Vector Control in Oakland's Homeless Encampments

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ABSTRACT: Homeless encampments are a persistent feature in the city of Oakland, California. Unsanitary conditions in these camps can contribute to large populations of Norway rats and associated vector-borne disease. Alameda County Vector Control Services District has developed a surveillance program for safe and efficient data collection in these encampments. This program includes outreach to residents, effective live-trap ping, ectoparasite collection, vector species suppression, and coordinating with other agencies. The District's operations around Oakland's pilot "Tuff Shed" homeless shelter strategy are presented as a case study for Norway rat and Oriental rat flea risk assessment and control.

KEY WORDS: disease, homeless encampments, live traps, Norway rat, Oakland CA, oriental rat flea, public health, *Rattus norvegicus*, *Rickettsia felis*, rodent control, *Xenopsylla cheopis*

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INTRODUCTION

An Oakland *Tribune* article in 1976 reported, "Punctuating their plight by presenting a dead, maggot infested rat to a county health official, a group of residents demanded action against a growing rat population to the city" (Sitman 1976). Public demand for a municipal rodent control program in Oakland, California led to the creation of the federally funded Oakland Rat Project, which in 1984 resulted in the formation of Alameda County Vector Control Services District (ACVSCD). In 1987, the District began a program to focus on "a severe rat problem emanating from the sanitary sewers" in the city of Oakland, inspecting over 8,000 manholes and applying an average of 943 pounds of rodenticide annually. Norway rat (*Rattus norvegicus*) complaints in Oakland have decreased from 1990 (Figure 1) through 2015. Homelessness has been a chronic problem in Oakland, however in the last 5-10 years, and there has been a sharp increase in the number of homeless encampments throughout the city. The complex situations found in homeless encampments challenged our normal concepts of "rodent control." We describe the approach our District developed to address the unique conditions found at these encampments.

EVALUATION OF THE CURRENT HOMELESS SITUATION

Though many people may perceive the homeless population as a uniform, monolithic group, we have found

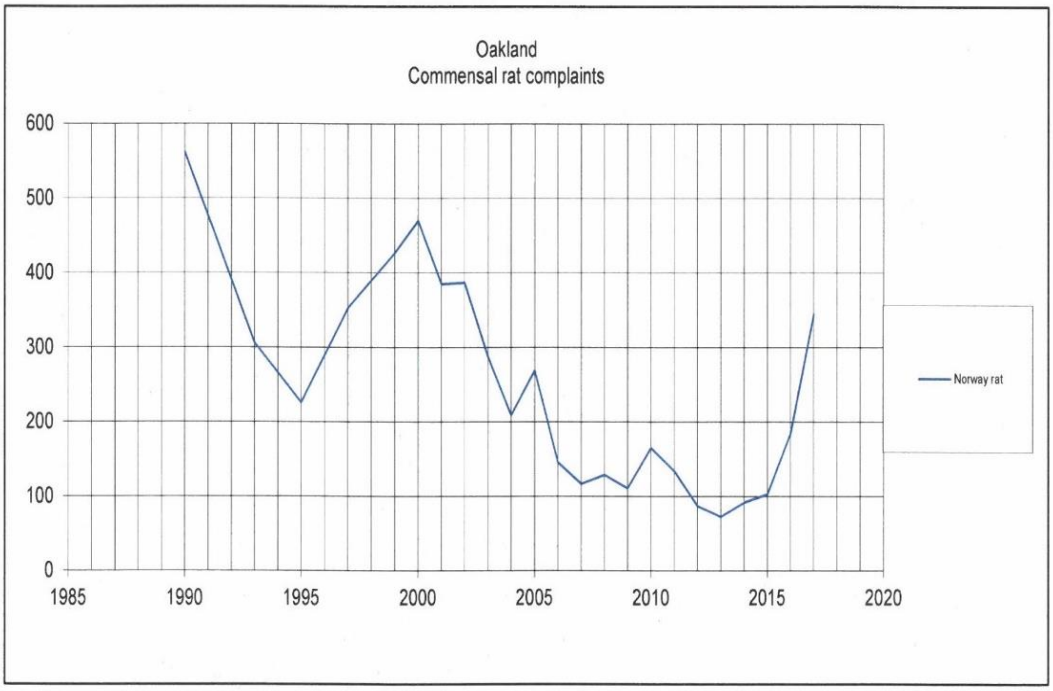

Figure 1. Norway rat complaints received by ACVSCD 1990-2015.

that each homeless population comprises unique individuals grouped by shared characteristics. Since 2011 the organization EveryOne Home has conducted biennial surveys of the homeless population in Alameda County. In 2019, EveryOne Home estimated 4,071 homeless individuals were residing in Oakland and 3,951 were residing in other parts of Alameda County (Applied Survey Research 2019). There are multiple factors affecting housing availability, and Alameda County is using a diverse range of strategies to address this issue. The City of Oakland has implemented multiple programs to assist people transitioning from homelessness into city owned navigation centers, sanctioned RV parks, or Community Cabin sites. Although very successful at moving residents into more permanent housing, these programs can accommodate about 50% of the city's homeless population, leaving the rest in "unregulated camps" (City of Oakland 2018). The 2019 survey conducted by EveryOne home enumerated over 100 of these encampments distributed throughout the city affecting surrounding residents (Applied Survey Research 2019). A prime goal of these housing programs is to "eliminate the health and safety impacts those encampments are having on the surrounding community" (City of Oakland 2018) while mitigating health risks to the homeless people. Alameda County Vector Control Service District's mission is to, "prevent the spread of vector-borne diseases, injury, and discomfort to the residents of the District by controlling insects, rodents, and other vectors and eliminating causal environmental conditions through education, and integrated pest management practices" (ACVCSD 2020).

When Oakland was incorporated in 1852, the estuary was transformed into a port, which supported a thriving whaling industry. Norway rats originated in Asia (Galef 2010) and became established in Oakland as the port grew. In 1900 there was a bubonic plague (*Yersinia pestis*) outbreak in San Francisco, followed by a second outbreak in 1907 with cases in Oakland (Kellogg 1937) during which 126 plague infected rats were captured and tested positive. The Norway rat is a commensal rodent of significant public health importance, found capable of serving as both a reservoir and vector of pathogens that pose a risk to urban populations (Mohr 1948, Elliott 2007). This species has been associated with *Streptobacillus moniliformis*, *Leptospira interrogans*, Seoul virus, and hosting ectoparasites capable of transmitting *Rickettsia typhi*, *R. felis*, *Bartonella elizabethae* (Easterbrook et al. 2007), and *Y. pestis*. Our District has discovered Norway rats infected with *L. interrogans* (serovars Patac and icterohaemorrhagiae) and *B. tribocorum* (unpubl. data).

Today the manifestations of homelessness present in Oakland are as diverse as its population. Camps vary in size, duration, sanitary conditions, hazards, and inhabitants. A person sleeping on the sidewalk or park bench with minimal supplies is not uncommon, and this transitory occupancy of a site has little impact. Locations where people are not cleared out regularly tend to develop more established residences. Often some form of shelter from the elements is prioritized; encampments beneath freeway overpasses can be seen throughout Oakland. The use of tents is very common, as is the practice of using a tarp along a fenceline for additional shelter and privacy. Often this style of structure is placed on wooden pallets, which helps the tent stay dry and anchors the tarp but allows rodents free access and shelter (Figure 2). Frequently if a structure like this has been allowed to remain, other similar structures develop around it over time. The longer these encampments remain undisturbed, the more the complexity of structures increases. This phenomenon can be observed using the street view function of Google maps (2400 Wood St. in Oakland, for example), then using the clock icon to check previous dates. Wood Street has been home to residents continuously since 2015, currently has about 25 RVs and 60 semi-permanent dwellings made of recycled building materials and more than 100 residents (Garofoli and Veklerov 2017). Wood Street, "a 4-star Yelp-rated 'curb side' community," has a "mayor" who is actively engaged with city government. This 'curb side' community is provided with sanitation services, regular trash collection, and even mailboxes, and it draws heavily from the ethos of Burning Man. The encampment at 23rd Aveue and east 12th Street had a similar level of infrastructure with city serviced outhouses, waste removal, health services, and volunteer-donated tiny houses, food storage, and a wood-fired oven. This encampment existed for 15 months (Tadayon 2019) and was home to roughly 100 residents. Our disease surveillance and rodent abatement program focused on the most established encampments.

Figure 2. Tents along a fenceline at 27th Street and Northgate Avenue, Oakland, California.

Unsanitary conditions we have observed associated with homeless encampments are at odds with integrated pest management (IPM) practices to minimize public health risk. Clutter, food waste, medical waste, and the absence of hygiene facilitated by indoor plumbing increase homeless populations' risk for a variety of diseases (National Health Care for the Homeless Council 2019). One complicating factor we observed is food donation. Good Samaritans will bring food to the homeless camp, but even when food is presented directly to the residents, there is inadequate food storage. More often, people set the trays of food across the street or on the curb, quickly becoming food for the rats. This happens with donated

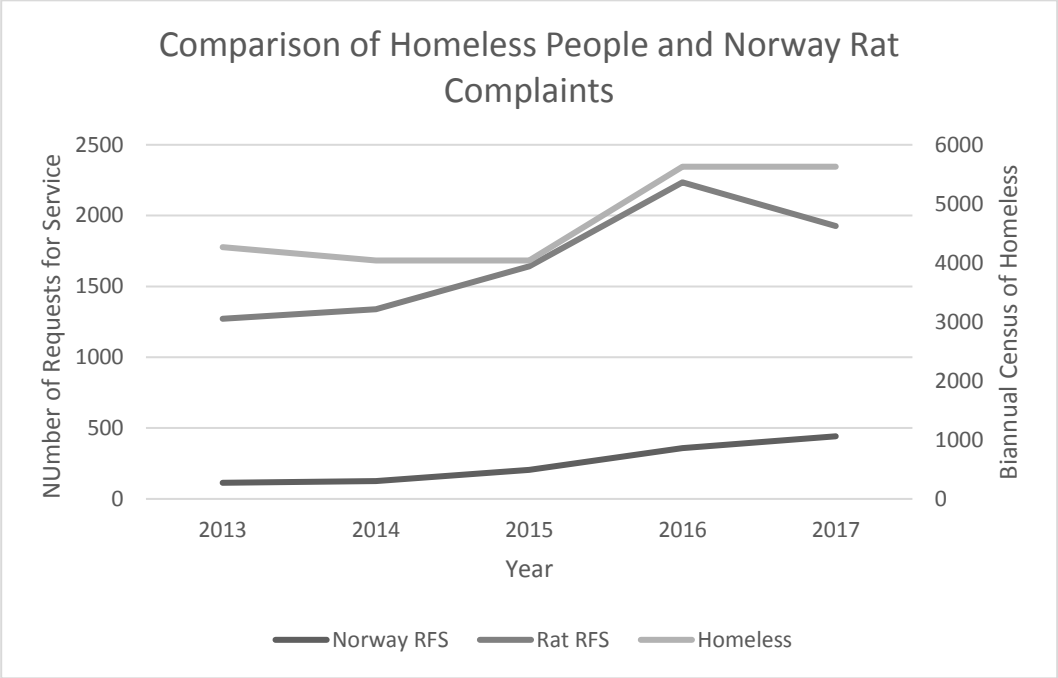

Figure 3. Homeless population census data vs. Norway rat complaints received by ACVCSD.

bags of clothing or blankets as well. Curb-side donations may provide concealment for illegal dumping, another issue which occurs in Oakland around these encampments. Additionally, many homeless residents accumulate a variety of debris around their home. The surplus food and shelter this creates may raise the local carrying capacity for Norway rats (Figure 3). However, this is not always the case. We inspected one camp which was gated, where entry was strictly controlled. We were told all the residents were female, living in vehicles, and who worked assiduously to prevent access to food by vermin (Veklerov 2018). The neighbors had no complaints about rodents, and we saw no evidence of rodent activity here after this camp was cleared.

There are numerous hazards working in this environment. Many homeless people have dogs which can be territorial, frightened, and unvaccinated, and our District does have rabies cases (usually annually in bats). The materials which accumulate around the encampments can constitute a safety risk: broken glass, exposed nails, haphazard structures, debris, and abundant used needles. The residents are another potential liability. Some homeless are experiencing untreated mental illness, substance abuse, or may be violent. Biologists working in these conditions must be cognizant of the inherent risks and exercise appropriate situational awareness while performing ongoing risk assessment.

THE ROLE OF ACVCSD

Alameda County Vector Control Services District exists to serve all residents of Alameda County, including those experiencing homelessness. Given these conditions in Oakland, a robust program to assess disease risk is our responsibility. Vector Control Ecologist David James (hereafter, "V. C. E. James") has been live -rapping rodents within Alameda County performing disease surveillance in conjunction with the California Department of Public Health for decades. This current program is based on his work and is evolving to integrate with the City of Oakland's efforts to mitigate the impacts of these encampments. Our protocol consists of inspection, outreach, a trapping operation, testing for pathogens, and performing suppression when needed.

Conducting Surveillance and Control in These Conditions

Due to the unique operational hazards, care is taken to work safely. Staff in our district work within the range of what they consider safe; no one is required to participate in any component of our disease surveillance. Biologists do not enter people's tents or dwellings and maintain appropriate personal space boundaries. Trapping is always done in teams of at least two biologists, wearing personal protective equipment (PPE) and equipped with cell phones.

Personal Protective Equipment

PPE consists of thick leather steel-toe boots, long pants, thick leather gloves over nitrile gloves, and a safety vest. Use of permethrin-based insect repellent is available if needed. Sanitizer is kept in the truck and used after operations are completed, and nitrile gloves are worn whenever traps or rodents are handled. After euthanizing rodents, live-traps are sprayed with disinfectant before being redeployed.

Outreach

Prior to initiating any trapping operation, we discuss the location with our colleagues. After reviewing the map, our records, and talking to the biologist assigned that census tract, a site inspection is performed by two or more

biologists. Depending on assessed risk and accessibility, inspection may be on foot or from a vehicle. Biologists strive to treat the homeless residents with the same respect we treat any other residents of Alameda County, while operating safely. Initially, we inquire about their experiences with rodents at that location while explaining our objectives and what the District's role is. Dog treats can create a positive interaction with peoples' pets, which may segue into dialogue with residents about our presence. We offer rodent control training on the fundamentals of IPM, limiting access to food or shelter, and safe use of snap traps. During subsequent visits we explain to interested residents our objectives, that we are not law enforcement, and that our focus is removing rats. Obtaining verbal permission and exercising courtesy when working near a residence or traveling through proximal paths is standard practice. Safety is always a top concern for our staff, so we do not push back if anyone says no. Businesses receive outreach as well with a card as a point of contact, literature about rodent control, inspection services, training on suppression options, and an explanation of our interest in the camp.

Site Selection

Locations providing unimpeded access to a chain link fence used in supporting homeless residences yielded the highest capture efficiency. Under the I-880 freeway, these were asphalt parking lots principally used by semi-trucks moving cargo from the Oakland port. There were multiple reasons this location was ideal. Norway rats frequently burrow under solid surfaces. The dirt-concrete interface along the fenceline allowed protection for burrows. The fenceline permits live cage-trap placement along runs, with high proximity to the shelter and food resources presented to rats by homeless "dwellings." The asphalt presented a good indication of recent activity from displaced dirt (created by burrowing) and fresh rodent excrement. Gauging the activity level of a burrow involved noting signs like digging, footprints and droppings, how smooth the dirt is around the entrance, and the absence of obstruction (trash, cobwebs, crumbs of dirt that would be moved by rodent activity), and rub marks on nearby hard surfaces. Traps were placed on level ground, facing active burrows, along the fenceline. Traps were concealed in cast-off clothing or garbage gathered at the trapping site. Concealing traps may prevent human theft, provide the illusion of security to rats, and mask any scent. Additionally, when available, materials on site are used to channel rats into the trap by creating vertical surfaces to guide the rat from the burrow to the trap (Figure 4).

Operations at 5th and Castro

The District undertook a large-scale suppression operation in the West Oakland neighborhood from Market to Martin Luther King Jr. Way and from 4th Street to 7th Street. More than 100 inhabited temporary structures existed in this neighborhood, bordering the fenceline along most blocks. Many sidewalks were impassable due to debris associated with these structures; business owners described unpreceded rat activity. Beginning in November 2017, V. C. E. James began live-trapping Norway rats to collect ectoparasites. High numbers of oriental rat fleas (*Xenopsylla cheopis*) were found on rats in this area. Live-trapping continued for two weeks, with each rat being euthanized, following American Veterinary Medical Association protocols, and combed for ectoparasites which were identified to species by V. C. E. James. Given the unusual environmental conditions that supported high Norway rat populations, and that trapping revealed high levels of oriental rat fleas, an elevated risk for disease transmission was present. The District's Laboratory was still under construction at this time, but subsequent analysis by real time polymerase chain reaction has revealed *R. felis* in fleas obtained here. Supervisor Kirkpatrick, V. C. E. James, and other staff mapped the burrows that were active throughout this area, which was being cleared by Oakland police and city workers in preparation for establishing the first "Tuff Shed" Village (CBS SF Bay Area 2017). On December 14, 2017, the District worked in teams to dust all active burrows throughout this 12-block area (148 burrows total) with Drione dust (Bayer Environmental Science U.S., Peoria, IL). To monitor the effectiveness of this treatment, Supervisor Kirkpatrick and V. C. E. James continued live-trapping for another two weeks, following the previously described protocols for collecting fleas. This second round of trapping revealed a 38% reduction in fleas per rat. In January 2018, rodent suppression in this neighborhood was undertaken. Using a pelleted formulation of a second-generation anticoagulant rodenticide (CONTRAC; Bell Labs, Madison, WI), multiple teams of three biologists applied 4-oz portions of rodenticide to active burrows, based on previous maps and dusted burrows. A flexible PVC conduit and funnel was used deliver pellets at least 6 inches into active burrows, as per the label. This application was followed with regular site inspections to remove carcasses as a precaution against secondary poisoning. In March 2018, this operation was repeated on a smaller scale, and by December 2018 an inspection revealed no significant signs of rodent activity.

Figure 4. Typical trap placement: concealed, channeled, aligned with run, along fence with tents, near active burrow.

Evaluation of Trapping Protocol

The District performs surveillance by live-trap ping at regular intervals in Oakland's largest homeless encampments. If trapping is initiated, based on outreach and site inspection, a similar trapping technique is applied at each camp. Live-traps (Tomahawk Live Trap, Hazelhurst, WI) are baited with peanut butter on the trigger, with a small amount of canned mackerel pressed into the peanut butter. The oil from the mackerel can be splashed in front of the trap. Traps are aligned with burrows that show signs of activity (digging, clean entrance, fresh droppings) along the fenceline, as close as possible to homeless dwellings. Materials gathered on-site are used to cover and disguise the trap, placed carefully to not interfere with door closing. Traps are placed along the fenceline at areas where there is evidence of rodent activity; their location is marked with flagging tape. Currently, we deploy 20 traps per trap-night. Using this technique, we average 58% trap success. However, we are trapping at sites with large populations, not subject to suppression efforts, in intervals of three successive trap nights per two months. A separate trapping program in Emeryville, CA employed a more standard "trap-line" method: twenty traps equipped with cage covers were deployed at evenly-spaced intervals along a fenceline and checked four days per week for two months. Capture success increased over time, but the average trap success over these 2 months was 19%.

CONCLUSION

As the issue of housing equity is addressed by cooperating programs within Alameda County, efficient disease surveillance and rodent suppression continues to be a focus of Alameda County Vector Control Services District. The operational protocols outlined here may serve to inform programs for other Districts; however, questions are always welcomed. Every component of operations performed by our District is subject to evolution of both cost effectiveness and efficacy. The trapping techniques discussed here represent an approach that has increased our capture number per man hour. Future developments to our program may include evaluating alternate methods of rodent suppression, increasing use of IPM around encampments, rodenticide resistance testing, pulse baiting, bait rotation, and population monitoring.

LITERATURE CITED

ACVCSD. 2020. Alameda County Vector Control Services District. Website. https://acvcsd.org/about-us/

Applied Survey Research. 2019. Alameda County homeless count & survey: comprehensive report. Applied Survey Research, San Jose, CA. https://everyonehome.org/wp-content/uploads/2019/07/2019_HIRDReport_Alameda_FinalDraft_8.15.19.pdf

CBS SF Bay Area. 2017. New Oakland homeless shelter using storage sheds set to open. Website, KPIX 5, CBS SF Bay Area. https://sanfrancisco.cbslocal.com/2017/12/04/new-oakland-homeless-shelter-using-storage-sheds-set-to-open/

City of Oakland. 2018. Oakland unveils newest rapid-rehousing facility and city council passes $8.6 million emergency funds for homeless services. Website, City of Oakland. https://www.oaklandca.gov/news/2018/oakland-unveils-newest-rapid-rehousing-facility-and-city-council-passes-8-6-million-emergency-funds-for-homeless-services

Easterbrook, J. D., J. B. Kaplan, N. B. Vanasco, W. K. Reeves, R. H. Purcell, M. Y. Kosoy, G. E. Glass, J. Watson, and S. L. Klein. 2007. A survey of zoonotic pathogens carried by Norway rats in Baltimore, Maryland, USA. Epidemiology and Infection 135(7):1192-1199.

Elliott, S. P. 2007. Rat bite fever and *Streptobacillus moniliformis*. Clinical Microbiology Reviews 20(1):13-22.

Galef, B. G. 2010. Norway rats. Pages 573-578 *in* M. D. Breed and J. Moore, editors. Encyclopedia of animal behavior. Volume 3. Elsevier Science, New York, NY.

Garofoli, J., and K. Veklerov. 2017. Homeless camps becoming entrenched in Oakland. *In* San Francisco Chronicle, June 28, 2017, San Francisco, CA. https://www.sfchronicle.com/bayarea/article/Homeless-camps-becoming-entrenched-in-Oakland-11240395.php

Kellogg, W. H. 1937. The plague situation. California and Western Medicine 47(1):69-71.

Mohr, C. O. 1948. Domestic rats, native rodents and fleas in relation to plague in the United States. CDC Bulletin 7(3):1-22.

National Health Care for the Homeless Council. 2019. Homelessness & health: what's the connection? Fact Sheet. February 2019. https://nhchc.org/wp-content/uploads/2019/08/homelessness-and-health.pdf

Sitman, L. 1976. Emeryville residents demand action on rats. Page 63 *in* Oakland Tribune, Oct. 29, 1976, Oakland, CA. https://newspaperarchive.com/oakland-tribune-oct-29-1976-p-63/

Tadayon, A. 2019. Oakland clears homeless encampment in Fruitvale. *In* East Bay Times, Feb. 1, 2019, Bay Area News Group, San Jose, CA. https://www.eastbaytimes.com/2019/01/31/homeless-encampment-in-oaklands-fruitvale-being-cleared/

Veklerov, K. 2018. City crews shut down East Oakland homeless 'village'. *In* San Francisco Chronicle, Dec. 6, 2018, San Francisco, CA. https://www.sfchronicle.com/bayarea/article/City-crews-shut-down-East-Oakland-homeless-13448602.php