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Canine Assistance to Increase Vole-Trapping Efficiency and Effectiveness

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ABSTRACT: We explored whether canine assistance would significantly improve efficiency and effectiveness of snap-trapping for non-chemical management of voles. We expected dogs' abilities to indicate real-time vole proximity could improve efficiency enough to render snap-trapping a feasible management tool at limited scales and where use of rodenticides is inappropriate. Timing was a critical component of our approach. Trapping commenced early January and thence every 14 days through mid-March, intended to directly reduce reproductive capacity by removing potential breeders before onset of breeding season and reducing early-season damage. We compared dog-assisted trapper efficiency and effectiveness to an "unassisted" human trapper working to scout and trap plots of the same size within the same field. We compared trap success (# voles killed per # traps set), efficiency (# voles killed per minutes spent searching and marking holes), and total search time invested.

A late (March) pilot round of trapping in 2022 on 5 Willamette Valley farms (1 hazelnut, 2 dairy pastures, 2 vegetable) provided limited but promising results and allowed us to refine our approach. Canine-assisted (3 trained amateur teams) and unassisted − but expert − humans tied in trap success (0.41 voles/trap and 0.40 voles/trap, respectively), but average efficiency and total search time spent by canine-assisted (0.48 voles killed/search minute, 97 total search minutes) out-performed that of an unassisted human (0.29 voles killed/search minute, 232 total search minutes). The regional vole population crashed prior to our 2023 season, which added further challenge to our work on 6 pastures. When voles were sparse, canine-assisted teams spent less time searching, but unassisted humans caught more voles per trap set. Canine-assisted teams (2 experienced amateur, 1 professional team) caught 0.029 voles/traps set and 0.11 voles/search min over 593 total minutes compared to unassisted human capture rate of 0.047 voles/traps set and 0.049 voles/search min over a total of 1207 search minutes.

KEY WORDS: canine assistance, efficiency, *Microtus canicaudus*, non-target species, Oregon, pastures, search time, snap traps, vertebrate pest control, voles

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INTRODUCTION

Voles (*Microtus* spp.) are among rodent species frequently noted as agricultural pests affecting crops and management systems across the northern hemisphere, and for which more effective management tools continue to be needed (Witmer et al. 2009). Rodenticides are a density independent management strategy that theoretically control a percentage of the population regardless of population size, allowing for a reactive management strategy. However, especially when working with organic or other producers who must rely on non-toxic strategies to manage voles, a more proactive, ecologically informed strategy is needed.

We collaborated with growers in the Willamette Valley of Oregon, a region in which vole damage is a perennial concern, which amplifies to a critical conflict during unpredictable population irruptions. The gray-tailed vole (*Microtus canicaudus*) is endemic to the Willamette Valley and is the main conflict species in our project area. The species excavates and maintains extensive networks of burrows and above-ground runways connecting the numerous burrow entrances, which are frequently persistent regardless of population abundance (Verts and Carraway 1998). The percent of adult females in breeding condition in the summer, when producers would normally be attempting to control populations, ranges from 78-92% (May to October; Wolff et al. 1994). However, as reproduction falls in winter (18% December, 0% in January-February, and 38% in March; Wolff et al. 1994), every adult death directly reduces breeding capacity at a critical time prior to vole breeding season and the concurrent growing season on farms. Once breeding ensues, a newborn female becomes capable of breeding as early as 18-21 days of age although many do not immediately become active. Gestation lasts 21-23 days, and she can conceive again upon parturition (Verts and Carraway 1998). These characteristics contribute to reproduction occurring simultaneously among multiple, overlapping generations and produce the periodic irruptive population events for which several species of *Microtus* are known.

Snap-trapping is effective in killing voles, but without an efficient way to identify specific entrances most likely to yield a capture, trapping for population-scale control is logistically infeasible across the extent of agricultural fields. However, trapping can be among the limited set of options for operations that cannot or do not use toxic rodenticides. Local farmers reported using low-cost, single-catch snap traps typically sold as house mouse traps. We considered multi-catch traps, which are more expensive, yet have the potential to be more efficient, and which have proved effective with vole species in Montana (Vantassel and Johns 2016) including long-tailed vole (*M. longicaudus*), meadow vole (*M. pennsylvanicus*), montane vole (*M. montanus*) and prairie vole (*M. ochrogaster*). However, Verts and Carraway 1998 cited a 1967 note from Maser that the gray-tailed vole (*M. canicaudus*) may not readily enter solid-sided metal traps. Therefore, we incorporated single-catch snap traps in our work.

Observed population thresholds are used to trigger management actions (e.g., pesticide application) for some insect pests during the growing season. Similar thresholds are less likely to be useful in the context of vole management due to monitoring challenges, and the relative severity of crop damage caused by a few voles. Preventative strategies informed by seasonal population fluctuations are more likely to succeed than management strategies that start when the population reaches a threshold. Vole populations drop during the winter and reproduction is low or seasonally absent, this provides an opportunity to curb population growth and reduce the risk of vole damage in the next crop. Although breeding ecology varies among Oregon's vole species, winter offers a universal opportunity to reduce the number of breeding animals before onset of the breeding season. However, conducting population control when targets are sparse and potentially broadly distributed across a field of persistent burrow structures makes the task more challenging.

Therefore, we used canine olfaction to address multiple factors that would challenge efficient trap placement by an unaided human trapper faced with a field full of hundreds of burrow entrances and reliant on visual identification of signs of recent use, such as vegetation clipping or fresh scat near burrow entrances, many of which are occluded by vegetation. Canines can indicate live vole presence in sparsely occupied burrow systems both when density is low (Gsell et al. 2010), when soil cover or weather conditions make human visual identification of sign (e.g., freshness of droppings) unreliable.

We conducted a first-stage proof of concept project focused on comparison of efficiency between trappers working on their own versus those assisted by canines in selecting which specific burrow entrances to trap in the presence of hundreds, if not thousands, of prospective entrances. We compared total time spent searching and positioning traps, voles killed per trap, and voles killed per minute of search time. The next stage for proof of concept would be determination of whether canine-assisted, over-winter trapping can produce a population impact high enough to significantly reduce crop damage.

METHODS

Our original design included aspects to allow dogs and handlers to train on scent of live, field captured but captive-maintained voles hidden in simulated burrow systems. Use of the olfactory abilities of dogs is complex, but our design would have enabled a basic quantified comparison of within- and across-team (i.e., individual dog-handler teams) accuracy. Common limitations affecting canine olfaction research is sample size of dogs/teams and potential breed and background differences (Lazarowski et al. 2020). Our intent was to collect data to estimate internal validity (accuracy rates within and among teams and between groups) through training stages and field validation. If successful, we would then have had the ability to estimate broader applicability and effectiveness of additional teams engaged in our training program (i.e., external validity; Lazarowski et al. 2020). Having standardized a training and testing protocol, our plan was to extend our methods to farmers and others interested in training their own dogs to assist in similar work.

In fall 2021, we enlisted 7 teams (dog + handler) that had already achieved advanced training or titles in competitive sports such as Nosework (®National Association of Canine Scent Work) and Scentwork (®American Kennel Club) to begin training the teams for field work. Six wild-caught voles were maintained in an approved animal facility owned by Oregon State University and were transported to the training site in ®Barn Hunt tubes (OSU IACUC #2021-0187, Oregon Scientific Take Permits (147-22, 023-23, 025-24). Tubes were constructed of 4" schedule 40 PVC and associated fittings to provide safe enclosures identical to those used to protect live rats during Barn Hunt competitions (®Barn Hunt Association, see p. 27 of Official Rulebook, <http://www.barnhunt.com/rules /barnhunt_clubrules_2019.pdf>). Vole-occupied tubes contained freshly cut grass, dandelion, or other herbaceous food and dry litter material. In addition to the vole-occupied tubes, we set up controls (no vole scent), and "bedding" tubes (no vole, but used bedding with vole excreta and grass).

Scent-pairing is a foundational step in training detection dog teams, regardless of the target species, purpose, or setting (DeShon et al. 2016). Dogs received positive reinforcement (i.e., praise or praise plus food or toy) when showing interest or indication (e.g., vocalization, posture, or other behavior) at the live-vole tubes. Teams were then presented with control, bedding and vole scent stations, building confidence and handler skill in reading accurate indications. This progression assists dogs in building scent specificity (i.e., live voles, not just vole scat or urine; Oldenburg Jr. et al. 2016). Shortly after beginning scent-pairing and proofing work, Leptospirosis was diagnosed in the captive cohort of voles. To protect health of facility staff and humans and canines involved in the field project further plans to train and assess with live voles were abandoned. The voles were euthanized, immediately freeze-dried, and then transferred to amber glass jars containing silica beads to avoid moisture intrusion. Subsequent training sessions in vole-occupied agricultural fields on campus began with reinforcement on odor of the freeze-dried voles, and the dogs appeared to alert more strongly to live voles in the field than to the freeze-dried voles used for training. Three dog-handler teams advanced to the fieldwork phase. The unassisted human searcher was a wildlife researcher trained to recognize signs of recent vole activity.

At each field site (hereafter, farm), we used aerial photographs, GIS, and ground-truthing to corner-flag a pair of ¼-acre plots in an area with signs of vole occupancy: one to be searched by the unassisted human, and the other to be searched by the canine team. Searchers planted a single pin flag at each burrow entrance identified as a trap site. Search time was recorded beginning when the searcher or team entered the plot and ended when they exited. The trapper entered the plot after searchers exited, setting pairs of snap-traps (mouse-size) perpendicular to each above-ground run leading to a burrow entrance, such that the treadles intersected but did not block the run. Because the traps were oriented across known runways, and because our target species was folivorous/herbivorous, we did not bait traps. Rather than depending on attraction (i.e., bait), our approach depended on interception of travel along habitual routes. In the case of more complex runs around a single entrance, additional pairs of traps were set. All traps included in that set counted as a "trap set", however we counted total traps set when calculating capture success (voles per traps set). Waxed cardboard "tents" to prevent non-target captures of perching birds were constructed from surplus milk carton material and were secured with nails driven into the soil. Tents were placed above the trap sets to avoid interference with the trap mechanisms. Trap placement was sometimes adjusted slightly (e.g., trap number or orientation) due to ground cover and terrain limitations. Because entrances to underground burrow systems are so numerous, we stuffed small (4-6" sq.) pieces of undyed burlap in each untrapped entrance within a ½-m radius of the ole identified to receive a snap-trap.

Traps were checked, data collected, and all materials removed 24 hours after the time of initial setting. We recorded date, time of set and check/removal, and success/tripped/no-trip for each trap-set, including trap-specific location relative to being nearer the entrance or the outer run. Project personnel were trained in primary (isoflurane) and secondary (cervical dislocation) means of providing euthanasia to any animals surviving within a trap. Only 1 animal (2022; vole) required euthanasia.

Our design was to begin trapping during the first week of January 2022, to trap each site once every 14 days, and to cease trapping immediately after juvenile voles appeared in our catch. The initial on-farm trapping season was severely delayed as our team dealt with the Leptospirosis-caused challenges. Therefore, we conducted a single round of pilot work in March 2022 on five farms (one hazelnut, two pasture, two winter vegetable) to refine field and data collection methods.

In 2023, we retained the two most consistent canine teams from 2022 and added one team that was experienced in professional wildlife-detection. Given logistical considerations and the high diversity in understory and patterns of vole habitat use we had observed among our 2022 farm types (pasture, hazelnuts, winter vegetables), we decided to work only in pastures on three farms in 2023. We created two pairs of three plots (one each canine, unassisted human, untrapped control) of ½ acre plots on each of three farms, resulting in six replicate "sites" (two canine plots, two unassisted human plots at each of the three farms). We trapped for 24 hours once every 14 days unless dictated otherwise by extreme weather conditions, specifically iced roads that precluded safe travel to the sites accompanied by solid ice (no burrow entrances visible) on field surfaces. We set unbaited traps on the first day and collected data and pulled equipment on the second day. We ceased trapping operations once juvenile (size, coloration) voles were detected via captures because that clearly marked that breeding season had begun (mid-March).

RESULTS

During the single-bout pilot in March 2022, a total of 284 trapsets were made after a total of 273 minutes of search time, across team types. Across the three canine teams, a total of 116 trap sets were located by canine-assistance in 97 minutes of search time, resulting in 47 vole captures, 10 non-target captures (12 deer mice, 7 shrews) , and a vole trap rate (voles/trap) of 0.41 with 0.48 voles trapped per minute search time. There was notable variation in efficiency among the 3 dog teams, ranging from 0.29 to 0.65 voles trapped/minute of search time. The unassisted human trapper set 168 trapsets after 232 minutes of search time, caught 67 voles and 9 non-target animals, for a vole trap rate of 0.40 with 0.29 voles trapped per minute search time.

Vole populations crashed in the winter of 2022-23. Over the entire 2023 season, canine-assisted teams searched a total of 593 minutes and placed 2,141 trapsets, killing 0.029 voles/trap with an efficiency of 0.108 voles/minute searched. The unassisted human searched 1,207 minutes and placed 1,276 trapsets, killing 0.047 voles/trap with an efficiency of 0.049 voles/minute searched. Across team type, 124 voles and 20 non-target animals (18 shrews, 2 deer mice) were removed.

DISCUSSION

We incorporated ecological factors not yet widely applied to vole management on farms. Despite complications, our pilot project allowed us to modify and optimize procedures, such as ceasing trapping after the first 24 hours to minimize non-target by-catch of other species using the vole burrow systems. Likewise, our results suggest that canine assistance in placing traps can significantly improve efficiency of snap-trapping in terms of time spent placing traps. Further sampling to compare catch-per-unit effort in years with average or more typical population abundance would be useful. Ongoing work (2024) will provide pilot data on whether over-winter trapping produces a difference in damage to pasture plot productivity and ground cover when assessed pre-, immediately post-, and 3 months post-trapping. However, the 2024 trapping and damage estimates are expected to be confounded by a continuing low-density phase in the regional vole population.

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LITERATURE CITED

DeShon, D. L., W. H. Wong, D. Farmer, and A. J. Jensen. 2016. The ability of scent detection canines to detect the presence of quagga mussel (*Dreissena rostriformis bugensis*) veligers. Management of Biological Invasions 7(4):419-428.

Gsell, A., J. Innes, P. de Monchy, and D. Brunton. 2010. The success of using trained dogs to locate sparse rodents in pest-free sanctuaries. Wildlife Research 37:39-46.

Lazarowski, L., S. Krichbaum, L. E. DeGreeff, A. Simon, M. Singletary, C. Angle, and L. P. Waggoner. 2020. Methodological considerations in canine olfactory detection research. Frontiers in Veterinary Science 7: Article 408

Oldenburg Jr., C., A. Schoon, and I. M. A. Heitkonig. 2016. Wildlife detection dog training: a case study on achieving generalization between target odor variations while retaining specificity. Journal of Veterinary Behavior 13:34-38.

Vantassel, S. M., and L. Johns. 2016. Voles in Montana: their biology, damage and control. Montana Department of Agriculture, Helena, MT.

Verts, B. J., and L. N. Carraway. 1998. *Microtus canicaudus*, gray-tailed vole. Pages 317-319 *in* Land Mammals of Oregon. University of California Press, Berkeley, CA.

Witmer, G. W., N. P. Snow, L. Humberg, and T. Salmon. 2009. Vole problems, management options, and research needs in the United States. Wildlife Damage Management Conference Proceedings 13:235-249.

Wolff, J. O., W. D. Edge, and R. Bentley. 1994. Reproductive and behavioral biology of the gray-tailed vole. Journal of Mammalogy 75(4):873-879.