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WHY DO WE KILL RATS?

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Abstract There are broadly four justifications to kill rats: they spread zoonotic diseases, they eat human foodstuff, they cause infrastructural damage and they are an invasive species. The justifications vary from context to context, and in many cases many of those do not hold up. In this plenary talk, I will talk through these different contexts and question how especially post-industrial urban areas can justify indiscriminate rat killing.

Key words conviviality, persecution, biodiversity loss, collateral victims

INTRODUCTION

One of the hallmarks of human societies is that we kill rats: across times, geographies and cultures, rats are persecuted for a variety of reasons (Lynteris, 2022). While methods, rat species, reasons and motivations, and aims differ, there is an aim of getting rid of rats, especially through lethal methods (Soppelsa, 2021). Indeed, rat killing is so indicative of an advanced society, that during the colonial period, there was a specific interest in not only killing rats but also enumerating the rat carcasses to perform management. The focus lies within cosmopolitan brown rats (*Rattus norvegicus*), but also black rats (*Rattus rattus*) are broadly present across the globe.

Through the institutionalization, rat killing is not only a harmless past time or a rare occurrence. Indeed, it has spawned a multi-billion industry of pest management with its own technologies, regulations and guidelines, and indeed scientific disciplines and conferences (Diagne et al., 2023). The urbanization, changing climate and increasing human population are all driving further worries of increases in rat populations (Richardson et al., 2025). Thus, it is more relevant than ever to ask the question of why we are killing rats. In this talk, I will first look at the reasons why we kill rats and then examine their justifications in different contexts.

Reasons to Kill the Rats

There are four main reasons to kill rats: 1) competition for food, 2) infrastructural damage, 3) spread of diseases, and 4) harm to native species. First reason, and historically the most pervasive reason for killing rats, is the perceived economical losses that rats cause eating our foodstuff (Myllyniemi, 2024). Rats eat grains from fields and granaries, but rats are omnivorous and interested in most of the human foodstuff. Even in 1950s in Finland, where the rat populations were probably small and the actual losses limited, the main rationale of spreading rodenticides was the economical. Ecologically seen, this could be straightforward direct resource competition. Contemporarily, the focus on rats in farms, storage spaces and grocery stores is significant. There is limited evidence on how large the losses are (though they can be measured in billions of dollars; Pimentel et al., 2005), and where there are the hotspots, but the anecdotal

evidence suggest large-scale farming is susceptible and acquires substantial pest management inputs. In turn, the relatively most difficult losses are expected to happen to poor citizens at their homes, where the food security is at stake.

The second reason to kill rats is that they cause infrastructural damage. Rats are well-adapted to human structures, not least due to their impressive abilities of burrowing, gnawing and making their way across a number of substances. Rats are known to break electric, water and waste infrastructure. Eating human food is intentional in a way that rats consider human-intended food also as rat food. While infrastructural damage can be intentional destruction of the structures, it can also be non-intentional. Intentionally rats destroy structures that are specifically aimed to keep rats away, i.e., then overcoming obstacles such as waste bins, walls or fencing. The reason for this destruction is that rats are interested in entering these areas; thus rat activities could be seen as them claiming rights to their living environment (de Bondt et al., 2023). At the same time, rats perform also less intentional infrastructural damage such as chewing on electrical wires. It is not known why rats (and other rodents) seem to be attracted to chewing the plastic parts of the electrical wiring. Similar to other harms perceived to be caused by rats, infrastructural damage are difficult to assess. Through our discussion with the people working with rats in Helsinki, the infrastructural damage is seen as the most important reason that rats are managed. “Gnawing electric wiring can cause fire hazard”, one municipality official mentioned.
Thirdly, for any given Western society and widely in other cultural spheres, the rats are predominantly seen as a health threat due to vectoring zoonotic pathogens and parasites, that is, they are able to carry diseases that are transmitted between humans and other animals (Lynteris, 2022). For example, the Finnish health protection act stipulates that rats must be exterminated from the properties to reduce the risk to the (human) health. Because of the focus into the human health, we have perception of risks here than towards foodstuff or infrastructure. The burden here seems to be strong on the tropical and subtropical areas and in the Global North there is a limited evidence of rat-borne pathogens. For example, in Finland, there has been in recent decades a total of three disease cases linked to rats, all of these were rat-bite fevers (Aivelo et al., 2024). Indeed, the current risk in Finland seems to be low as even in the most populous areas, the prevalence of zoonotic parasites and pathogens is low. It is not known how often and which contexts humans are exposed to zoonotic pathogens or parasites happen.

Fourthly, the most systematic rat extermination is currently under way in the oceanic islands: whole islands, though starting from the smallest, uninhabited ones, are treated with rodenticides to get rid of the established rodent populations (Howald et al., 2007). The ecological aim is to return to the previous ecological status before the entry of the invasive species.

The Imperfect Killing

It is undisputed that rats gnaw and burrow, eat human food, carry pathogens that could transmit to humans, and cause ecological mayhem at some sites. Beyond this, the evidence becomes sparser. As outlined above, rat activities seem to be highly context-dependent. For evidence-based policy on rat management, there is a distinct lack of evidence, except for the invasive species control. It has been shown that fragile ecosystems bounce back when the invasive species are removed from the ecosystem. Otherwise, most research looks at the efficiency of rat control methods from the point of view of rat populations, but less commonly on the downstream effects. When I reviewed the literature for the evidence that rat lethal control reduces pathogen transmission risks, I did not find any papers. Theoretically, it is well-established that lower population density means less pathogen transmission. Still, the lethal control does not only reduce population size, but also perturbates population. Generally, disease ecology has shown

that population perturbations commonly increase the parasite or pathogen transmissions, and specifically, there is one study showing that lethal control increases risk of *Leptospira* infection in the rats (Lee et al., 2018).

While it is perceivable that the lethal rodent control would also create unexpected effects to the infrastructure or food yields or storage, it is less likely. Rats are masters in cooperation and dividing the tasks, so it is expected that a larger number of rats is able to access resources that individual rats would not. For example, the Helsinki plastic waste bins are said to be "rodent-safe", yet, in the places where there are high rat populations – and only in these places – rat-sized holes can be found in these bins. It seems that rats can access these food resources when there is enough rats available to share the time and effort burden in chewing these structures. Thus, we might expect that infrastructural damage is dependent on the rat population size rather than other aspects of population dynamics. It is widely known, though not much studied, how disturbances affect rat populations. For example, in the cases of sudden removal of a food resource, or structural disturbance, such as construction work or flooding, rat populations have been known to quickly relocate. Thus, it is also perceivable that a rat control could lead to them relocating to another site, though it is not clear in which contexts lethal control would lead to rat dispersal.

I have thus far considered rat killing as an discrete event that is undertaken and then it happens. This is obviously not the case, where killing is spatially and temporally continuous process that affects the rats, the other species and the ecosystem more broadly. Killing might not be successful as rats do not necessarily expose themselves to be killed, as they evade traps or rodenticide. The technologies of killing might not work perfectly, when snap-trap just bites off one leg, rodenticide causes symptoms but does not kill, or when technology targets other species. It is also important to assess the effects of this imperfect killing. For example, injuries for the rats cause animal welfare concerns as they might cause prolonged suffering.

Rats are so killable that we accept that there are also collateral victims. For example, rodenticides move in the food chains so much, that in a study, 74% of the avian and mammalian predators surveyed in the Southern Finland contained detectable amounts of rodenticides (Koivisto et al., 2018). It is not uncommon for pets, such as dogs and cats, to eat rodenticides and to die or get sick. Sublethal effects of rodenticide are poorly understood even though they are arguably very common. In preliminary findings, our research group compared the prevalence of rat pathogen and parasites and rat rodenticides and found out that the occurrence of some pathogens and parasites correlate with the exposure to rodenticide. Thus, this suggest that the use of rodenticides could actually increase the risks of zoonotic pathogens and parasites to humans.

Practical implications and further research

There is a real governance issue when it comes to the legal basis for the rodent control. For example, in Finland, the current basis in human health risks is tenuous as the risks seem low and the effects of rodent management strategies are unknown. My suggestion would be to create much stronger legal hierarchy of tools, that would emphasise preventative strategies.

As rat populations, sightings, behaviour, and (perceived) damages are highly context-dependent, it is not clear when rat control is needed or beneficial or, for example, when more investment in prevention would be enough or preferable. The ways of living with rats and the preconditions for the less aggressive cohabitation between humans and rats require substantial additional research.

I am involved in five current research projects under the Helsinki Urban Rat Project umbrella that aim to shine a light on these issues. First of all, I, Suvi Sallinen and Viktor Zöldi are studying the effects of pest-management induced population perturbation where we are aiming the distangle these effects. In the second project, led by Tarja Sironen, we aim to look at the

(sero)prevalence of rat-borne pathogens and parasites in different occupation groups, who are most likely to be exposed to these pathogens or parasites, including pest management professionals, cleaning personnel, waste collectors and so on. In a third project, spearheaded by Karolina Lukasik, the ways and means of living together with rats in everyday life are studied in urban allotment gardens (Lukasik et al., 2024), and in a fourth project, coordinated by Heta Lähdesmäki, we look at the ways of rat-proofing urban structures (Lähdesmäki et al., 2024). Fifth project, that is just starting, will look at how waste citizenship is formed together with immigrants, Finnish waste management practices and rats.

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