A ROADMAP FOR MUNICIPAL RODENT MANAGEMENT

In North America, rats have infested cities since at least the mid-1700s (Puckett et al. 2016), resulting in an ongoing rat race by municipalities to cull their populations (Sullivan 2004). Unfortunately, the "war on rats" approach has proven largely unsuccessful (Easterbrook et al. 2005; Lee et al. 2022), and rat issues continue to affect residents, stakeholders, and visitors. Municipalities face shared challenges of developing and implementing sustainable rat management programs on a large scale, yet there is no professional society dedicated to advancing the science of municipal rodent control. Furthermore, there are only a handful of technical resources intended for this important audience, and subject area experts are rare. Therefore, the purpose of this roadmap is to highlight the need for advancement in the field of municipal rat management and identify potential steps forward.

Vision: Municipalities implement science-based rat management programs that minimize environmental, health, and economic risks associated with rats and the techniques employed for uban rat management.

Objectives:

1. Increase and improve knowledge of urban rats (*Rattus norvegicus* and *R. rattus*) and their management. Despite the long history of rat problems in municipalities, formal research on urban rats has been limited. Collaborative approaches to studying rats are needed and necessary to better understand these pests and develop science-based management approaches. At a minimum, the following steps are needed before Objectives II and III can be considered:

- Further expand on the ecological knowledge of urban rats to understand population and social structures, population densities, temporal changes to populations, movement patterns, interactions with control techniques and equipment, etc. in multiple municipalities.
  - Employ ecological information to develop predictive models that can identify areas and timeframes when the risk of rat issues is high.
  - Use ecological information to test and refine rat management practices (i.e., when is the best time of year to implement management? What techniques will be most effective at controlling rats at different stages of population growth?).
- Implement long-term studies on the impact of management techniques (i.e., sanitation technology, refuse containerization, exclusion approaches, use of nontoxic lethal methodologies, etc.) in different municipalities to understand how they affect rat populations over time and under variable conditions.
- Develop methods that provide an accurate estimate of the urban rat population in a defined area, including practical surveillance or sampling tools for use at smaller scales to document changes in rat populations as part of control efforts.

- Develop decision-making tools to help municipalities determine when and what intervention is needed to reduce rat problems that take into account the risks associated with management techniques (i.e., rodenticide use).

2. Assist municipal rodent control agencies in delivering effective programs. To date, there are limited resources and opportunities for municipal leaders to learn about large-scale rat management. This is partially due to the lack of formal research on urban rats (Objective I), but also due to a lack of academic interest, political will, and resource investment toward prioritizing the development of solutions to rat issues in municipalities and their causes. This objective will use the foundation of ecological urban rat studies to advance the field of municipal rat management:

- Plot (map out) the complexity of urban rat problems, including identification of the factors that allow rat populations to thrive (various sources of food, water, and shelter), and the social, political, and environmental forces that contribute to those factors. For example, if food availability in the form of garbage sustains rat populations, what factors contribute to the presence of garbage in different locations of a municipality: behaviors? systems? processes?
- Develop and deliver specialized educational content that describes effective approaches used to manage rats at the municipal level. This requires an approach that is different to what the professional pest management industry does at commercial and residential sites.
- Develop minimum guidelines for managing rats in cities, including approaches to monitoring and selecting the most cost-effective management tactic.
- Develop clear and measurable goals (program metrics) for rat management in cities that can be used for evaluation of municipal programs.
- Elevate the status of urban rats as study organisms worthy of the scientific community's interest. Rats are pests of public health importance, and they affect quality of life issues, yet have not received the same attention or funding as cockroaches and bed bugs. Furthermore, rodents should be an important topic for politicians to consider beyond campaign talking points.
- Determine if the concept of an interagency rat task force can reduce rat populations (assuming full cooperation and allocation of funds).
- Create a community for municipal rodent program leaders to meet, discuss, and learn from each other, perhaps as a professional society for the advancement of rat management in cities.

3. Determine the economic costs associated with effective municipal rat management. Municipalities make decisions based on perceived or actual costs and benefits. However, there are currently no economic assessments available regarding the true costs of rat infestations, including costs for local businesses and residents. Information derived in Objective I (i.e., components of a scientifically based, effective rat management program) will be used to estimate the costs of delivering successful rat management at the municipal level:

- Determine the actual cost to deliver an effective rat management program (assumes guidelines for effective municipal rodent management exist).
- Conduct an economic analysis to determine which rat management method is the most economically feasible to achieve program goals (assumes clear goals set by municipality, and no conflict of that approach with safety of residents, nontarget organisms and the environment).
- Develop economically sustainable programs that are impactful (assumes knowledge of an effective approach to municipal rat management).

Approaches for Success:

Several approaches are needed to achieve the proposed objectives.

I. Research: Despite the long history of rats in cities, relatively little is known about their biology, behavior, population dynamics, and the best long-term management approaches to use in these environments. Replicated research in multiple municipalities is needed to understand rat population dynamics and identify approaches to make management efforts more successful. Further, research is needed to establish goals and metrics that make sense for program evaluation. Finally, research can help develop decision-making tools that will assist municipalities in implementing science-based programs that rely on data collection and interpretation to provide management recommendations.

II. Collaboration: several types of collaborations are needed to realize the vision of this roadmap. These include:

- Municipalities + Researchers: Parsons and others (2017) identified the importance of, and challenges regarding collaboration in managing urban rats. Specifically, to understand the biology, behavior, and to test predictions about management of urban rats, researchers need to study live, unaltered populations. However, for municipalities, once a problem is identified, management efforts are often swiftly implemented to eliminate the rats. This conflict between the needs of researchers and that of the municipality must be addressed with agreements to ensure that projects proceed as planned to advance the science of urban rat management.
- Municipalities + Pest Professionals: Typically, pest professionals (exterminators) provide services to commercial and residential customers within a municipality. This may include an entire building, or only individual zones within that building (i.e., a first-floor deli, but not the residential apartments above or base-building below). In most cases, rat problems extend beyond property boundaries and collaboration can facilitate management efforts. For example, rats may be feeding on the garbage from a restaurant but are observed nesting in an adjacent city park or stormwater basin. A pest professional has no jurisdiction over those nesting sites and will thus have limited impact on the population by addressing only the feeding site. Furthermore, pest professionals likely deal with rat issues daily, and can provide important context to local rat management efforts.

- Municipalities + Professional Builders Associations: Rarely are biologists invited to be involved in the most important rodent prevention phase - new building construction. Initial steps are sorely needed to bridge this gap and to establish an ongoing relationship that will benefit all property owners from homes to businesses and capital construction of cities.
- Municipalities + Urban Planners: Urban rat problems are extremely complex and result from several factors that are themselves complicated. In municipalities, such complex issues are addressed by developing strategic plans, like those devised for city-wide transportation and refuse management. Collaborating with urban planners can help municipalities understand rat problems from a broad perspective and provide opportunities to implement proactive approaches that benefit rat control, such as infrastructure changes and new processes and procedures to limit garbage availability. To date, rat management programs have not been considered in municipal planning, highlighting the low-priority status of rats compared to other city-wide challenges.
- Municipalities + Economists: Limited information is available on the actual costs of rodent infestations in cities. Too, because best practice guidelines do not exist for municipal rat management, it is not currently possible to calculate the true cost of implementing an effective program. This information will be useful in making economic arguments in support of rat management programs, as well as various practices used to manage rats. For example, labor costs of one technique might be high, but if that technique reduces high economic costs of damage caused by rats, it might be justified.
- Municipalities + Social Scientists: Human behaviors in municipalities influence the presence of rats. Collaboration with social scientists can help determine the best approaches for educating residents about rat problems that will result in behavior change.
- Municipalities + Funding Agencies: Municipalities may seek funding from various agencies, including the federal government, to help develop and implement programs. Agencies may provide expertise and guidance for developing and implementing rat management plans (i.e., the Centers for Disease Control and Prevention), or simply provide funding for municipalities to conduct their own work.

III. Communication: In addition to the current and abundant rat control educational information available to the public (e.g., Centers for Disease Control and Prevention, University extension programs, city websites), new, innovative social media platforms should be developed and evaluated to educate residents and commercial entities on what they can do to reduce rat issues where they live, work, learn and play. Better public education can serve to further limit the availability of conditions that attract and sustain urban rats issues.

IV. Employment Opportunities: Municipalities can help advance the field of rat management by creating and supporting academic positions for the study of rat biology, behavior, and management. To date, there are a limited number of rodent management experts, with no pipeline for new students due to a limited job outlook. Urban pest management programs are historically underfunded, despite the continuing trend of more people living in cities and dealing with commensal pests.

Works Cited:

- Easterbrook, JD, T Shields, SL Klein, & GE Glass. 2005. Norway rat populations in Baltimore, Maryland, 2004. Vector Borne Zoonotic Diseases 5(3):296-299.
- Lee, MJ, KA Byers, C Stephen, DM Patrick, R Corrigan, S Iwasawa, & CG Himsworth. 2022b. Reconsidering the "War on Rats": what we know from over a century of research into municipal rat management. Frontiers in Ecology and Evolution 10:813600.
- Parsons, MH, PB Banks, MA Deutsch, RM Corrigan, & J Munshi-South. 2017. Trends in urban rat ecology: a framework to define the prevailing knowledge gaps and incentives for academia, pest management professionals (PMPs) and public health agencies to participate. Journal of Urban Ecology 3(1):jux005.
- Puckett, EE, J Park, M Combs, MJ Blum, JE Bryant, A Caccone, F Costa, EE Deinum, A Esther, CG Himsworth, PD Keightley, A Ko, Å Lundkvist, LM McElhinney, S Morand, J Robins, J Russell, TM Strang, O Suarez, L Yon, & J Munshi-South. 2016. Global population divergence and admixture of the brown rat (Rattus norvegicus). Proceedings of the Royal Society B 283:20161762.
- Sullivan, R. 2004. Rats: Observations on the History & Habitat of the City's Most Unwanted Inhabitants. Bloomsbury Publishing, New York, NY. 253p.

Prepared by:
Matt Frye, New York State IPM Program, Cornell University

Contributors:
Ray Delaney, City of Philadelphia, Department of Public Health
Bobby Corrigan, RMC Pest Management Consulting, Inc.
Jody Gangloff-Kaufmann, New York State IPM Program, Cornell University

The Municipal Rodent IPM Working Group was funded by the Northeastern IPM Center through Grant #2018-70006-28882, Accession Number: 1017389 from the USDA National Institute of Food and Agriculture, Crop Protection and Pest Management, Regional Coordination Program.

USDA National Institute of Food and Agriculture U.S. DEPARTMENT OF AGRICULTURE
New York State Integrated Pest Management Program
Northeastern IPM Center