Rat Infestation: An Analysis of the Black Rat (*Rattus rattus*) Outbreak around Kamloops, British Columbia

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Abstract:

*Infestations of certain organisms occur when their living conditions are highly favourable. A species that is capable of quickly adjusting to a new environment, has a high reproductive output, no significant predators, and access to abundant resources will flourish. In particular, the Black Rat (*Rattus rattus*) population has increased rapidly within British Columbia over the last four years. The increase is currently understudied and greater research is needed on the specific distribution of rats and the influences on their population outbreak. Obtaining more knowledge about these factors could be the first step in controlling their population. Using information collected from recent news articles, testimonials, and pest control companies, I have conducted a preliminary study on the Black Rat around Kamloops, British Columbia. This project highlights some known locations of the Black Rat and, additionally, describes their general behaviour and characteristics. I also suggest a theory on the Black Rat's origin in*

Kamloops. The goal of this study is to provide a starting point for future research on this topic, including potential control of the species in this location.

Keywords: *Rattus,* Urban, Outbreak, Preliminary

Introduction

The Black Rat (*Rattus rattus)* is an easily distinguishable rodent that flourishes because of its ability to accommodate itself to almost any habitat type. It exhibits a slender, black or light-brown body, large hairless ears, creamish-white belly, and a uniformly coloured tail that is longer than its head and body length combined (Iucngisd 2017) (Fig. 1). Like all members of the Order Rodentia, the species is characterized by adaptations for gnawing, particularly the continuously growing incisors on the upper and lower parts of the jaw. This order comprises roughly 42% of the world's mammalian diversity (Wilson and Reeder 2005). The genus *Rattus* includes 61 species. Five of the 61 species prefer habitats in closer proximity to humans, whereas the other 56 are associated with oceanic islands, forests, and sub-alpine to alpine habitats. The Black Rat is one of the five that thrives in urban environments (Wilson and Reeder 2005).

The Black Rat, a native of southern Asia and India, has spread throughout Europe and into North America, especially in large cities (Iucngisd 2017). The species is thus very widespread and it has successfully colonized many different habitat types on every continent except Antarctica. The fact that the species is commonly referred to as the "roof rat," the "house rat," or "the ship rat" is evidence of its non-selective nature. The rats' superior reproductive output and adaptable behaviour, along with their ability to function as habitat generalists, makes them highly invasive (Feng and Himsworth 2013). Behaviours such as

food sampling and neophobia enhance their survival and allow them to flourish in novel environments with ease (Feng and Himsworth 2013). Neophobia, which is the fear of novel stimuli, encourages them to avoid possibly harmful elements in familiar environments. This makes managing the rodent difficult and contributes to their rapid population expansion (Feng and Himsworth 2013).

Black Rat mortality is primarily a function of resource limitation and minor interspecific competition (depending on the population density). However, the resources they need are typically plentiful because of their reliance on humans (Feng and Himsworth 2013). Urban environments (particularly densely-populated neighbourhoods) provide abundant shelter and food sources, enabling the rat population to expand rapidly. Black Rats are so dependent on humans that they are rarely found in the wild. Indeed, humans are often the sole suspects in the increase and spread of particular Black Rat populations (Feng and Himsworth 2013; Aplin et al. 2011). Their diverse diet includes all types of organic waste, as well as fruits and vegetables from gardens, including apples, peaches, crab apples, beets, tomatoes, and apricots. Food and organic waste that is improperly stored is the most significant food source for rats; this includes fruit fallen from trees and bird seed from feeders, material in compost bins, and pet food set outside. The Black Rat is opportunistic and takes advantage of a wide selection of foods in its environment. For shelter, the rats prefer areas with lots of cover, including dense evergreen shrubs and hedges and spruce trees, which allows them to remain hidden from predators. Suitable sheds or even houses are also used. Their alternative name, “roof rat,” is indicative of the fact that they tend to seek out higher areas and are good at climbing (Feng and Himsworth 2013).

In British Columbia, the Black Rat has been abundant in the Lower Mainland for decades and its population has appeared to increase substantially in the southern interior of the province over the last five years (Tom Broad Pers.

Comm.; Duftin Pers. Comm.; Nagorsen 2005). Because the outbreak is such a recent event, no significant, systematic efforts have been made to assemble records of the animals. Major cities, such as Kelowna, Vernon, and Kamloops, which had not previously seen the Black Rat, are now facing outbreaks. This can be worrying, as the rats transport disease and thus pose health risks for humans. Native species can also be negatively affected by a sudden increase in the population of an invasive species (Harris and Macdonald 2007; Stokes et al. 2009). Vancouver authorities have launched multiple studies on Black Rats and Norway Rats (*Rattus norvegicus*, also known as the Brown Rat), since the city is considered to be the point of origin of rat outbreaks in BC (Vancouver Rat Project 2017). This is primarily because these rats are known to travel from overseas by ship. Alberta has maintained a "rat-free status" since 1937 due to the lack of known residential populations of the Norway or "roof rat" in the province. Rat control has been easy for Alberta due to the physical terrain of the western Rocky Mountains that blocks rat traffic, sparse human distribution on the north and south borders of Alberta, and a 30km long "rat control zone" along the southeastern corner where local and provincial governments attempt to restrict rats from entering (Alberta Invasive Species Council 2018).

Due to the recent dramatic expansion of the Black Rat population in Kamloops, research on their distribution and numbers should be encouraged. Multiple news articles have been published on the growing population of Black Rats in Kamloops and local pest control companies also agree on the fact that Black Rat numbers have increased (CFJC 2016; Tom Broad Pers. Comm.; Terry Weis Pers. Comm.; Duftin Pers. Comm.; Abell Pest Control Pers. Comm.; 1st Defence Pest Control Pers. Comm.). The news articles describe an increase in the number of areas of the city in which the Black Rat has been seen, and also note residents' concerns and give tips on controlling the population. Evidently, the

outbreak has the public worried about health issues since the Black Rat is a vector for diseases (CFJC 2017).

The goal of this study was to discover if—and where—the Black Rat exists in Kamloops. Using information collected from various sources, I conducted a preliminary study on the Black Rat in and around Kamloops. Here, I describe known locations of the species, as well as its general behaviour and characteristics. I also suggest a theory about how the species arrived in Kamloops. Specifically, my objectives for the study included answering questions such as, 1) what is the general ecology of the Black Rat? 2) when did the species arrive and how might it have travelled here? 3) what is the status of the different rat species in Kamloops? 4) what is their distribution in Kamloops? 5) do they have a preferred habitat? 6) are there also populations north or east of Kamloops? 7) what is the status of the population in terms of growth and abundance? and, finally, 8) what is the most humane and effective way to trap rats for later, more detailed study?

Methods

The study involved recording known occurrences of the Black Rat, consulting with individuals, questioning local naturalists and homeowners, and reviewing primary and grey literature. Individuals from the City of Kamloops, pest control companies, ranches, farms, equestrian centres, stores that sell rat traps, and landfill sites were asked about the status of the Black Rat in and around Kamloops both by email and phone. Any company, farm, or store throughout Kamloops willing to cooperate and thought to have information on the Black rat was questioned, as time allowed. Multiple pest control companies were questioned extensively to obtain different opinions on the Black Rat presence in and around

Kamloops. Questions were always asked without bias from previous conversations with companies, experts, farms, or stores, and no specific areas of the city were targeted. Reports of rat locations were accepted only after being sent in to experts on rat biology or after being substantiated by photos or specimens. Photos or specimens were not solicited in any way, from any particular part of the city; they were sent by people who were interested in the topic or who had contact with these experts. Therefore, while not randomized, these reports likely represented with some accuracy the locations where the rats first appeared in large numbers. This information was then compiled and analyzed to address the objectives listed above.

Results and discussion

Locations were identified using testimonials from individuals who had seen evidence of the Black Rat, whether they were homeowners or people affiliated with the City of Kamloops or a local business. Identified locations of Black Rat populations from resident testimonials include those listed in Table 1.

Table 1. Known locations (and dates) where homeowners have come in contact with the Black Rat in Kamloops.

Address	**Area of Kamloops**	**Date**
2600 block, Valleyview Dr.	Valleyview	2013
800 block, Windbreak St.	Brocklehurst	2016
210 block, Tranquille Rd.	Brocklehurst	2015

Brock Community Gardens	Brocklehurst	2013-2014
800 block, Crestline St.	Brocklehurst	2013
2300 block, Rosewood Ave.	Brocklehurst	2014-2015
2000 block, Fleetwood Ave.	Brocklehurst	2016
De monte St.	Brocklehurst	2014-present
1600 block, Parkcrest Ave.	Brocklehurst	2016
1000 block, N Glen Dr.	Brocklehurst	NA
2500 block, Tranquille Rd.	Brocklehurst	2016
2200 block, Parkcrest Ave.	Brocklehurst	2016
Mahood Pl.	Upper Sahali	2016
100 block, Chancellor Dr.	Upper Sahali	NA
2400 block, Qu'Appelle Blvd.	Juniper Ridge	2017
NA	Valleyview	2016

Fig. 1. Pictures provided by Rick Howie of *Rattus rattus* from Kamloops. (A) Anterior view of the Black Rat and (B) teeth view.

Locations of Black Rat populations in and around Kamloops were also identified by contacting the City. The Kamloops city garden coordinator knew of two instances of rats in the Riverside Park West Community Garden as well as in the Crestline Community Garden (Shannon Gourley Pers. Comm.). Rats have not been an issue in the Kamloops and Heffley Creek landfills, nor have they been encountered during regular garbage and recycling pickup except for in the southern region of the North Shore (Allan Michener Pers. Comm.). A few sightings of Black Rats have been made at the TNRD landfill in Heffley Creek in 2015 (Jamie Viera Pers. Comm.; Mike Taverner Pers. Comm.); however, a major outbreak in this area has not been reported. Rats are not an issue at Kamloops landfills specifically, although occasionally rats have been transported in solid waste shipping containers from coastal areas (Carol Danyluk Pers.Comm). It is suggested that rodents generally do not survive the compaction that occurs during the loading and unloading of shipping containers (Carol Danyluk Pers. Comm.).

Finally, multiple businesses, including pest control companies, were contacted about the Black Rat's presence in and around Kamloops. Two equestrian centres, Copper Hills Equestrian and Circle Creek, located on the outskirts of Kamloops, were contacted and both reported no rats of any kind in the last ten years (Ann Wallin Pers. Comm.; Colleen Meyer Pers. Comm.). A slaughterhouse near Copper Hills, known as Kam Lake View Meats, has encountered no rats (Ron Keely Pers. Comm.). A few general stores, including Purity Feed and Agri Supply, which provide supplies such as rat traps to farm owners, were contacted. Purity Feed stated that the rat outbreak started in early August 2016 (fruit season), the first rats being found in Brocklehurst and the Ord Rd area based on customer testimonials. In the last year they surpassed their average numbers, selling roughly 200 commercial traps and 500 regular traps, but if customers were desperate for pest removal they were directed to pest control companies (John McCurrach Pers. Comm.). Agri Supply noticed that their sales for traps rapidly increased over the last year, especially since the Owl Road dump closure. Between January and March 2017, they had sold 12 black hole mole traps (also used for rats), 90 victor snap type rat traps (they usually sell approximately 6-12 per year), and 3 live rat traps (used to trap pack rats (*Neotoma cinerea*)) (Lynn Blake Pers. Comm.). I contacted two pest control companies that have a wide range of experience throughout the province in order to determine how far the Black Rat has spread. They confirmed that the Black Rat is present in the interior of British Columbia in areas such as 100 Mile House, Williams Lake, Prince George, and Kelowna (Abell Pest Control Pers. Comm.; 1st Defence Pest Control Pers. Comm.), and perhaps even in Fort Nelson, although the technician I spoke to was unsure about whether these were Black Rats (1st Defence Pest Control Pers. Comm.). David Nagorsen, currently a biologist at Mammalia Biological Consulting, and previous Curator of Mammals at the Royal BC Museum, notes that, to this date, the Black Rat has only been documented as far north as

Kamloops in the interior of British Columbia, and as far as Haida Gwaii in the British Columbia coastal islands (David Nagorsen Pers. Comm.).

Three pest control companies within Kamloops provided insight about the Black Rat outbreak within Kamloops itself. The numbers of Black Rats seem to be higher in lower elevations of Kamloops; this may be because these areas allow them to avoid colder weather and higher rainfall (Terry Weis Pers. Comm.). City streets are significant barriers to the spread of Black Rats and tend to separate them into smaller populations (Feng and Himsworth 2013). Thus, Black Rat home ranges are often confined to a single city block in urban areas. However, they may inhabit more than one property, depending on resource availability. Black Rats may have expanded their range and increased their population size as human population density has increased and, thus, more food has become readily available to them (e.g. in compost bins and bird feeders) (Terry Weis Pers. Comm.). Frank Ritcey, provincial WildSafeBC coordinator, has attempted to capture rats in the wilderness outside of Kamloops with no luck, further supporting the idea that they are dependent on humans (Frank Ritcey Pers. Comm.). Karl Larsen and Sheri Watson, who both teach in the Natural Resource Science Department at Thompson Rivers University, and who trap animals for various courses, have had no captures near Kamloops in the past 21 years (Karl Larsen Pers. Comm.).

Calls to local Kamloops pest control companies to remove the Black Rat first began in 2010. Although there were only a few that year, they doubled the next year (2011); a huge population surge has occurred since 2012 (Terry Weis Pers. Comm.; Tom Broad Pers. Comm.; Duftin Pers. Comm.). The records of one company suggest that the Black Rat population is peaking, and may decline and stabilize in the next few years (Tom Broad Pers. Comm.). Before 2010, there were very few or no rats documented and the first sightings were in the

Brocklehurst area of Kamloops, according to local pest control companies (Terry Weis Pers. Comm.; Tom Broad Pers. Comm.; Duftin Pers. Comm.). Interestingly, it is speculated that the construction of the Brocklehurst Tim Hortons catalyzed the introduction of the rats, as trucks brought supplies to the store from Vancouver; some of the first major Black Rat sightings were near there (Tom Broad Pers. Comm.). The opening of the Chances Casino in Brocklehurst is another possible cause of the Black Rat's rapid introduction into Kamloops because transport trucks also came from Vancouver to this location and there has been a surge of calls about Black Rat since then (Duftin Pers. Comm.). It is noted that 2012 brought an increase in construction and new development in the north shore area of Kamloops (*Kamloops This Week* 2012). The density of Black Rats within Kamloops varies, the highest being centered in the Brocklehurst area. The Black Rat population density, from highest to lowest in Kamloops, is thought to be Brocklehurst, Valleyview, North Shore, Westsyde, Downtown, and Sahali, with only a few at the higher elevation areas of Aberdeen and Juniper Ridge. These areas were considered to be highest to lowest based on identical pest control company testimonials. Non-highlighted sections of the city were never mentioned in the testimonials (Tom Broad Pers. Comm.; Duftin Pers. Comm.; Terry Weis Pers. Comm.; Fig. 2).

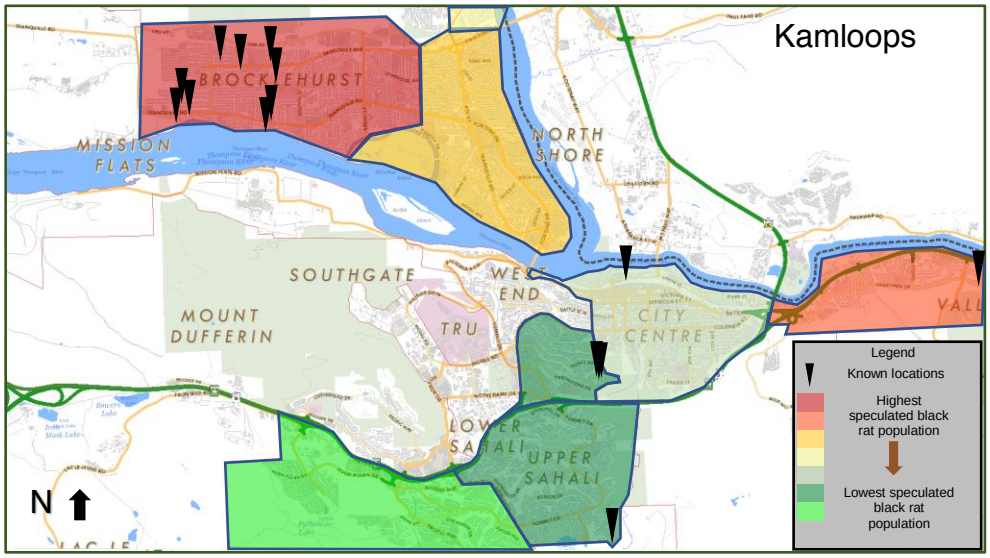

Fig. 2. A map of Kamloops showing known locations of the Black Rat in broadly defined sections of the city. Known locations, shown by arrows, are based on evidence of the Black Rat presence (photos, specimens, or expert ID). Speculation about population density is based on evidence provided by pest control companies. Rats are reported to be most abundant in Brocklehurst, followed by Valleyview, North Shore, Westsyde, Downtown, and Sahali; only a few have been found in areas at higher elevation, including Aberdeen and Juniper Ridge.

The Black Rat appears to be the main rat species located in Kamloops. The Norway Rat is very rare in Kamloops; only a few have been caught in the last 20 years which, it is speculated, is because they cannot survive in the winter (Tom Broad Pers. Comm.; Duftin Pers. Comm.). One owner of a pest control company stated that he could count the total number of Norway Rats caught within 20 years with his fingers (Tom Broad Pers. Comm.). Considering that the pest control companies' testimonials have been similar and have conveyed strong confidence in the Norway Rat's rarity, it is fairly certain that the Norway Rat has not been mixed up with Black Rat reports (Tom Broad Pers. Comm.; Duftin Pers. Comm.).

In addition, the Black Rat has mainly displaced the native Bushy-tailed Woodrats (*Neotoma cinera*, also referred to as pack, bush, or wood rats), in residential areas near forest terrain (Tom Broad Pers. Comm.; Duftin Pers. Comm.). Although their interactions with the Bushy-tailed Woodrat have not been carefully studied, the Black Rat is known to displace and outcompete other native rodent species by aggressive interference competition (Harris and Macdonald 2007; Stokes et al. 2009).

In the future, trapping studies should be done to carefully document relative population sizes in various parts of the city and to set a baseline for monitoring changes in numbers. Trapping would best be done using live traps with any captured Black Rats then humanely killed by mechanical stunning followed by decapitation (Terry Weis Pers. Comm.). If applicable, intraperitoneal injection of barbiturates with physical restraint is a possibility; however, this method is expensive. Future researchers should follow guidelines outlined by the Canadian Council on Animal Care (CCAC 2017). Live trapping should be used because of the possibility of catching unwanted animals such as small cats and dogs, or other native wildlife. Clearly, Brocklehurst or the North Shore would be good locations for live trapping of Black Rats, assuming the residents give their permission. Future researchers may also want to consider areas where they do not appear to be found right now, such as higher elevations of the city in Dufferin, Upper Sahali, or Juniper. Also, future researchers could place live traps in non-residential areas of the city such as various parks and compare this data to that obtained from residential areas.

If live trapping is too costly and an inconvenience, researchers should also consider monitoring through reporting. If researchers reach out to the public with a well-publicized hotline or website to allow reporting of the Black Rat, perhaps a better idea of the Black Rat's numbers in Kamloops could be formed. Publicity

and information sharing on Black Rat populations through social media or community groups could give researchers a better idea about rat locations. Evidence (specimens, photos, or possibly careful descriptions) that would allow confirmation of the species identity of all reported rats should be mandatory for reports provided by the public.

Conclusions

The Black Rat has rapidly spread through Kamloops in the last few years. The findings reported here reveal what is known so far about the species' status in Kamloops. Ecologically, they prefer the lower elevations of the city, and higher ground around homes, as well as proximity to evergreen shrubs and hedges and spruce trees. Efforts to trap them outside city boundaries have been unsuccessful. It is speculated that they arrived sometime in 2010, but their numbers proliferated in 2012 because of transport trucks and have since rapidly increased. Other surrounding cities appear to be experiencing the same problem. Pest control companies in Kamloops have increasingly dealt with the Black Rat while other common rodent species, such as the woodrat, have declined in abundance, and few Norway Rats have been reported.

It is possible that residents are simply becoming more aware of the Black Rat in recent years, causing reports to increase. However, this is likely not the only reason for the increase; testimonials from Kamloops pest control companies attest to a rapid increase in the number of rats, as well as calls about them each year since 2012, with the number of calls sometimes doubling. In 2012, the North Shore had a lot of construction and new development involving transport trucks coming from Vancouver. Although correlation is not the same as causation, it certainly is an acceptable theory.

Finally, an effective and humane method of rat trapping would involve live rat trapping, followed by decapitation. Rat trapping should be set up in dense residential areas of Kamloops at low elevation such as Brocklehurst and the North Shore. Researchers should also consider areas where they are not currently found, such as Dufferin, Upper Sahali, Juniper, and in city parks. A more cost-effective and convenient method may be monitoring through reporting. Reaching out to the public through media and social groups could promote better data collection through a possible report hotline or website. These preliminary results will provide a starting point for future research that could study the species in more depth.

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