



Rodents running riot in supermarkets - do we need to worry?

15 April 2024

Jonathan Jarman, Chris N. Niebuhr, Nick Wilson, Jackie Benschop

Summary

In January and February 2024, the public of Aotearoa New Zealand (NZ) were captivated by graphic images of rodents running around supermarkets in Dunedin, Christchurch and Auckland. As rodents can spread enteric diseases such as salmonellosis – these pests should indeed be completely excluded from retail outlets. But this Briefing also considers the most common reported rodent-related disease in NZ (leptospirosis) and scans the wide variety of other health-relevant problems from rodents (eg, damage to food, damage to insulation, damage to water piping, impact on mental health etc). It also discusses the impact of climate change and the need for the potential expansion of rodent control in NZ.

In January and February 2024, the public of Aotearoa New Zealand (NZ) were captivated by graphic images of rodents running around supermarkets in Dunedin, Christchurch and Auckland.¹ The purpose of this Briefing is to look at the ecology of rodents in our country, examine the evidence linking rats to human health, and examine the need to expand our rodent control efforts.

Rodents and humans have lived together for thousands of years.² It is likely that rodents were one of the original reasons why cats were domesticated.³ The close relationship that can occur between many rodent species and humans is described as being commensal² which comes from a Latin word which means dining at the same table.⁴

Four species of rodents have been introduced into NZ, the house mouse (*Mus musculus*), and three species of rats, the kiore (*Rattus exulans*), brown rat (*R. norvegicus*), and black rat (*R. rattus*). While kiore are mostly restricted to a few offshore islands, the other three species are distributed across the main islands, with all four species having commensal relationships with humans.⁵ See [Appendix One](#) for more information on the ecology of rodents in NZ.

Supermarkets - a rodent utopia?

Rodents can harm human health in a large number of ways – see Table 1. In particular rodents contaminate food and the environment with their saliva, urine and faeces which can carry pathogenic microbes. For example, black rats excrete an average of 52 faecal pellets per 24 hours⁶ and during active shedding one rat faecal pellet may contain up to 1.0×10^8 *Salmonella* colony-forming units.⁷

Supermarkets are very attractive for rodents because of the large amount of food and

places to hide. For every rodent seen during the day it is estimated that there are 20 to 50 individuals that are unseen.⁸ Contaminated ready-to-eat foods carry a particularly high risk to human health. Bacterial pathogens such as non-typhoidal *Salmonellae* can grow on contaminated foods above 5.2°C but most serovars are killed instantly at temperatures above 75°C.⁹ Rodent body parts found in food that has been heated such as bread or canned produce are likely to be lower risk and in fact are a source of human food in some parts of the world.¹⁰

It is usually difficult to pinpoint rodents as the cause of a foodborne illness and there is a lack of evidence on the scale of this source of infection in NZ. While finding evidence of rodent activity in human food can be very upsetting, it is likely that it causes only a small part of the total enteric disease burden. For example, *Campylobacter* contamination of fresh poultry meat is estimated to cause 54 000 cases, 548 hospitalisations, and 28 deaths per annum in NZ.¹¹ Despite this, it is clear that all businesses involved in the food supply chain require pest management strategies combined with stringent food safety standards and a zero tolerance to rodent sightings. It is likely that climate change with warmer weather and more extreme weather events will increase rodent populations and increase the adverse impacts on humans.^{12 13 14}

Rodent urine and leptospirosis

The most common reported illness linked to rodents in NZ is leptospirosis due to *L. borgpetersenii* sv Ballum and *L. interrogans* sv. Copenhageni.

Leptospirosis is an illness which can vary from having no symptoms to a severe illness that may be life-threatening. In addition to a severe acute illness with two thirds of notified patients hospitalised, up to 50% report a prolonged recovery with associated social, financial, and mental health consequences.^{15 16} Both mild and severe leptospirosis are highly underdiagnosed.¹⁷

Mice and rats are the maintenance hosts for *L. borgpetersenii* sv. Ballum and *L. interrogans* sv. Copenhageni, respectively. Once infected rodents excrete *Leptospira* in their urine for their remainder of their lives. On average mice urine contains 3.1×10^3 and rat urine contains 5.7×10^6 *Leptospira* cells per millilitre.¹⁸ Contact with rodent urine such as farmers handling rodent-contaminated animal feed, people working in pest control, and the general population dealing with rodents in their homes are at risk.¹⁹ Pet rodents are also increasingly popular. While there is no direct evidence linking a pet rodent to a case of leptospirosis in NZ, there are overseas reports suggesting a possible relationship.^{20 21}

[Appendix Two](#) has extra detail on rodents and leptospirosis.

Table 1: Summary of the potential harms to human health from rats and mice in NZ (adapted and updated from:²²; more detailed evidence [provided in Appendix Three](#))

Area of harm	Further details
Zoonotic diseases	Rodents can carry pathogens which cause disease in humans. These diseases include cryptosporidiosis, giardiasis, leptospirosis and salmonellosis.
Damage to food supplies	Rodents can eat and contaminate food at all points along the food supply chain and within people's homes.

Area of harm	Further details
Damage to building insulation and to building walls and roofing	Rats can damage insulation and cause leaks, leading to colder, damper homes which in turn contribute to mould in houses (a risk factor for respiratory and mental health).
Fires associated with rat damage	Rats can gnaw through electrical wiring and contribute to building fires and electrocution risks.
Mental health impacts of rodent infestations	Rats and mice in and around a dwelling can be a source of anxiety for occupants. Additionally the smell of dead rodents inside walls/roofing can negatively impact wellbeing.
Damage to water and sewerage system infrastructure	Through their tunnelling activities, rats can damage sewer and water lines.
Contribution to landslides and flooding risk	Rodent burrowing and vegetation suppression (through eating seeds) can contribute to landslides this includes the collapse of banks of canals and ditches, resulting in flooding.

Expanding rodent control in Aotearoa New Zealand?

NZ has been successful in eradicating rodents (and other predatory mammals) from approximately a third of its offshore islands, although these islands were typically small and uninhabited, and account for just 10% of offshore island area.²³ While some recent success has been reported from Miramar Peninsula,²⁴ expanding rodent management to the majority of mainland NZ, and achieving the current 2050 predator free goal, may require the use of different approaches or technologies.

What is new in this Briefing?

- Four species of rodents have been introduced into Aotearoa New Zealand (NZ), the house mouse (*Mus musculus*), and three species of rats, the kiore (*Rattus exulans*), brown rat (*R. norvegicus*), and black rat (*R. rattus*).
- There are significant health risks from eating ready-to-eat food contaminated by rodents.
- Leptospirosis is the most common reported illness linked to rodents in NZ and is likely to be highly underdiagnosed.
- It is likely that climate change with warmer weather and more extreme weather events will increase rodent populations and increase the adverse impacts on humans unless expanded control measures are used.

Implications for public health

- All businesses involved in the food supply chain from the farmer to the point-of-sale to the consumer require pest management strategies combined with stringent food safety standards and a zero tolerance to rodent sightings within retail outlets.
- Rodent urine should be considered potentially infectious at all times and the appropriate contact precautions taken when handling rodents, traps, or pet rodent bedding.
- More surveillance and research are required on the ecology of rodents and the impact of climate change within our urban settings.
- Different approaches and new technologies may need to be considered if Aotearoa New Zealand is to expand rodent control and become free of rodent pests by 2050.



Author details

Dr Jonathan Jarman, Retired Public Health Medicine Specialist and former Medical Officer of Health

[Dr Chris Niebuhr](#), Researcher - Wildlife Ecologist, Manaaki Whenua – Landcare Research

[Prof Nick Wilson](#), Professor of Public Health, University of Otago, Wellington.

[Prof Jackie Benschop](#), Professor of Veterinary Public Health, Massey University

Images credit: Grant Morriss, Manaaki Whenua – Landcare Research

Appendix One: Rat ecology in NZ - extra details

Although brown rats are the subject of most world-wide research on urban rats, the most common urban rat in NZ is actually the black rat.²⁵ While brown rats tend to be only found near water or foodstuffs, black rats are more widespread within NZ. This species possesses stronger climbing abilities, which allow them to better take advantage of three-dimensional spaces, including vegetation and building ceilings.²⁶

Appendix Two: Leptospirosis and rodents - extra details

Leptospirosis is one of the most common zoonotic bacterial diseases in the world. Infection generally occurs when humans have direct contact with contaminated animal urine, fluids or body tissue, or through indirect contact with contaminated soil or freshwater.²⁷ The pathogen gains entry through cuts and abrasions on skin and through mucous membranes such as conjunctival or oral surfaces.²⁸

A New Zealand 2019-2022 study found that people notified with leptospirosis were 2.2 (95% CI: 0.9-5.3) times more likely to report seeing evidence of rodents (eg, droppings, gnawing) in the months before they became ill than controls were in the month before interview. This estimate is adjusted for sex, rurality, age, season, and occupation. In 2023, 17 *L. Ballum* cases were reported and four people indicated possible contact with rats.²⁹

Our farmed ruminants (sheep, cattle and deer) can also be exposed to rodent urine and develop antibodies to the rodent strains. This means they have been infected and may shed these strains as well acting as bridge for infecting humans.

Appendix Three: Harms to human health from rodents

Supplementary Table 1: Detailed summary of the potential harms to human health from rats and mice in NZ (adapted and updated from:²²)

Area of harm	Further details
Zoonotic diseases (eg, cryptosporidiosis, giardiasis, leptospirosis, and salmonellosis)	<p>A number of rodent-associated zoonotic pathogens have been found in NZ, including: Bacteria – <i>Leptospira</i>, <i>Salmonella</i>, <i>Campylobacter</i>, <i>Rickettsia typhi</i> (Murine typhus); Protozoa – <i>Giardia</i>, <i>Cryptosporidium</i>, <i>Toxoplasma</i>; Nematode – <i>Trichinella spiralis</i>. Each of these have been identified from at least one rat species in NZ, with the majority also identified from mice.^{5 30} Additionally, the plague-causing bacteria, <i>Yersinia pestis</i>, was found in rats at the Auckland port in 1900, around the same time 21 cases of plague were recorded.^{31 32} While the flea species required for transmission of plague are present in NZ, no cases have been reported since 1911. Other pathogens are associated with these rodent species globally, including <i>Escherichia coli</i> (<i>E. coli</i>), <i>Bartonella</i>, <i>Streptobacillus moniliformis</i>, <i>Angiostrongylus cantonensis</i>, and Seoul hantavirus.^{14 33} In a 2016/17 survey of mice on a dairy farm in the North Island, 104/192 were infected with sv. Ballum.³⁴ Opportunistic kidney samples from <i>Rattus spp.</i> trapped in Aotearoa in 2019-2020 found 13/120 PCR positive for pathogenic <i>Leptospira</i> [unpublished data, J Benschop]. Rodents can carry pathogens which contaminate animal feed and thus enter the “farm to fork” food supply chain for humans.^{35 36 37} Roof-collected rainwater is the source of drinking water for some NZ households, especially in rural areas. Such water can be of poor microbiological quality in NZ with some of the above named pathogens involved (eg, <i>Salmonella</i>, <i>Giardia</i> and <i>Cryptosporidium</i>; as reviewed elsewhere³⁸). Rodents are likely to contribute to such contamination – but so could other animals such as birds and possums. Rat-bite fever (eg, from <i>Actinobacillus muris</i>³⁹ and from <i>Spirillum minus</i>⁴⁰) has been recorded in NZ, but it is very uncommon.</p>
Damage to food supplies	<p>Rodents can eat and contaminate food at all points along the food supply chain and within people’s homes. There is no specific data for New Zealand but it is estimated that effective rodent control could avert 280 million cases of malnutrition each year worldwide. Rodent production losses were calculated to be US\$ 1.9 billion in Asia, US\$ 45 million in the United Republic of Tanzania, US\$ 19 billion in the United States of America, and US\$ 60 million in Australia.³⁷</p>
Damage to building insulation and to building walls and roofing	<p>Insulation of housing benefits health⁴¹ and is highly cost-beneficial in the NZ setting.⁴² But rats, especially <i>R. rattus</i>, damage building insulation. Damaged roofing and other parts of buildings can also result in leaks that then contribute to mould in houses (a risk factor for respiratory and mental health).</p>
Fires associated with rat damage	<p>Rats can gnaw through electrical wiring (especially <i>R. rattus</i>) and so contribute to building fires and electrocution risks.⁴³ There are local NZ reports of this cause of fires.⁴⁴</p>

Area of harm	Further details
Mental health impacts of rodent infestations	A WHO Report states that: “It should also be recognized that the awareness of rats and mice in and around a dwelling can be a source of anxiety for its occupants”... “Thus, the presence of rats and mice also affect mental health”. ⁴³ NZ examples of this problem include the smell of dead rodents inside walls/roofing, ⁴⁵ and the presence of hungry rats approaching people in picnic areas. ⁴⁶ There is a potential health equity issue with rats more likely to be seen in disadvantaged areas though this finding may be more applicable to overseas urban settings where there is aging infrastructure, poor sanitation, overcrowding and poverty. ⁴⁷
Damage to water and sewerage system infrastructure	Through their tunnelling activities rats (<i>R. norvegicus</i>) can damage sewer and water lines. Even minor damage may increase the risk of these systems failing when stressed by other factors (eg, the extreme age of such piping in some NZ urban areas – such as over 100 years for some Wellington piping ⁴⁸).
Contribution to landslides and flooding risk	“Burrowing by rats (<i>R. norvegicus</i>) can cause landslides on embankments as well as causing the collapse of banks of canals and ditches, resulting in flooding”. ⁴³ As rodents eat seeds they may also depress vegetation levels in urban areas – which may in turn may reduce the capacity of vegetation to stabilise areas at risk of slips and reduce flooding risk (ie, via vegetation holding more rainfall and reducing the speed of run-off).

References

1. The Spinoff. Rat tracker: An interactive map of supermarket rodent sightings in NZ. The Spinoff 2024;(15 February). Available from: <https://thespinoff.co.nz/kai/15-02-2024/rat-tracker-an-interactive-map-of-supermarket-rodent-sightings-in-nz#>
2. Puckett EE, Orton D, Munshi-South J. Commensal rats and humans: integrating rodent phylogeography and zooarchaeology to highlight connections between human societies. *Bioessays* 2020;42(5):1900160.
3. Driscoll CA, Macdonald DW, O'Brien SJ. From wild animals to domestic pets, an evolutionary view of domestication. *Proceedings of the National Academy of Sciences* 2009;106(supplement_1):9971-78.
4. Merriam-Webster Dictionary. Commensal – adjective. Available from: <https://www.merriam-webster.com/dictionary/commensal>. [Accessed 5 April 2024].
5. King CM, Forsyth DM. (Editors). The handbook of New Zealand mammals (Third Edition). Melbourne, Oxford University Press, 2021.
6. Frankova M, Kaftanova B, Aulicky R, et al. Temporal production of coloured faeces in wild roof rats (*Rattus rattus*) following consumption of fluorescent non-toxic bait and a comparison with wild *R. norvegicus* and *Mus musculus*. *Journal of stored products research* 2019;81:7-10.
7. Umali DV, Lapuz RRSP, Suzuki T, et al. Transmission and shedding patterns of Salmonella in naturally infected captive wild roof rats (*Rattus rattus*) from a Salmonella-contaminated layer farm. *Avian diseases* 2012;56(2):288-94.
8. Hamidi K. How do rodents play role in transmission of foodborne diseases. *Nutri Food*

Sci Int J 2018;6(1):1-4.

9. ESR Ltd. Non-typhoidal Salmonellae. Ministry for Primary Industries. 2018. Available from: www.mpi.govt.nz/dmsdocument/1214-Non-Typhoid-Salmonellae. [Accessed 5 April 2024].
10. Gruber K. Rodent meat—a sustainable way to feed the world? Using rodents as food has a long tradition in many parts of the world. *EMBO reports* 2016;17(5):630-33.
11. Baker MG, Grout L, Wilson N. Update on the campylobacter epidemic from chicken meat in New Zealand: The urgent need for an upgraded regulatory response. *Epidemiology and Infection* 2021;149:1-10. doi: 10.1017/s095026882000299x
12. Bhatia R. What's with all the supermarket rats and mice? *Stuff* 2024;(15 February). Available from: <https://www.stuff.co.nz/nz-news/350177452/whats-all-supermarket-rats-and-mice>
13. Brunton T. 'More rats than they have seen' – Cyclone-damaged areas face rodent plague. *Radio New Zealand* 2023;(6 April). Available from: <https://www.rnz.co.nz/news/national/487488/more-rats-than-they-have-seen-cyclone-damaged-areas-face-rodent-plague>
14. Himsworth CG, Parsons KL, Jardine C, et al. Rats, cities, people, and pathogens: a systematic review and narrative synthesis of literature regarding the ecology of rat-associated zoonoses in urban centers. *Vector-Borne and Zoonotic Diseases* 2013;13(6):349-59.
15. Benschop J, Mocke S, Collins-Emerson JM, et al. An exploratory qualitative enquiry into workers' experiences of leptospirosis and post-leptospirosis in Aotearoa New Zealand. *The New Zealand Medical Journal (Online)* 2023;136(1570):30-41.
16. Prinsen G, Baker M, Benschop J, et al. “We don't really do doctors.” messages from people diagnosed with occupational leptospirosis for medical professionals on infection, hospitalisation, and long-term effects. *Heliyon* 2023;9(9)
17. Sanhueza JM, Baker MG, Benschop J, et al. Estimation of the burden of leptospirosis in New Zealand. *Zoonoses and public health* 2020;67(2):167-76.
18. Barragan V, Nieto N, Keim P, et al. Meta-analysis to estimate the load of *Leptospira* excreted in urine: beyond rats as important sources of transmission in low-income rural communities. *BMC research notes* 2017;10:1-7.
19. Nisa S, Wilkinson DA, Angelin-Bonnet O, et al. Diverse epidemiology of *Leptospira* serovars notified in New Zealand, 1999–2017. *Pathogens* 2020;9(10):841.
20. Mori M, Bourhy P, Le Guyader M, et al. Pet rodents as possible risk for leptospirosis, Belgium and France, 2009 to 2016. *Eurosurveillance* 2017;22(43):16-00792.
21. Nordholm AC, Omland LH, Villumsen S, et al. Leptospirosis meningitis transmission from a pet mouse: A case report. *Journal of Medical Case Reports* 2019;13:1-4.
22. Wilson N, McIntyre M, Blaschke P, et al. Potential public health benefits from eradicating rats in New Zealand cities and a tentative research agenda. *Journal of the Royal Society of New Zealand* 2018;48(4):280-90.
23. Russell JC, Broome KG. Fifty years of rodent eradications in New Zealand: another decade of advances. *New Zealand Journal of Ecology* 2016;40(2):197-204.
24. Radio NZ. Rats, stoats, weasels eliminated from Wellington's Miramar Peninsula. *Radio NZ* 2023;(7 November). <https://www.rnz.co.nz/news/national/501902/rats-stoats-weasels-eliminated-from-wellington-s-miramar-peninsula>.
25. Miller KF, Wilson DJ, Hartley S, et al. Invasive urban mammalian predators: distribution and multi-scale habitat selection. *Biology* 2022;11(10):1527.
26. Innes JG, Norbury G, Samaniego A, et al. Rodent management in Aotearoa New Zealand: approaches and challenges to landscape-scale control. *Integrative Zoology* 2024;19(1):8-26.

27. Lau C, Craig S. Leptospirosis. In: Heymann DL, editor. Control of Communicable Diseases Manual. Washington: American Public Health Association; 2022. p. 360-369.
28. Haake DA, Levett PN. Leptospirosis in humans. *Leptospira and leptospirosis* 2015:65-97.
29. Lopez L. Personal communication with L Lopez, senior analyst, Health Intelligence, ESR. 11 March 2024.
30. McKenna P. An updated checklist of helminth and protozoan parasites of terrestrial mammals in New Zealand. *New Zealand Journal of Zoology* 2009;36(2):89-113.
31. Health New Zealand Te Whatu Ora. Plague. Communicable Diseases Manual. Chapter last reviewed and updated in May 2012. Available from: <https://www.tewhatauora.govt.nz/for-the-health-sector/health-sector-guidance/communicable-disease-control-manual/plague/>
32. Yarwood V. A Plague On All Our Houses. How one bacterium built our health system. *New Zealand Geographic*. Mar-Apr 2022; 174. Available from: <https://www.nzgeo.com/stories/a-plague-on-all-our-houses/>
33. Nkogwe C, Raletobana J, Stewart-Johnson A, et al. Frequency of detection of *Escherichia coli*, *Salmonella* spp., and *Campylobacter* spp. in the faeces of wild rats (*Rattus* spp.) in Trinidad and Tobago. *Veterinary medicine international* 2011;2011
34. Moinet M, Oosterhof H, Nisa S, et al. A cross-sectional investigation of *Leptospira* at the wildlife-livestock interface in New Zealand. *PLOS Neglected Tropical Diseases* 2023;17(9):e0011624.
35. Backhans A, Fellström C. Rodents on pig and chicken farms—a potential threat to human and animal health. *Infection ecology & epidemiology* 2012;2(1):17093.
36. Daniels M, Hutchings M, Greig A. The risk of disease transmission to livestock posed by contamination of farm stored feed by wildlife excreta. *Epidemiology & Infection* 2003;130(3):561-68.
37. Meerburg BG, Kijlstra A. Role of rodents in transmission of *Salmonella* and *Campylobacter*. *Journal of the Science of Food and Agriculture* 2007;87(15):2774-81.
38. Stewart C, Kim ND, Johnston DM, et al. Health Hazards Associated with Consumption of Roof-Collected Rainwater in Urban Areas in Emergency Situations. *Int J Environ Res Public Health* 2016;13(10):(E-publication 15 October). doi: 10.3390/ijerph13101012
39. Sakalkale R, Mansell C, Whalley D, et al. Rat-bite fever: a cautionary tale. *N Z Med J* 2007;120(1254):U2545.
40. Dow GR, Rankin RJ, Saunders BW. Rat-bite fever. *N Z Med J* 1992;105(931):133.
41. Howden-Chapman P, Matheson A, Crane J, et al. Effect of insulating existing houses on health inequality: cluster randomised study in the community. *BMJ* 2007;334(7591):460. doi: 10.1136/bmj.39070.573032.80
42. Chapman R, Howden-Chapman P, Viggers H, et al. Retrofitting houses with insulation: a cost-benefit analysis of a randomised community trial. *J Epidemiol Community Health* 2009;63(4):271-7. doi: 10.1136/jech.2007.070037
43. Bonnefoy X, Kampen H, Sweeney K. Public health significance of urban pests. Copenhagen: WHO Regional Office for Europe. pp.403. [cited 2017 May 5]. Available from: http://www.euro.who.int/_data/assets/pdf_file/0011/98426/E91435.pdf2008.
44. Tranter P. Beware of the fire hazard that comes with rats and mice. *Nelson Mail* (14 April). [cited May 5]. Available from: <http://www.stuff.co.nz/nelson-mail/opinion/78922739/Beware-of-the-fire-hazard-that-comes-with-rats-and-mice>. 2016
45. Weekes J. Tenant did smell a rat: property firm ordered to pay over stench. *Dominion Post* (13 January):pA3. 2017
46. Smallman ER. Brazen rats ruin riverside picnics. *Stuff* (5 November). [cited May 5]. Available from:

<http://www.stuff.co.nz/environment/85947945/brazen-rats-ruin-riverside-picnics>. 2016

47. Lam R, Byers KA, Himsforth CG. SPECIAL REPORT: Beyond zoonosis: The mental health impacts of rat exposure on impoverished urban neighborhoods. *Journal of Environmental Health* 2018;81(4):8-13.

48. MacManus J. Explainer: Understanding Wellington's pipes crisis. Stuff 2021;(30 January).

<https://www.stuff.co.nz/dominion-post/wellington/124098301/explainer-understanding-wellingtons-pipes-crisis>.



Public Health Expert Briefing (ISSN 2816-1203)

Source URL:

<https://www.phcc.org.nz/briefing/rodents-running-riot-supermarkets-do-we-need-worry>