***
- ***Brodifacoum***
- ***Diphacinone***
- ***Difethialone***

SOURCES: Santa Monica Mountains National Recreation Area research, L.E.K. Serieys, UrbanCarnivores.com

CREDIT: National Park Service
nps.gov/samo