SECTION 2: BIOLOGY OF RODENTS/CASE STUDIES

[Annual Rodent Control Issue] The Science of Urban Rodentology

Features - Cover Story: Annual Rodent Control Issue

This discipline focuses not only on the biology and behavior of common urban rodent species, but also addresses scientific approaches for their management.

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Bobby Corrigan

The Norway rat is considered highly intelligent for its ability to adapt to different urban situations and to learn from its experiences in and around our buildings. As such, they are a constant challenge for pest professionals the world over. (Photo: B. Corrigan)

As is likely obvious, mammalogy is the scientific study of mammals. About 5,419 species of mammals exist and they are classified into about 29 orders. Rodentology is a branch of mammalogy that examines the study of rodents (the word rodent means “gnawing mammal”). The Rodentia is the largest order of mammals and among the most successful. The order Rodentia contains about 2,277 species with a few new species being added every couple of years. This equates to 42 percent of all species of mammals on Earth being a rodent! For comparison, humans belong to the primates within the family Hominidae, which contains but six species, (i.e., only 1 percent of all mammal species).

Urban rodentology is a sub-discipline of rodentology, (as urban entomology is a sub-discipline of general entomology). Urban rodentology focuses not only on the biology and behavior of the rodent species most commonly associated within and impacting cities and towns, but also addresses scientific approaches for their management.

A Complex Science.

As with most sciences, urban rodentology is a complex subject. However, the following points present a capsule view of this study:

- Urban rodentology deals with live, intelligent mammals that are capable of adapting to a wide array of habitats ranging from simple garden sheds to complex skyscrapers; from a suburban kitchen to a super grocery store and so on.
- Urban rodentology involves multiple rodent species; each species unique.
- It demands interdisciplinary approaches, from medical significance to understanding the structural components of everyday buildings; from the chemistry of rodenticides to choices of urban landscaping, etc.

- Because urban rodents are so successful, they are found the world over, in nearly all cities and towns, as well as rural areas and even as feral mammals living away from humans. Urban rodents are found in tropical cities to remote islands off the coast of Alaska; in dry deserts and in wetlands; in coal mines and high up in the Andes.

The purpose of this article is to examine more closely the complex but fascinating science of urban rodentology. But more importantly, we want to consider why an understanding of urban rodentology is so essential to pest professionals the world over in ensuring successful (i.e., effective and profitable) management programs of rodent pests.

Inter-Disciplinary Sciences and Trades Involved With Urban Rodentology

Here is a partial list of scientific disciplines, trades and skills that interface with urban rodentology on an ongoing basis:

- Mammalogy
- Ethology (rodent and human)
- Botany
- Epidemiology
- Microbiology
- Food Safety
- Population Biology
- Medical Entomology
- Parasitology
- Building Construction and Design
- Landscape Architecture
- City Infrastructure
- Transportation — Construction Elements (especially planes and trains)
- Pesticide Safety and Training
- Food Plant Sanitation
- Livestock Operation
- Zoological Park Operation

Associated Trades and Skill Sets:

- Wild animal trapping
- Structural pest proofing (doors, pipe penetrations, etc.)
- Keen observing
- Being an investigator before an applicator

Primary/Secondary Rodents.

For the purpose of urban rodent management programs, we can divide urban rodent pests into two groups: primary and secondary urban rodents.[1] In order of significance, the primary urban rodent species in many parts of the world are: 1) House mouse, *Mus musculus*; 2) Norway (brown) rat, *Rattus norvegicus*, and, 3) Roof (black) rat, *Rattus rattus.*These three species are often referred to as “commensal,” “domestic” and “old world rats and mice.” These rodents belong to the mammalian subfamily, Murinae, after the early Latin word origin of “mur” meaning “mouse.” In this subfamily alone, there are 519 species. Worldwide, within the mouse genus Mus, there are about 38 species, while about 64 species occur within the rat genus Rattus.

Formulas for Success.

Our urban rodents are well recognized for being among the most successful of the successful rodents. In fact, the everyday house mouse has been characterized by some scientists as perhaps the second most successful mammal on Earth, right behind Homo sapiens.

So how can we scientifically explain the success of these mammals? There are at least six impressive reasons: 1) a high degree of adaptability to many different structural and infrastructural environments; 2) very fast reproductive rates when resources are plentiful; 3) ability to squeeze families or a local colony into relatively small spaces; 4) some members of local colonies possess highly secretive, elusive behaviors; are active at night; remain alert and immobile per any strange sound, etc. 5) body shapes and colors to avoid detection and predation (i.e., same color as shadows

and the ground); capable of scurrying quickly from shadow to shadow; and, 6) intelligence and cognitive abilities. (Among animals, intelligence is difficult to precisely define. However, general indications of intelligence include the ability to learn, matched with behavioral flexibility. Rats, for example, are considered to be highly intelligent, because research has proven they can learn and perform new tasks — an important asset when entering a new building or area for the first time.)

Species-specific Successes.

In addition to the six general qualities discussed above, each of the three primary species also possess a number of individual qualities that make them successful.

The House Mouse

- Often referred to by mammalogists as the “master of adaptation.”
- Because it is found virtually in all urban and most non-urban environments, R.J. Berry, the famous English biologist, refers to the mouse as a “mammalian weed.”
- Its small size enables it to nest and hide in areas “right under our noses.” One overlooked napkin box in a restaurant storage closet can harbor 25 mice. Eight mice have been found nesting beneath a hollowed out hard roll in a bakery.
- Not all mice in a colony are “curious.” Some mice are like rats, they may avoid new objects such as traps and bait boxes completely. All control programs should account for “curious” and non-curious mice.
- Short home ranges enable the mouse to avoid encountering traps and bait stations if the equipment is not spaced accurately based on detailed inspections.
- Fast track to sexual maturity when resources are abundant. House mice have been found to be sexually mature in 35 to 40 days in ideal environments (e.g., a supermarket that doesn’t detail clean beneath the gondolas).

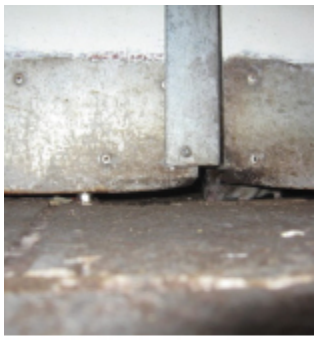
The Norway Rat

- Because of its intelligence, mammalogists have referred to it as “diabolically clever.”
- Research has shown rats are capable of decision making based on previous experience. Just as recently as last month, new research showed that rats can also regret bad decisions.
- Similar to the house mouse, rats can hugger-mugger their families into a relatively small spaces. It not uncommon to discover an entire family of rats occupying a single concrete hollow block within a partition wall.
- Rats have adapted to consuming many different food items, or, the same food item over and over as their environment dictates. And should their normal food suddenly become unavailable (i.e., due to a clean-up or removal), city rats can readily shift over and live on the natural foods found in their environment (earthworms, plant seeds, berries, birds and bird’s eggs, acorns, cockroaches, fish and virtually any local mammal, bird, or reptile of smaller size).
- Rat colonies in urban areas can harbor with their natural homes of earthen burrows (in parks, around structural landscaping); or, they can be readily at home within the walls, floors and ceilings of urban structures of all types. Serious rat infestations commonly develop high up in the ceilings of apartments and office buildings.
- Depending on the availability of food, water and harborage, the brown rat can establish both short and long home ranges from 25 feet to upwards of 450 radial feet from their nests.
- Rats have been tracked dispersing relatively long distances of up to five miles round trip in one night and returning successfully to the same nests. These types of feats help explain how rats explore and exploit new neighborhoods where resources are more abundant.

- Some colony members can, for a complex array of reasons, be highly secretive and remain cautious of new objects (traps, bait stations) or even new arrangements of objects familiar to them within their daily routine. Pest professionals the world over have high regard for the extraordinary efforts it requires to capture the “smart rats” encountered from time to time.

The Roof Rat

- Because the roof rat occupies and is active in the spaces above the typical field of vision of humans and many ground-dwelling prey (cats, dogs, skunks, foxes, coyotes), this species is often among the most elusive of the three urban species.
- Inside buildings, the roof rat commonly nests up in difficult-to-access spaces of soffits, attics, floor-ceiling voids, leafy nests up in tree tops, dense foliage nests (and therefore, rodent proofing should be a mandatory element of roof rat control services).
- Roof rats can have extended home ranges upwards of 500 feet (and more), crossing the property lines of several different property owners. This can complicate control programs.
- Because most roof rats tend to be black in color and their travelways located in dark and shadowy elevated areas, roof rats can remain out-of-sight and out-of -mind — until the numbers increase to a problem level. Roof rats can exist around urban buildings in an on-off pattern. For example, they can interact with building spaces for a few weeks or months at a time, but then leave the building and exist and nest in trees or bushes living on natural foods for weeks or months. This behavior can frustrate both the servicing pest professional and the affected client.



The author took this photo one night as mice were coming and going from beneath a delivery door to a food store. Notice the approaching mouse (see arrow) and heavy mouse smears at the base of the right door. Pest proofing is a scientific sub-discipline and trade of urban rodentology. Most property owners (and even many maintenance staff) have incomplete knowledge about how to properly pest-proof doors, repair holes, cap off block walls and the like. (Photo: B. Corrigan)

Secondary Urban Rodents.

Depending on the location, there are other rodents of significance in and around urban areas. In fact, as urban sprawl continues, any one or more of the secondary urban rodents listed below can emerge as a primary rodent pest species. These rodents also are capable of significantly damaging buildings, contaminating food or posing health threats to humans, their pets and/or their livestock.

- Tree squirrels (gray, fox, red, flying)
- Peromyscus mice (deer mice and white-footed mice).
- Chipmunks
- Woodchucks
- Ground squirrels (e.g., California ground squirrel)
- Pack rats (woodrats)
- Voles

Inter-disciplinary in Scope.

Similar to other aspects of urban pest management, working with urban rodents necessitates involvement in other scientific disciplines as well as other trades and skill sets. Urban rodentology is, for sure, a science but also an art requiring the honed skills of a craftsman.

You can’t provide excellent mouse control, say, in a large commercial office building if you don’t possess a modicum of knowledge about how an office building is put together. This is because city rodents learn, memorize and mark various utility pipes and chases that allow them to move up and down between floors, as well as which are the safest and fastest routes to go from nest to food (e.g., the office building’s coffee break room, or the messiest desks among 100 others). So this involves convincing humans how to maintain desks (altering behavior) so as to not allow mice to proliferate and spread.

If you have ever tried to control roof or Norway rats infesting ceiling areas of a large vertical apartment complex you understand the level of difficulty. Knowing how to read a blueprint to identify various utility chases is more than half the battle. It’s fair to say this kind of knowledge is a prerequisite of being able to gain control.

Moreover, the skill sets of pest proofing and building repairs are essential in being involved in rodent pest management (i.e., weather stripping a door is not the same as pest proofing a door; plugging a small hole to exclude rodents isn’t as simple as stuffing steel wool into a hole or spraying from a can of expanding foam).

Finally, for those involved in the management of urban rodents, the art and the science of being keenly observant is critical. Greatness in eliminating pest rodents is not about using only great baits and traps, it’s about being a great inspector via keen observational skill as to where to place the baits and traps.

Arthur Conan Doyle wrote in his Sherlock Holmes series, “You must be trained to see what others overlook.” The clever rodents of our cities and towns require nothing less.

Suggested Great Reads in Urban Rodentology

- Barnett, S.A. 2001. *The Story of Rats.*Their impact on us and our impact on them. Allen and Unwin. Crows Nest, Australia. 202pp
- Berry, R.J., 1981a. *Town mouse, country mouse: adaptation and adaptability in* Mus domesticus. Mamm. Rev. 11:91-136
- Bronson F.H., 1984.*The adaptability of the house mouse.* Sci. Amer. 250(3):116-125.

Summary.

Pause for a moment to consider the professional management of the “every day” house mouse among various urban structures that occur on a typical service route for a pest professional anywhere — i.e., a mouse infestation in the following: supermarket; warehouse; suburban home with a garage and a basement; suburban home next door without garage and basement; an office building with hundreds of cubicles and suspended ceilings; an old restaurant in the old part of the city; an elementary school; and so on. Certainly there is no single template of service for any of these situations. In urban rodentology there aren’t too many “service templates” from which to push the “repeat button.”

Perhaps after reading this, you will be inclined to agree — urban rodentology is as deep a study as is urban entomology, acarology, microbiology or any other of the sciences inter-connected to urban pest management. This science demands site specificity and situational analysis. It is truly a science requiring dedicated, astute and enthusiastic professionals.

The author is an urban rodentologist with RMC Pest Management Consulting, Richmond, Ind.

[1]Depending on the global city or region, other species of rats and mice are also important pests. For example, the Bandicoot and Polynesian rats are important in many parts of Asia and the Pacific Rim countries. Wood mice invade buildings during cold seasons in many European countries and so on.

Annual Rodent Control Issue

Keeping the Mouse Out of the House

Erdye's Pest Control uses its knowledge of construction practices to solve mice infestations.

By Jeff Fenner

Would the thought of servicing upward of 15,000 snap traps each week send shivers through your technicians? It might for some but it doesn't faze Josh Erdman and his team at Erdye's Pest Control, Green Bay, Wis. Erdye's has carved out a strong position in its multi-state service area, which includes Wisconsin, the Upper Peninsula of Michigan and eastern Minnesota, taking care of residential customers' mice problems.

"Our goal is not to set up a monthly service schedule for mice with a client, it is to solve their problem the first time," says Erdman, who spent 20 years in the property management and construction industries before dedicating his time and resources to pest management in 2012.

Erdman says the biggest flaw with most mouse management programs is they don't address the root of the problem. "Not sealing a house properly will ultimately lead to other control efforts failing," says Erdman, who estimates 60 percent of his business is dedicated to mouse control.

Following thorough property inspection protocols, Erdye's technicians identify access points and seal openings using construction grade materials. They also set good old-fashioned snap traps — in abundance — to knock down any existing mice population. Upsell opportunities are available for remediation work — removing damaged insulation in attics, basements, crawlspaces and wall voids, and sanitizing areas infested by mice.

"My construction background provides me with knowledge of where a home's structural weak points are located that allow mice access," says Erdman, who conducts hands-on training with his technicians on construction practices. "We train them on what to look for and act on it."

Another area Erdye's differs from the competition is that it isn't afraid to charge the customer what it takes to fix their mouse problem over the long haul and not just in the short term. The company offers a set price for the initial trapping program set up, but fees vary for exclusion and cleanout work depending on the specific needs and unique aspects of the property.


Erdman

"All rodent situations are different and need to be priced accordingly," says Erdman. "We have learned through trial and error, but at the end of the day our customers pay us to fix the problem."

Erdye's extensive use of snap traps — each home they service averages 35 to 60 traps depending on the size — is another trademark.

"We do not use sticky traps and we do not use bait inside because we do not want to have rodents die in wall voids and other inaccessible areas and cause additional problems and expense for customers," says Erdman, who does deploy bait stations on the exterior to knock down the population.

Because Erdye's technicians need access to a home's interior to check traps, their route scheduling may not be viewed as efficient, but that is fine with Erdman. "I wouldn't change it because we will spend the extra time and fuel it takes to get there to take care of clients to our standards," he said.

The company's exclusion-first approach — complemented by the investment in traps and exterior bait stations — also is dictated by the Upper Midwest's harsh winters and its impact on homes. "Homes can change structurally with the seasons and create new opportunities for mice to gain access," Erdman said. "That is why we start with exclusion and the results have been good for us and our customers."

Word-of-mouth marketing, referrals, a strong, consistent social media presence, and positive online reviews also have helped Erdye's triple the size of its mouse control business over the last three years.

"Customers get what they pay for and the reason behind our growth — hands down — is because we fix their mouse problem from the start," adds Erdman.

When asked if this model can be replicated, Erdman says yes, if a company is willing to invest time to train technicians about construction practices and deal with non-traditional routing practices.

House Mouse Facts

- Mice are quick, agile creatures and can travel at speeds up to **12 feet per second.**
- Mice **feeding habits can differ inside and outside** of a structure. Inside they consume human or pet food (they love grains) and outside will consume seeds, vegetation and insects.
- Mice **can survive with little water** and will conserve their intake when water sources are scarce.
- Mice are "nibblers" and will **make up to 200 separate trips** from a nest to a food source taking only milligrams each visit.

Source: Rodent Control: A Practical Guide For Pest Management Professionals

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‹ Previous
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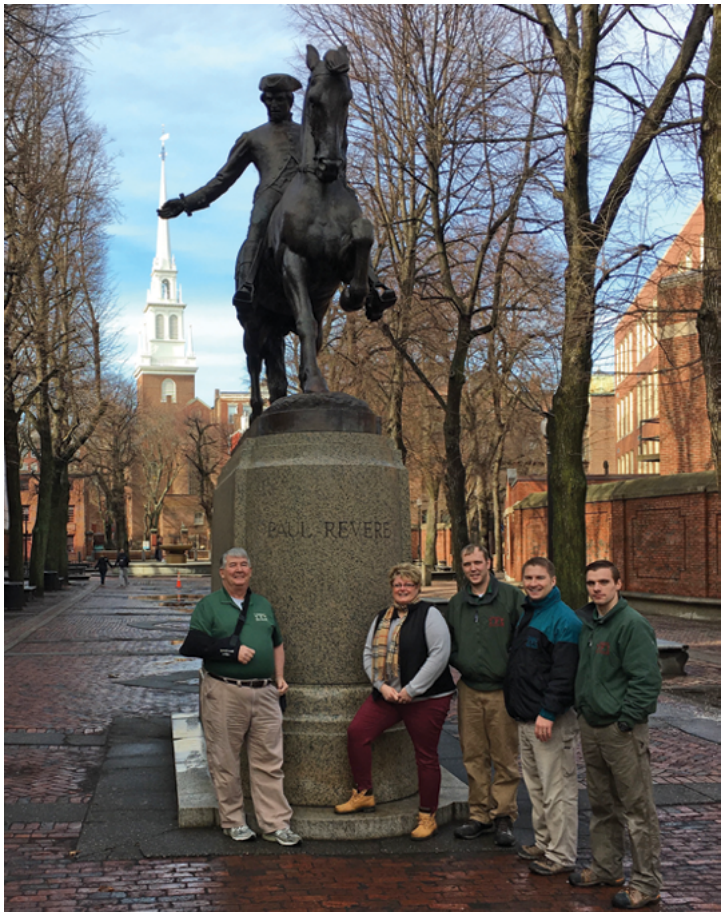
Annual Rodent Control Issue

One if by Land, Two if by. . .Vent?

Yankee Pest Control was called to take care of rodent issues at Boston's Old North Church, one of the country's most important landmarks.



Posed in front of the Paul Revere statue are (left to right) Galvin Murphy, Sr.; Sheila Haddad; Tom Dobson; Galvin Murphy, Jr.; and Brendan Walsh.

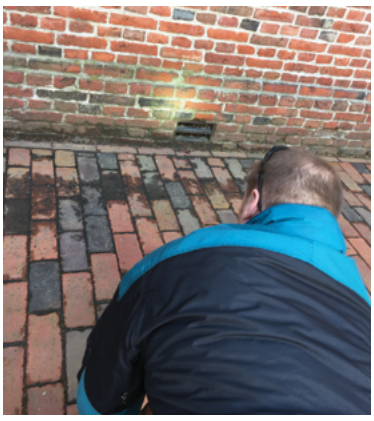
By Brad Harbison

As a longtime resident of Boston, Galvin Murphy, Jr., always has had a great appreciation for the area's historical significance, including landmarks such as the Old North Church *(read more about the church below)*.

When Yankee Pest Control was contacted by the church to take care of a rodent issue, Murphy knew they would need to develop a program to delicately handle the church's history.

"Our job was to inspect and put together a pest control program for a rat issue they were having in their administrative building, gift shop, garden, and church, and a mouse problem in the sexton's house," Murphy said. (A sexton is a person who oversees a church's maintenance needs.)

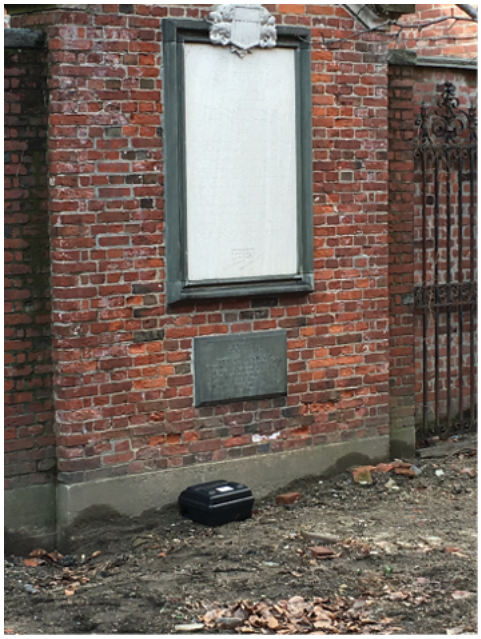
Murphy was taken to the basement of the church, which contains a crypt that is 300 years old. "Walking above in the church I had no idea I was walking atop the resting place of over 1,100 people entombed in this very small space with 37 large tombs," he said. "This was certainly one of the most memorable events of my 20 years in this industry, and certainly a first."



From a historical vantage point, the crypt houses the first captain of the USS Constitution, British soldiers killed at the Battle of Bunker Hill, and nearly 50 "strangers." That tomb houses 35 children and 10 adults that died in the city's streets from disease such as smallpox, yellow fever and plague. "While standing and taking in all the history I was brought back to reality by rat droppings lining the tops of the crescent-shaped brick tombs," he said. "Now we established the problem, how were they getting in?"

Murphy said that determining the rats' entry points into the church was not nearly as challenging as it could have been, considering the church is in one of the city's most densely populated neighborhoods. On the exterior of the church, virtually on grade with the sidewalk, there were about a dozen vents no bigger than two courses of bricks — perfect entry points for rats. "I couldn't help but think what type of architects they had 300 years ago and they certainly didn't consider IPM in their plans! Come to find out that in the heat of August, even in the 1700s, having 1,100 people entombed in an unventilated space could prove to ensure the air would always be nice and ripe. Lo and behold the vents are a brilliant idea and a mainstay at the church."

After inspecting the church, Murphy realized that this was going to be more than any rat job. "It was going to be our team involved in preserving history for the people of Boston. This was perfect grounds to show that our industry puts the importance of community involvement and the preservation of our national treasures before revenue."



A bait station placed beneath a plaque that explains the significance of the signal lanterns of Paul Revere.

Assisting Yankee Pest Control was Bell Laboratories, which donated more than a dozen EVO Express devices, and Sheila Haddad, vice president sales-East, Bell Laboratories. The EVO Express devices were installed on the exterior of the administrative building, in the crypt of the church and around the gift shop.

"We did not install any material abutting the exterior of the church. We also utilized the low profile of the Protecta LP bait station below a shed on the right side of the gift shop," Murphy said. "We were able to bait burrows directly, exterior and interior bait, and interior trap."

Other products donated by Bell Laboratories and used on site included 12 T-Rex snap traps, which were used along with Contrac Blox, Fastrac pellets, and Ditrac tracking powder.

Follow-up service, Murphy said, included multiple services scheduled within the first two weeks of the program.

Murphy said he was proud to be a part of this team effort to preserve an important part of his city's and his country's history. "We were able to take this as an opportunity to help an active congregation and as a piece of American history to do our little part with no financial burden to the Old North Church."

The author is managing editor of PCT magazine.

About the Old North Church

Built in 1723, Christ Church in the City of Boston, known to all as the Old North Church, is Boston's oldest surviving church building and most visited historical site. The church became a landmark thanks to the pivotal role it played in igniting the American Revolution. As British troops were approaching, Paul Revere instructed the church's sexton Robert Newman, and Vestryman Capt. John Pulling Jr., to hang one lantern in the church's steeple if the British where coming by land, or hang two lanterns if they were coming by sea (hence the phrase "One if by land, two if by sea."). In 1775, on the eve of revolution, the majority of the congregation were loyal to the British King and many held official positions in the royal government, including the Royal Governor of Massachusetts, making Robert Newman's loyalty to the Patriot cause even more extraordinary.

Paul Revere statue in front of the Old North Church.

‹ Previous
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