

An Experimental Rat Eradication Program in an Urban Area

LLOYD SMITH, C.S.I.(C), M.R.S.H.

AN EXPERIMENTAL rodent control program which I conducted in the municipalities of Victoria, Esquimalt, and Oak Bay at the southern tip of Vancouver Island, B.C., Canada, was born of a conviction that it is technically possible to eliminate rats from urban areas.

The program deviated from orthodox public health practice in two important respects: (a) it was based on the extermination of rats rather than on control through sanitation measures, such as removal of food and harborage and rat-proofing, and (b) it was conducted as an active health department service, thus extending health department participation in rodent control beyond its normal educational and law-enforcement role.

The attempt at complete eradication began in 1958 in Victoria and one of its suburbs, Esquimalt, and lasted for 2½ years. In 1961 the municipality of Oak Bay joined the health area, and a similar program was conducted there.

These seaport municipalities have a combined population of 81,692, and they cover an area of 14 square miles. A long coastline affords abundant natural food and harborage for rats, and a mild climate enables them to live outdoors year-round. The area is connected by road and rail to both rural and urban areas which report normal rodent infestation.

This urban area is somewhat unusual in that it has few back lanes. Properties, particularly in residential areas, are separated at rear and

sides only by fences, against which are many compost heaps or boxes holding garden refuse and food scraps. These materials supplement the natural food and harborage for rats. Over the years, the heaps had become so heavily infested that in some areas a network of runs had become established on the surface in addition to the underground sewer infestations.

Before this attempt at complete eradication, the health department had achieved a virtually rat-free condition in the center of Victoria's business section. My experiment was aimed at the remainder of the city, including the broad residential perimeter.

In essence, the program consisted of attacking rats with an anticoagulant rodenticide (A). The primary targets were beaches, sewers, and compost heaps. Other targets were vacant properties, surface drains, dock areas, refuse disposal areas, and buildings. As a qualified sanitarian, I had right of entry to all premises. Although I had no previous experience in rodent extermination, I soon was able to recognize rat runs and to gauge the extent of infestation. In this orientation stage, I drew heavily from the literature on the characteristics of rats (1).

Materials and Techniques

The bait consisted of yellow edible cornmeal, hand-mixed in buckets with the anticoagulant rodenticide in the proportion of 19 to 1. A little pure corn oil was added so no white dust would adhere to the hands and clothing. The mixture was prepared in 10-pound (4½ kg.) quantities. The maximum quantity distributed in 1 week was 200 pounds (91 kg.). The

Mr. Smith is a sanitarian with the Greater Victoria Metropolitan Board of Health, Victoria, British Columbia, Canada.

weekly average was about 50 pounds (23 kg.) during the busiest months of the campaign.

On the principle that when rats emerge from their runs in search of food and water they travel no farther than necessary, I placed the bait as close to the runs as possible and protected it from animals, children, and weather. I visited the sites of active infestation daily, and replenished bait as necessary. When I was satisfied that all feeding had ceased, I always left a test quantity of bait at the site. I asked the occupant of the premises to observe this bait and to report immediately if it was disturbed. At this time also, I requested any necessary improvements in sanitation. At beaches and other unoccupied sites I checked my test baits periodically for signs of reinfestation.

Although other food or garbage was available, the rats always ate the cornmeal mixture. This preference of the Norway rat (the most common species in urban areas) for cornmeal has also been demonstrated in the laboratory (2). When it was necessary to throw the bait into an inaccessible place, I wrapped it in waxed paper in approximately 1-ounce (28 gm.) packages and placed as many of the packages as I thought were needed. I found that wrapped bait tended to disappear in greater quantity than unwrapped bait, indicating that the rats stored the bait in their runs. However, there are many advantages to wrapping and I followed this technique much of the time.

During the program period, I baited 723 private homes, 93 waterfront locations, 8 schools, 32 public buildings, 3 refuse disposal areas, 62 vacant properties and parks, 15 sites on railway embankments, and 29 commercial establishments including 2 shipbuilding yards, a grain elevator, 3 sawmills, 7 food establishments, and 5 factories.

Usually, I baited the site once a day for 5 days. At some locations, however, feeding ceased after 3 days and at others it continued for as long as 18 days. Although I test-baited hundreds of sites, I recorded only those that proved active. The heaviest infestations were in seafront sites. One of these, adjacent to the main sewer outfall, required 40 pounds (18 kg.) of bait before feeding stopped.

At no time did I attempt to synchronize the baiting program with my other responsibilities

in environmental sanitation because I believed that rats would be easier to eradicate in their undisturbed state. Disturbing them before poisoning would have scattered the infestation. I also felt that the success of the program would depend on public cooperation in reporting infestations.

To achieve uninhibited reporting, I had to build an image of myself as a public servant rather than a law-enforcement officer. This approach did not mean abandoning sanitation regulations, it simply meant a change in timing. Sanitation needs were tackled after, not before, the rats were killed. Invariably, grateful recipients of the service were willing to carry out instructions, because at this time it was easy to show why the rats had been attracted and how reinfestation could be prevented.

The cost of the program included my salary as sanitarian, less the value of routine sampling, other extermination work, and unrelated educational and inspectional duties that I was able to undertake during this program; traveling expenses to cover the 800-900 miles traveled each month and the cost of bait at about 20 cents per pound (1½ kg.).

Nothing was spent on publicity or advertising. In my opinion, this policy wasted a great deal of time, traveling, and bait, but it avoided serious opposition to the program. Such opposition in the early stages could have ended health department activity in rodent control in this area as it has done elsewhere (3).

Results and Discussion

In the final stages of the campaign, inspection of the areas that had been most heavily infested revealed a rat-free condition, as did a door-to-door survey over extensive areas. Also rat free were all the restaurants, bakeries, warehouses, and other food establishments; public buildings, such as schools, hospitals, nursing homes, and hotels; and recreation areas, such as parks, swimming pools, and beaches, which were under routine inspection by the health department. A significant number of these places had been infested.

Significant also was the cessation of rat reports from the city's garbage collectors and sewer crews who had been told of the service and asked to report infestations. Before the

program they had accepted rat infestation as an inevitable hazard of their occupations.

Following the program, the director of the British Columbia Provincial Museum reported difficulty in obtaining live rats to feed his rattlesnake, and one of his biologists stated that throughout the city he saw old rat runs but no rats.

In Oak Bay, a concentrated attack on beach and sewer infestations obtained dramatic results in a few months during 1961.

I believe this success was the logical result of adequate baiting over the entire infested area.

So that fear of accidental poisoning would not be a deterrent to satisfactory reporting, no opportunity was lost to explain the following safety features: The dry cornmeal bait is not palatable to children or pets, and it is placed out of their reach. Even if, through a combination of peculiar taste and excessive curiosity, a child or animal did eat some of the bait, one feed would not hurt him. For anticoagulants to cause poisoning, they must be consumed over a period of days. Should accidental poisoning occur, the symptoms are reversible by blood transfusion and administration of vitamin K (4). Anticoagulants are not toxic to birds and are not as toxic to some farm animals as to rats (5). In practice, this product is almost a specific rat poisoning. There has been no report of accidental poisoning by anticoagulants in the area covered by this program.

One injury was reported: a preschool child was bitten on the hand by a poisoned rat which he tried to pet. Mothers of small children were always warned that rats who are feeding on this poison move slowly and do not always run from danger. During this phase of the program small children should be well supervised. If cats or dogs catch rodents in this state of stupefaction or even eat them after they are dead they will not be injured.

Anticoagulant poisoning is painless. Some people refrain from reporting rats because they do not want them to suffer. Some religious groups refuse to kill rats (or anything else) because of a belief in reincarnation. With such people, cooperation may be gained if at all only by skillful communication or discipline.

At the end of the experimental period, I was able to return almost full time to routine duties.

Only a small proportion of my time was required for investigation of rat complaints. Most complaints at this period were of strange noises, unexplained holes in the garden, and other irrelevant phenomena. This indicated that the residents of the area were alerted and presumably would have notified the department of a serious recurrence of the old infestation, had it been evident.

Reinfestation occurred at relatively few locations. These reinfestations were invariably lighter, but continued to be a puzzling feature until well into the campaign. I am convinced that such reinfestations were fringe infestations which will not disappear until the central infestation is tracked down and removed.

In one example of this phenomenon, sporadic reports of rats were received from one side of a single block on the fringe of the business district. As no other calls had been received from the entire business center of the city for more than 2 years, this block aroused particular curiosity. Since each infestation disappeared after less than a half a pound of bait ($\frac{1}{4}$ kg.) had been consumed, it seemed that only one or two rats had appeared each time. Eventually a call was received from a dock on the waterfront at the foot of the same street, five blocks away. Here, 60 pounds (27 kg.) of bait were consumed before this waterfront area was rat free, and after that there were no more rats at either location.

The major single mistake during this experiment was to offer too little bait in the beginning. Experience alone shows an exterminator how much bait to use. I believe that it is better to waste bait by using too much than to risk using too little. It is essential that the first feedings at any location be enough so that by the time the first rats show symptoms of poisoning all will have ingested a lethal dose. Some bait should always remain after a night's feeding. If all the bait has been consumed, not enough has been put out.

An unexpected observation was that the most heavily infested areas were not the most unsanitary areas. The opposite was true. The most exclusive residential district was overrun whereas a close scrutiny of congested rundown sections disclosed a much lighter infestation. This applied not only to districts but also to

individual premises. Many spotlessly clean homes and well-kept gardens were invaded. The association of rats exclusively with dirty conditions is an unfortunate concept, because it causes reluctance to report infestation through embarrassment.

The most disturbing feature of the experiment and a subsequent investigation in other places was the reluctance encountered in some health officers to face facts in connection with rats. I observed a remarkably consistent response, which was first, to minimize the problem, then to refuse to admit that the problem can be effectively tackled, and then to disclaim responsibility for it.

Public response to the program, on the other hand, was encouraging. Rat infestation was a matter of serious and immediate concern to those directly affected. The appreciation expressed for the health department's willingness to provide a free and effective service was gratifying and rewarding. The only opposition came from a commercial pest control company which was adversely affected. In my opinion, the loss to the commercial exterminator is far outweighed by the benefits that accrue to the community as a whole.

In my opinion also, only the health department can carry out effective rodent control. Even if an individual hires an expert operator to do the work, he is limited to his own property. Rats are not so limited, nor is the properly qualified and authorized sanitarian.

There is nothing mysterious about the spread of rats. They become established in a neglected spot much as weeds do and from there they fan out to new locations. The new infestations may be some distance away if an easy travel route, such as a sewer, is available. The exterminator's job is to track down and eliminate all of them. If he leaves one in an area, the infestation will recur and he will have to go back and do the job more thoroughly.

Removal of food and harborage forces rats to move on to new locations. They can be eliminated only by killing them systematically and completely over a wide area. In addition to technical knowledge, an exterminator must have right of entry and adequate training in public relations to do a thorough job. When the job is apparently completed the machinery must

remain to deal with reinfestation. This procedure is well established in every health office to control communicable disease and other public health problems.

Following this intensive experimental work in rodent control, I was granted an extended medical leave of absence. During this leave, I traveled some 35,000 miles for 7 months, mostly through the southern hemisphere. I took this opportunity to observe rodent control and to discuss it with people both inside and outside the public health field. Knowing what could be accomplished to control rats, I wished to find out what was being done elsewhere.

Briefly, the pattern is fairly typical: health officers will advise and conduct educational campaigns, but they tend to leave active rat extermination to individual effort. There are exceptions, and some active programs of health departments are worth reporting if only to point out the danger of moving in the wrong direction. For example, one large city is proud of a program in which rats are being tracked down by trained dogs. Another city responds to reports of rat infestation by ratproofing the buildings, trapping the rats inside, and sending the bill to the property owners. On a Pacific island which I visited, thousands of coconut trees were protected from rats by bands of galvanized metal around the trunks. Damage to unprotected trees was noted.

Some public health departments were dispensing anticoagulants to the public over the office counter. Invariably, both the quantities and the advice given were inadequate. Other departments had discarded the poison after unsuccessful trials. Their techniques erred in mixing and placing. Many individuals and also some professional exterminators have stopped using anticoagulants because of similar errors.

Mistakes in handling the product include improper mixing, sprinkling it on the ground, and mixing it with other poisons. But by far the most common malpractice is to put out one tin of bait regardless of the size of the tin or the extent of the infestation, and assume when the tin is empty that the product is ineffective because the rats are still there. Another factor that has damaged public confidence is that the poison does not work as fast or effectively on mice as on rats, although it is advertised as

effective against mice. Mice are far more easily controlled by the DDT tracking patch method than by anticoagulants (6).

Conclusion

Rodent control assumes a degree of importance in a health department program in direct proportion to the recognition of the need. Sometimes the need is real and pressing, at other times it is imagined. The public, and sometimes health officials, may use fear of rodent infestation as a lever to deal with unsanitary conditions, but it is unrealistic to assume that rat infestation is the only reason or even the major reason for maintaining a clean community. There is a need for a completely honest and straightforward approach to both rodent control and general sanitation. Both are the responsibility of the public health department because they affect public health and cannot be handled well by private individuals alone. In my experience, a health department

can at modest cost eliminate rat infestation simply by correct use of anticoagulants on a systematic basis.

REFERENCES

- (1) Federal Security Agency, U.S. Public Health Service: Ratborne disease prevention and control. Communicable Disease Center, Atlanta, Ga., February 1949.
- (2) Hayes, W. J., Jr., and Gaines, T. B.: Laboratory studies of five anticoagulant rodenticides. Public Health Rep 74: 105-113, February 1959.
- (3) Felton, H. L.: Integrating public health and commercial rodent control. Amer J Public Health 41: 1101, September 1951.
- (4) Link, K. P.: The discovery of dicumerol and its sequels. Circulation 19: 102, January 1959.
- (5) DeKruif, P.: Sure death to rats. Reader's Digest, March 1951.
- (6) Department of National Defence, Canada: Armed Forces manual on pest control. Revised 1960. Defence Research Board, Environmental Protection Section, Ottawa.

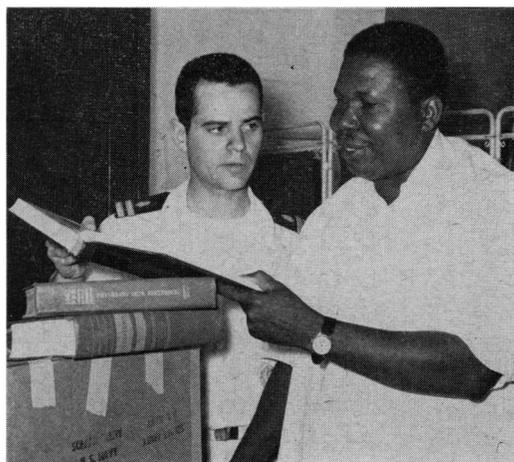
EQUIPMENT REFERENCE

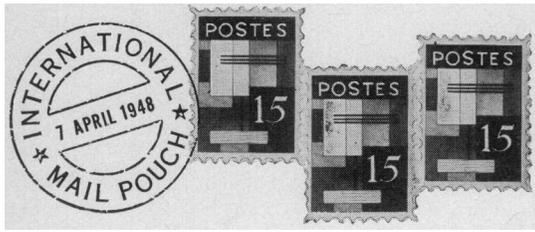
- (4) Warfarin, .05 percent concentrate.

Medical Literature for Africa

Tons of medical literature and other medical supplies donated by the people of the United States were distributed to seven African countries, Brazil, and the island of Tristan da Cunha by the U.S. Navy's Project Handclasp during the recent South Atlantic Amity IV cruise. The recipients included hospitals, medical schools, and health departments. At some ports, Peace Corps representatives and medical missionaries received the literature for distribution to health workers.

Persons who wish to donate books and journals on medical subjects may send them to Project Handclasp, % U.S. Naval Supply Center, Norfolk 11, Va., or San Diego, Calif.





Soviet Medical Geography

"Medical Geography," an English translation of the book, "Geograficheskiy sbornik," volume 14, published by the Academy of Sciences of the USSR, Leningrad (chief editor Academician Ye. N. Pavlovskiy) has been issued by the Joint Publications Research Service, U.S. Department of Commerce.

Sections of the book are devoted to the historical development of Soviet medical geography, medico-geographic sketches of several regions of the USSR, data on the geography of tickborne encephalitis in Siberia, peculiarities of the geographic distribution of cancer in the USSR, medical-geographic sketches of Austria and Alaska, geography of Japanese encephalitis in Japan, medical cartography, and a survey of Soviet and foreign medico-cartographic works.

Motivation for the study of medical geography by the Soviets is evident in the statement that sufficient knowledge in this field enables epidemiologic forecasts to be made concerning sparsely populated and economically unexploited territories. Vast areas of the USSR fit into this category.

The flavor of Soviet concern with medical geography is reflected in the section on the Kamchatka peninsula written by A. V. Yakovlev. The region is undergoing intensive development and settlement because of abundant natural resources. The population is engaged chiefly in the fishing and fur industries, and raising reindeer is important in the north. The terrain is rugged and mountainous, and the climate, with 300 to 1,100 mm. of precipitation annually, is cold and damp.

Recent studies have shown that acclimatization on the peninsula is accompanied by an increase in basal metabolism, which then remains at the new level indefinitely. Energy expenditure also increases because of the almost incessantly blowing winds, low temperatures, and the deep drifting snow cover.

The wind chill factor, in addition to its effect on

body heat, is considered in the heating and construction of buildings in this area; it is suggested that the long axis of a building be located parallel to the wind direction. During strong winds, the impact of fine, hardened snowflakes can give rise to kerato-conjunctivitis. Wind goggles prevent this type of tissue damage, and in the winter ultraviolet filters are needed to protect against the intense irradiation. In summer the winds pick up large amounts of caustic dust which irritate the skin and exposed mucous membranes as well as the respiratory tree.

The peninsula is an undesirable place for people with heart defects or hypertension, and many of them notice an aggravation of symptoms upon arrival.

Nightsoil is used for fertilizing, and the soil is extensively contaminated with helminth eggs. However conditions do not favor their development and helminthiasis in human beings is not widespread. Trichinosis is prevalent in brown bears, a fact of considerable importance since the meat is eaten by the inhabitants.

Tick exanthematous fever, tickborne encephalitis, and tularemia have not been reported from the peninsula, although host reservoir species and vectors exist in which these diseases could become established. *Dermacentor marginatus* and *D. silvarum* are plentiful. *D. silvarum* is a carrier of tickborne encephalitis virus and tick exanthematous typhus in other parts of the Soviet Union.

Vegetation is not particularly diversified, with 60 percent of the peninsula covered with woods and shrubs. Buttercup is used as a vitamin C source by the natives and there are many edible berries. Vegetable gardening is becoming more extensive, especially in the Kamchatka River valley. Most of the homes are one-story wood or wood-and-earth buildings.

Most prevalent diseases are grippe, dysentery, mumps, and tuberculosis. Immunity to diseases common among children is lacking in Kamchatka's adults, and when outbreaks of these diseases occur, adults are also infected. Yakovlev attributes this to the physical isolation of the centers of population from each other.

—Excerpted from "Medical Geography of the USSR" review by Dr. J. P. Ransom, *I.C.R.S. Medical Report* 5:21-42, January-March 1963.