The Rapidly Changing Look of Structural Rodent Control

Prepared for the ASPCRO Annual Meeting
Portland, Maine
August 27, 2025.

Bobby Corrigan, Ph.D.
Urban Rodentologist

Thank You APSCRO!

It’s an honor to be invited.

A post card from New York City


BigBelly
SOLAR
A LITTLE LITTER CAN LEAD TO
BIG PROBLEMS
CALL 311 FOR MORE INFORMATION

> Anim Cogn. 2017 Mar;20(2):199-213. doi: 10.1007/s10071-016-1039-5. Epub 2016 Sep 27.

Tool-use by rats (Rattus norvegicus): tool-choice based on tool features

Akane Nagano [1], Kenjiro Aoyama [2]

Affiliations + expand

PMID: 27679521 DOI: 10.1007/s10071-016-1039-5

Abstract

In the present study, we investigated whether rats (Rattus norvegicus) could be trained to use tools in an experimental setting. In Experiment 1, we investigated whether rats became able to choose appropriate hook-shaped tools to obtain food based on the spatial arrangements of the tool and food, similar to tests conducted in non-human primates and birds. With training, the rats were able to choose the appropriate hooks. In Experiments 2 and 3, we conducted transfer tests with novel tools. The rats had to choose between a functional and non-functional rake-shaped tool in these experiments. In Experiment 2, the tools differed from those of Experiment 1 in terms of shape, color, and texture. In Experiment 3, there was a contradiction between the appearance and the functionality of these tools. The rats could obtain the food with a functional rake with a transparent blade but could not obtain food with a non-functional rake with an opaque soft blade. All rats chose the functional over the non-functional rakes in Experiment 2, but none of the rats chose the functional rake in Experiment 3. Thus, the rats were able to choose the functional rakes only when there was no contradiction between the appearance and functionality of the tools. These results suggest that rats understand the spatial and physical relationships between the tool, food, and self when there was no such contradiction.

Keywords: Rats; Rodents; Tool-choice behavior; Tool-use behavior


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22 JUN 2018 07:42 pm

APRIL 26, 2024

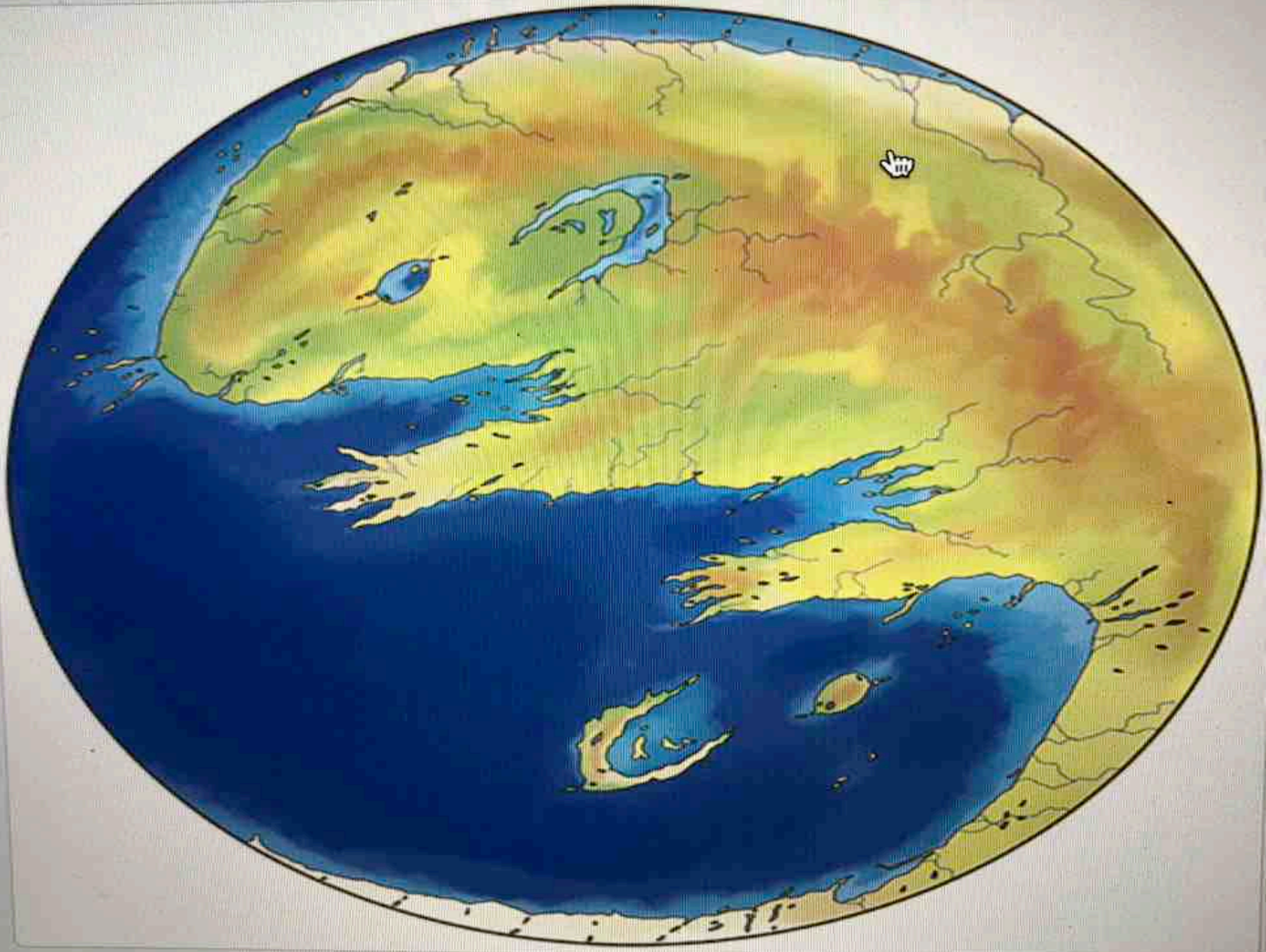
Editors' notes

Experiment reveals strategic thinking in mice

by Johns Hopkins University

Over consecutive trials, the mice would turn the wheel left for a bit, then switch …

Rodent populations continue to rise world-wide.



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RESEARCH ARTICLE | SOCIAL SCIENCES

Increasing rat numbers in cities are linked to climate warming, urbanization, and human population

JONATHAN L. RICHARDSON, ELIZABETH P. MCCOY, NICHOLAS PARLAVECCHIO, RYAN SZYKOWNY, ELI BEECH-BROWN, JAN A. BUIJS, JACQUELINE BUCKLEY, ROBERT M. CORRIGAN, FEDERICO COSTA, [...], AND YASUSHI KIYOKAWA +9 authors Authors Info & Affiliations

SCIENCE ADVANCES • 31 Jan 2025 • Vol 11, Issue 5 • DOI: 10.1126/sciadv.ads6782

Abstract

Urban rats are commensal pests that thrive in cities by exploiting the resources accompanying large human populations. Identifying long-term trends in rat numbers and how they are shaped by environmental changes is critical for understanding their ecology, and projecting future vulnerabilities and mitigation needs. Here, we use public complaint and inspection data from 16 cities around the world to estimate trends in rat populations. Eleven of 16 cities (69%) had significant increasing trends in rat numbers, including Washington, D.C., New York, and Amster

Abstract
INTRODUCTION
RESULTS
DISCUSSION
ATERIALS AND METHODS
Acknowledgments

Impacts extend beyond damage.
Living with rodents can elicit:

Fear

Anger

Stress

Worry

Exhaustion

Sleep disturbance

Avoidance behaviors

Byers, Cox, Lam, Himsworth. 2019. "They're always there": reside

The Rapidly Changing Look 2025.

Rodent IPM Updates August 2025.

1. Site-specific, *assessment-based* rodent control is the professional goal vs. simple linear wall equipment-dropping (i.e., the Amazon clickers and building supers can do that).

2. IPM remains the gold standard – esp. rodent control.
3. Behavioral-based equipment placement

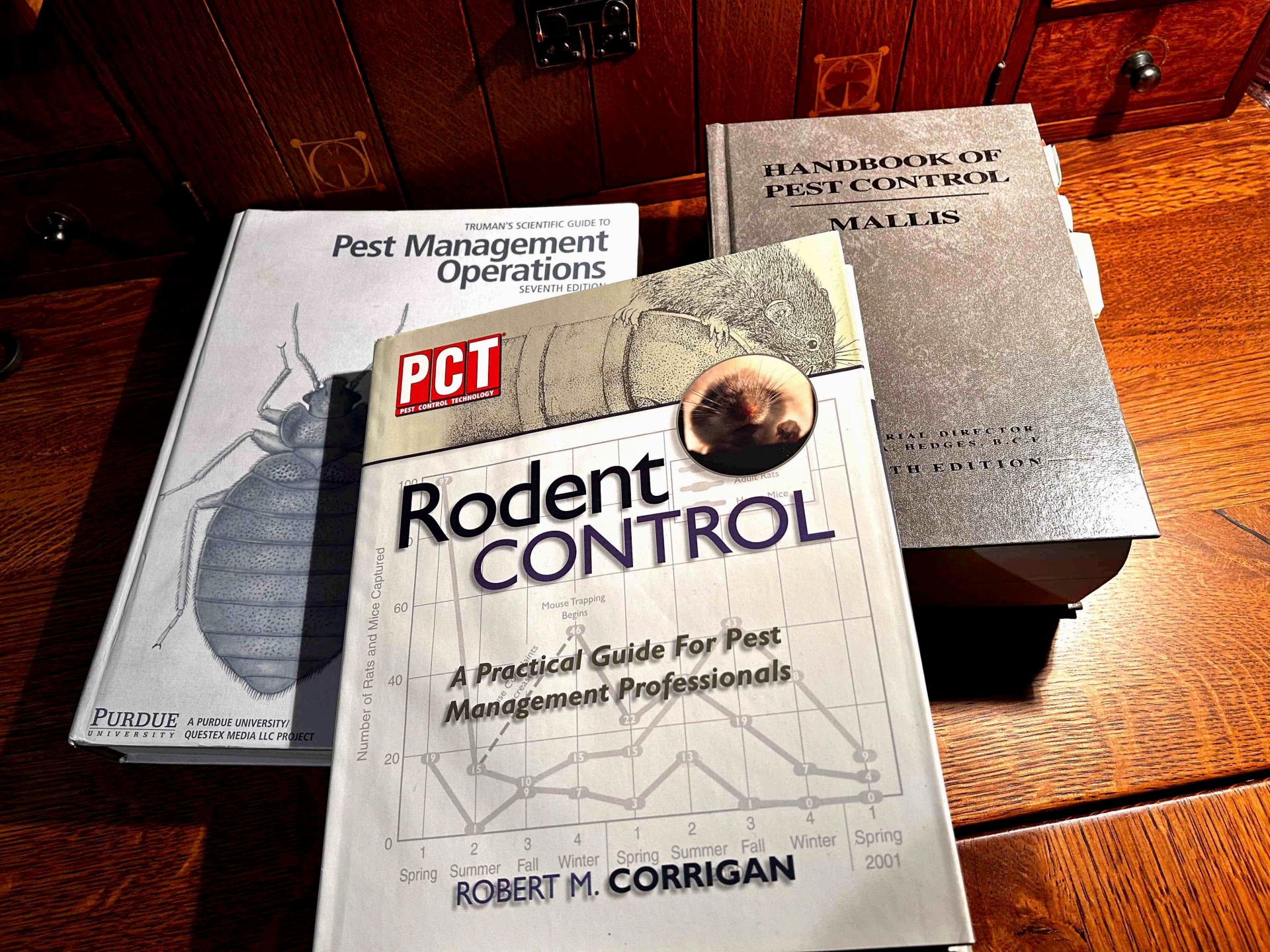
4. Equipment Aversion and Disregard (EAD)
5. Digital Monitoring Technology (Sensors)

6. Rodenticides and Wildlife (x 5) and the 2025 IPM Tool Box
(e.g., an on-going change to Non-SGAR Anticoagulants outside.

7. Norway rat burrow infestations: CO^{2} and CO

SGARs and the environment:

The current formal global science is irrefutable.


TRUMAN'S SCIENTIFIC GUIDE TO
Pest Management Operations
SEVENTH EDITION
PURDUE UNIVERSITY
A PURDUE UNIVERSITY/ QUESTEX MEDIA LLC PROJECT
HANDBOOK OF PEST CONTROL
MALLIS
PCT
PEST CONTROL TECHNOLOGY
Rodent CONTROL
A Practical Guide For Pest Management Professionals
Number of Rats and Mice Captured
Mouse Trapping Begins
Spring Summer Fall Winter Spring Summer Fall Winter Spring
2001
ROBERT M. CORRIGAN

1. Rodenticides offer an economical approach for eliminating moderate and serious infestations.
2. Rodent baits are usually well accepted by most rodents under a wide range of environmental conditions.
3. Rodenticides can be formulated into several different mediums (food baits, liquid baits, and tracking powders). Thus, specific formulations can be matched to each situation.
4. Contemporary rodenticides present relatively low hazard and poisoning threats to nontargets when used according to label directions. (The anticoagulant rodenticides offer a readily available antidote in cases of accidental poisonings; the non-anticoagulants require relatively large and unlikely amounts of baits to be ingested to attain a lethal dose.)

Types of Rodenticides

Many different types of rodenticides have

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Raptors (Hawks, Owls, Eagles, Merlins)

Non-threatening small mammals

Predators (fox, coyote, bobcats, raccoons, skunks, weasels)

Reptiles (Snakes)

Fish and other aquatic organisms

Livestock human foods (swine and poultry)

Nature is a well-oiled machine of millions of years that works on milli-second precision.

Life Sustaining Event = speed + dexterity+ accuracy + strength measured in milliseconds. (Pht.Wisconsin Pollinators)

deployed in the agricultural sector, where rodent urine and feces spoil an estimated **20 percent** of the world's food supply. Perhaps the biggest factor behind the success of second-generation anticoagulants is the simple fact that they are really good at killing rats.

Just one night of eating the bait is usually enough to deliver a fatal dose, but the actual process of a rat bleeding out may take upward of five days. For a hawk or an owl or any other predator that regularly eats rodents, this can spell trouble; once consumed, the chemicals can stay lodged in animal tissue for months—posing an ecological menace.

The chemicals can stay lodged in animal tissue for months—posing an ecological menace.

"What makes these particular rodenticides such a concern is the fact that they have these long half-lives…and so they can accumulate in the food chain," says Maureen Murray, director of Tufts Wildlife Clinic, who has been studying these chemicals since 2006. In that time, the problem appears to have gotten worse, and more and more birds are turning up with multiple second-generation anticoagulants in their system. The first Bald Eagle to die from rodenticides in Massachusetts, for instance, had **three of the four chemicals** in its liver.

Last year Murray reported that **100 percent** of 43 Red-tailed Hawk carcasses she examined had traces of second-generation rodenticides. That followed her 2017 study in which **96 percent** of 94 hawks and owls tested positive for the poisons. Murray was quick to note that evidence of exposure does not necessarily translate to cause of death. There are instances in which it is clear a bird died directly from "acute rodenticide toxicosis": The blood isn't able to clot, so bruising occurs throughout the body, and the lungs can fill with blood. Other complications can include lethargy, immobility, loss of appetite, and small wounds that won't stop bleeding. While these may not be enough to directly kill a bird, they may

Solid Global Research (Refereed Science)

SGARs bait boxes all around the urban properties of cities and towns are essentially wildlife landmine fields.

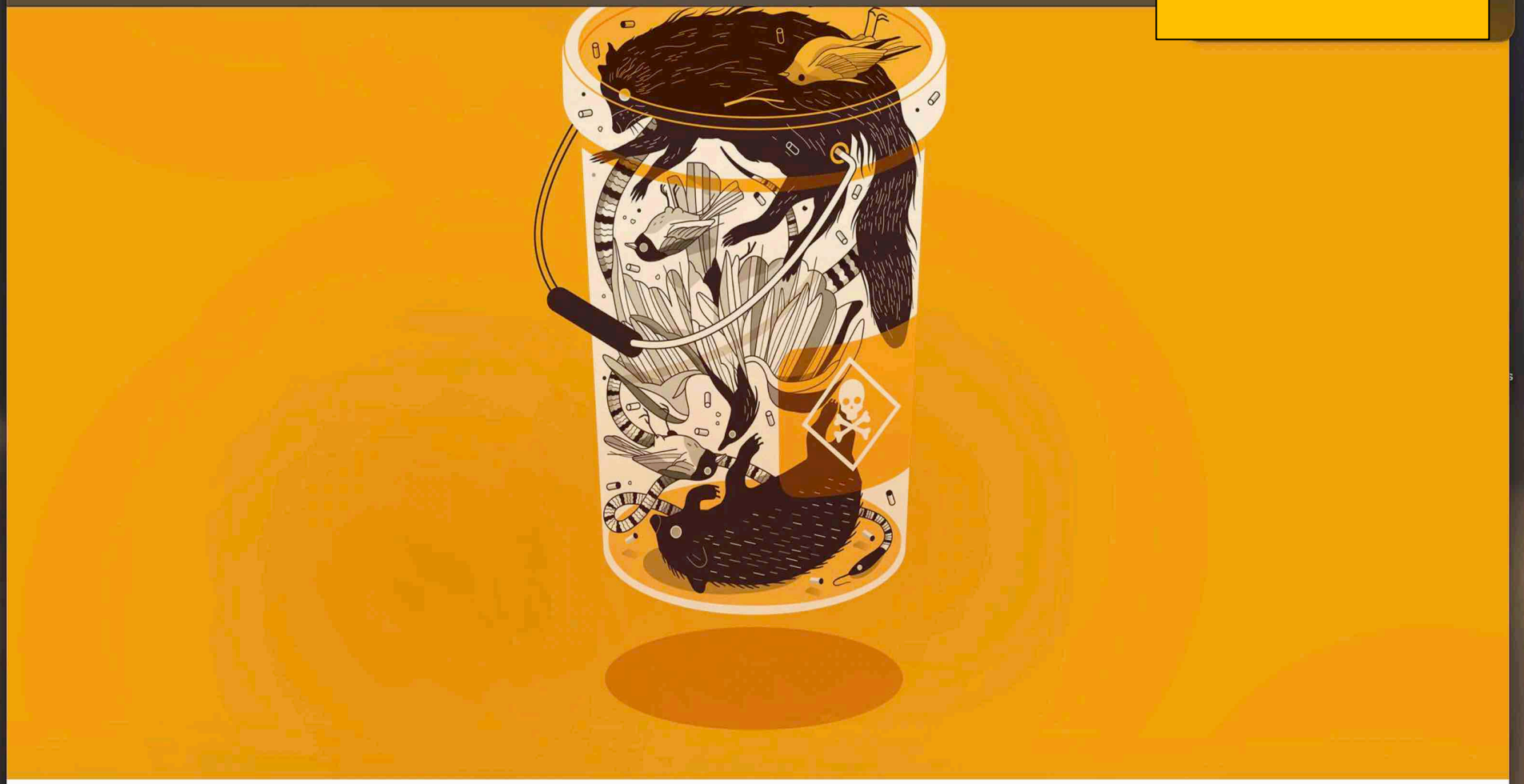

Illustration: Harry Campbell

From Audubon Magazine

The Internet Has a Rat Poison Problem

How online sales of highly regulated, super-toxic rodenticides exploit gaps in the law and imperil wildlife.

By Chris Sweeney
Winter 2021

My shopping spree was born out of boredom. On a lazy July morning I was in bed browsing Amazon when I

2025 projected sales to the lay-public :

$ 5.8 Billion

(Hey John Q you must read the label; it's the law).

2025 projected sales to the professional market

$ 80 Million

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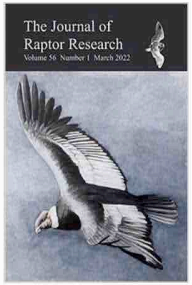
The Journal of Raptor Research

HOME ISSUES EARLY ONLINE FOR AUTHORS EDITORIAL BOARD MEMBER ACCESS SUBSCRIPTIONS COVER ART HELP

Volume 56, Issue 1
March 2022



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Effects of Anticoagulant Rodenticides on Individual Raptors

Effects of Rodenticides on Raptor Populations

Mitigating the Effects of ARs on Raptors

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Conservation Letter: Raptors and Anticoagulant Rodenticides

Eres A. Gomez; Sofi Hindmarch; Jennifer A. Smith

Journal of Raptor Research (2022) 56 (1): 147–153.

https://doi.org/10.3356/JRR-20-122 **Article history**

Keywords: *anticoagulant*, *blood clotting*, *nontarget poisoning*, *secondary exposure*, *toxicosis*

Introduction

Widespread use of anticoagulant rodenticides (ARs) creates an ongoing global conservation concern for raptors. ARs have the potential to negatively affect birds primarily by secondary exposure (via scavenging or depredating primary consumers of ARs), which may cause toxicosis following the consumption of a poisoned prey. Exposure to ARs has been documented in numerous raptor species sampled from a wide range of regions, including North America (Stone et al. 2003, Albert et al. 2010, Thomas et al. 2011, Murray 2017, Gabriel et al. 2018), Europe (Berny et al. 1997, Sanchez-Barbudo et al. 2012, Hughes et al. 2013), Asia (Naim et al. 2010, Hong et al. 2019), and Australia (Lohr et al. 2018). This Conservation Letter provides a scientific review of AR exposure to raptors at this global scale and highlights lessons learned and potential solutions. This letter is not intended as an exhaustive literature review. Rather, the intent of the Raptor Research Foundation (RRF) is to provide readers with enough evidence-based examples that readers can appreciate the scope and prevalence of AR exposure, understand the potential effects on raptor species and populations, and recognize some of the challenges associated with addressing AR exposure in raptors across regions.

ARs are a form of ingested rodent pest control that work by blocking the vitamin K cycle, which inhibits blood

The seven most important words relative to your bait's effectiveness.

as to be vulnerable to commensal rodent invasions and/or to harboring or attracting rodent infestations. Examples of such structures include homes and other permanent or temporary residences, food processing facilities, industrial and commercial buildings, trash receptacles, agricultural and public buildings, transport vehicles (ships, trains, aircraft), docks and port or terminal buildings, and related structures around and associated with these sites. Fence and perimeter baiting beyond 100 feet from a structure, as defined above, is prohibited. Do not sell this product in individual containers holding less than 16 pounds of bait. Do not place near or inside ventilation duct openings. Do not contaminate water, food, feedstuffs, food or feed handling equipment, or milk or meat handling equipment. Do not apply directly to food or feed crops. Do not broadcast bait. Burrow baiting with this product is prohibited.

*Not permitted for use against the following species in California: Cotton rat, Eastern harvest mouse, Golden mouse, Polynesian rat, Meadow vole, White-throated woodrat, Southern plains woodrat, and Mexican woodrat.

Selection of Treatment Areas: Determine areas where rats and/or house mice will most likely find and consume bait. Generally, these are along walls, by gnawed openings, in corners and concealed places, between floors or walls, beside burrows, or in locations where rats and/or house mice or their signs have been observed. Remove as much alternative food as possible.

APPLICATION DIRECTIONS: Each pouch contains 0.35 oz. (10g). House Mice: Apply 1 pouch per placement, usually spaced 8 to 12 feet apart. Up to 4 pouches may be needed at points of very high house mouse activity. Maintain a constant supply of fresh bait for 15 days or until signs of house mouse activity cease.

Rats: Apply 9 to 43 pouches per placement, usually spaced 15 to 30 feet apart. Maintain a constant supply of fresh bait for 10 days or until signs of rat activity cease.

Bait may be removed from pouch and placed in a feeding device that secures the unwrapped bait in a bait station. Discard empty wrapper in the trash.

Putting out baits (soft or firm) nearby garbage :
Will it matter?


GF
CANS, PLASTICS
BOTTLES ONLY
RECYCL

The Journal of Veterinary Medical Science

FULL PAPER

Ethology

Existence of wild brown rats (*Rattus norvegicus*) that are indifferent to novel objects

Ryoko KOIZUMI[1,3], Yasushi KIYOKAWA[1]*, Kazuyuki D. TANAKA[2], Goro KIMURA[2], Tsutomu TANIKAWA[2] and Yukari TAKEUCHI[1]

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[2]Technical Research Laboratory, Ikari Shodoku Corporation, 1-12-3 Akanehama, Narashino-shi, Chiba 275-0024, Japan
[3]Present address: Wildlife Damage Management Group, Central Region Agricultural Research Center, National Agricultural Food Research Organization, 2-1-18 Kannondaira, Tsukuba, Ibaraki 305-8666, Japan

ABSTRACT. Exposure to novel objects typically evokes avoidance behavior in wild animals, which is called neophobia. We previously found that wild brown rats (*Rattus norvegicus*) that were trapped in a park in downtown Tokyo, Japan, exhibited neophobia. We also found that this behavior was accompanied by the activation of the basolateral complex of the amygdala (BLA). Previous studies have suggested that genetic factors are the primary determinants of neophobia. Since rats in cities form populations with distinct genetic characteristics, it is reasonable to assume that wild rats caught at different locations in urban centers will exhibit different levels

5a. Early detection and intervention of rat colonies and populations via remote rodent sensor technology.

Figure xx. These small, powerful rodent sensors, can be placed inside exterior bait stations (toxic or non-toxic), or can be installed sans a bait boxe to monitor for the 24/7/365 presence or absence of rats (or mice inside) around or inside a property. Alerts of each rodent at each minute of a day/night and their precise location are sent to a phone, tablet or desk computer. Data dashboard software provide up–to-date alerts and status, and progress of rat control on blocks, alleys, parks, building perimeters, refuse staging corrals, campuses, and many other applications. *Essential technology* large-scale Rat IPM programs as well as for municipality program cost efficiency. (EverSmart® Rodent Sensors (Microshare.io) shown here, but no endorsement implied over any other rodent remote sensor technology).

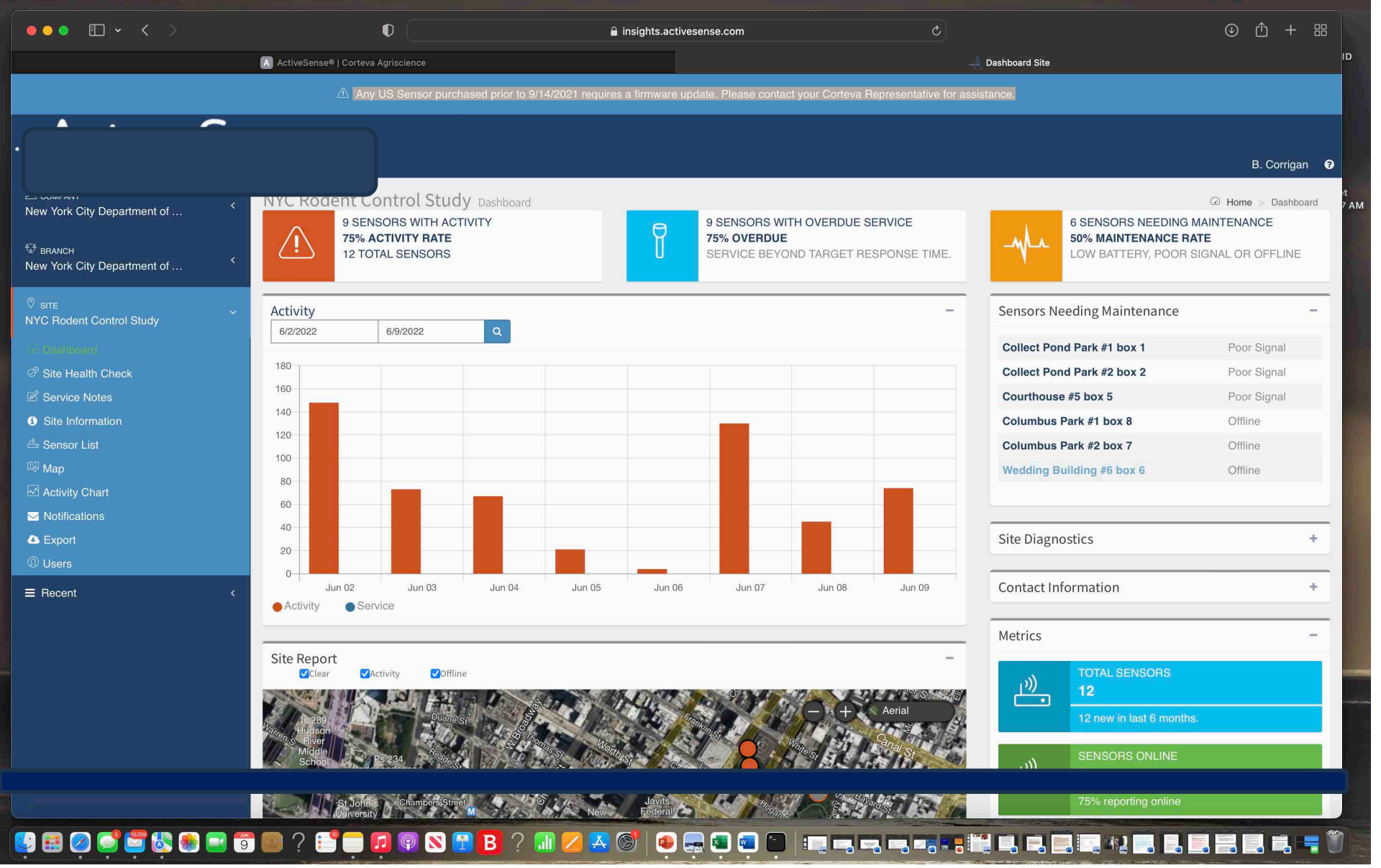

Figure xx. A remote sensor dashboard used in city-level (NYC) rat control research (for 3 years) by RM Corrigan. The insight into rat populations and their distribution and thus their targeted remediation was invaluable. (Scientific publications pending).

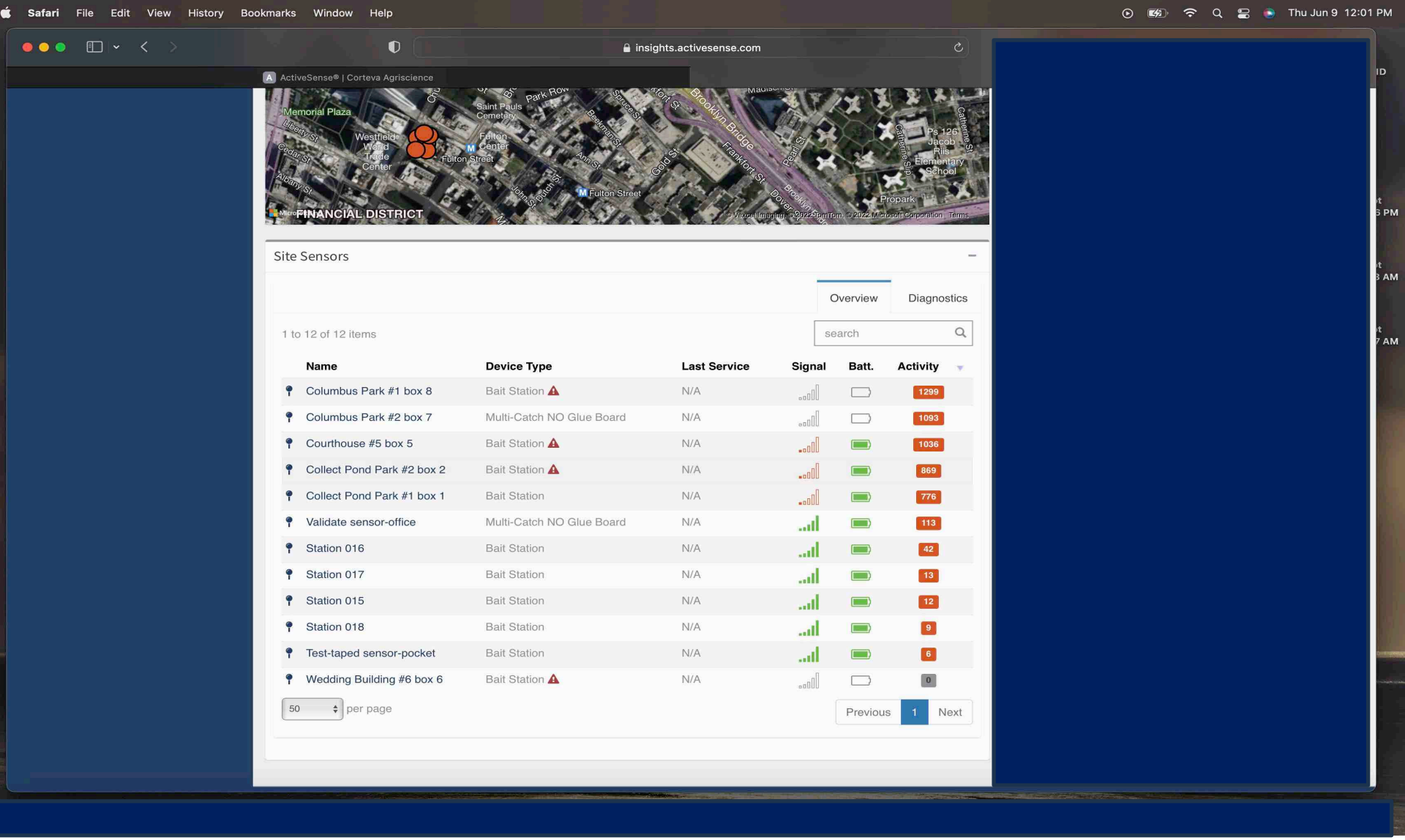

Figure.xx Remote Sensor Technology Software provides incredible data for each sensor in each box. And data can be presented in multiples of perspectives depending on the interest (location, building side, park quadrant, etc). In this case, I asked the dashboard to organize the rat visits per station within a community park by most to least. This instructs a city as to where to best spend their labor resources and materials most economically. Over the long run, large sums to a program's city budget line can be saved.

The Non-SGARs Tool Box

(And this does not mean less effective rodent control results).

Thank You.

1. **Non anticoagulant baits**
Bromethalin Cholecalciferol

2. **First Gen Anticoagulants**

3. **Outstanding Trap Technology and growing**

4. **Carbon dioxide and carbon monoxide**

5. **New rodent baits as we speak**

6. **Pest Proofing Technology and Services will (should) increase**

7. **Electronic monitoring for colony assessments vs. culling.**


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