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A Non-Lethal Technique for Raccoon Removal from Human-occupied Structures

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STUDY RATIONALE

Raccoons are among the most common source of complaints in urban areas to pest management professionals (e.g., Williams and McKegg 1987, Pest Control Technology 2002). Artificial sources of food in urban areas concentrate raccoons (Prange et al. 2004) and rates of survival and reproduction often are higher in urban areas (Prange et al. 2003). More than half of the female raccoons in urban populations den in human-occupied structures (O'Donnell and DeNicola 2006), which further compound issues of managing urban wildlife conflicts. Knowledge and methods (e.g., cage-traps) exist to remove denning raccoons relatively quickly from these structures, however, the full array of consequences to the health and safety of nursing raccoons and their young often may not be considered or may be simply ignored. Furthermore, many states prohibit translocation of captured raccoons, often resulting in euthanasia of captured animals.

Homeowners and some small but unknown proportion of professionals might employ lethal and sometimes crude techniques, such as noxious fumes, smoke, or loud noises in an attempt to avoid the costs of traditional trapping and removal. Some classes of frightening devices, such as ultrasonics, have failed to meet manufacturers' claims (Sprock et al. 1967, Howard and Marsh 1985). Chemical repellents pose potential risks to homeowners and to wild

and domestic animals. For example, the use of unregistered repellents may pose unacceptable health or humane risks. For example, mothballs are not only flammable but have harmed pets that have inhaled vapors or consumed pellets (Aiso et al. 2005, DeClementi 2005). Additionally, the use of mothballs or ammonia to evict chimney-denning raccoons may cause the young to endure noxious fumes for days, unless and assuming the female returns to remove them.

Given that raccoon populations have not only expanded northward in North America, especially through the North Central states into Canada, and also have increased in density in urban and rural areas (Gehrt et al. 2002), the need for cost-effective conflict resolution is high. Biologically-based repellents are those that utilize odors to evoke an instinctual response of avoidance. Since biological repellents rely on instinct, they have a very high potential for effectiveness while avoiding aforementioned risks and harms. Research in the area of biologically-based repellents is quite low and to our knowledge, no study has been done on these products for raccoons. Furthermore, this technique is likely under-utilized, in part due to a lack of training and education.

STUDY PROTOCOL

Our objective was to compare the effectiveness of two commercially-available biologically-based, non-lethal repellents (Raccoon Eviction Fluid, On Target ADC, Cortland, Illinois, USA; Raccoon Eviction Fluid, Wildlife Control Supplies, East Granby, Connecticut, USA) against a control (deionized water) to repel raccoons from human-occupied structures, specifically chimneys, with their young. The application of water as a control allowed us to differentiate between bio-repellent effectiveness and human disturbance to den sites. Specific questions that our study was designed to answer included:

1) Do biologically-based repellents effectively convince female raccoons to abandon den sites in human-occupied structures?

2) If female raccoons move their den site, will they simply move to a different part of the same structure?

3) If female raccoons move their den site, will the relocations be permanent, or will they return to the original den sites within a few days?

4) Will repellents result in female raccoons abandoning their young?

We conducted our study in urban areas of the eastern U.S. during the 2009–2012 denning seasons for raccoons. We relied on the cooperation of professional wildlife control operators to apply products, record responses, and reduce costs of the study. Operators verified that chimneys were occupied by a female raccoon and her young. Operators randomly applied one of two repellents or the control to an absorbent ball, which was dropped into the occupied flue. Operators recorded data describing characteristics of the structure before departure. Two to three days after the application, operators inspected the chimney to determine if the female raccoon vacated the den site with the young. Treatments were considered a success if the raccoons had left and had not relocated elsewhere on client property.

RESULTS

Our sample size was small, with only seventeen reports returned. Our data included only 15 samples because one report failed to include efficacy data and another failed to note which product successfully evicted the raccoons (Table 1).

Table 1. Efficacy data on raccoon eviction products, spring 2009–2012.

Success was defined as no raccoons present following treatment.

Product	Success	Failure
Control (water; *n* = 4)	1	3
Raccoon Eviction Fluid-Wildlife Control Supplies (*n* = 6)	3	3
Raccoon Eviction Fluid-On Target ADC (*n* = 5)	0	5

Despite the small sample sizes, several important findings are evident. For example, we hypothesized that the repellents would be proven effective, but the results were decidedly mixed. We were especially surprised at the results for Raccoon Eviction Fluid-On Target ADC. Its efficacy with evicting females with young has been reported in Wildlife Control Technology (Ryan, 1995) and in personal communication. Aside from participant error or random chance, it is possible the low efficacy rate was due to the extended wait time (2 to 4 years) between our receipt and distribution of the product to participants and its use in the field. Concern about shelf-life was raised with the manufacturer prior to its use. He, however, suggested that the product should be fine provided it was stored in a cool place. While we had stored it in a closet in a basement, we cannot account for how wildlife control operators stored it prior to use. While these products have no expiration dates, it is possible that the active ingredient loses efficacy over extended periods of time and/or it was damaged due to temperature extremes common in the back of service vehicles.

The eviction fluid produced by Wildlife Control Supplies, LLC. exhibited an efficacy rate of 50%, which was much higher than our control. The success rate of this repellent is high enough to suggest that wildlife control operators may wish to consider it when a customer

demands non-lethal control or if lack of access makes traditional control methods inappropriate. If we included the unknown treatment (i.e., participant failed to identify treatment type) with the water control, then we can claim that the control evicted raccoons 12% of the time. These data seem to support anecdotal reports from wildlife control operators that disturbance of the natal dens of female raccoons may be enough to cause her to relocate her young. We received no evidence that raccoons returned to the property even when chimney caps were not installed.

We were concerned that the use of raccoon eviction products would cause undesirable behaviors, such as abandonment of young or relocation to another part of the building or property. Though one participant noted the removal of two young, it was unclear from that particular operator's documentation whether any young were abandoned. We also found no evidence of raccoons moving to other portions of the structure or property. In addition, no animals were found dead during this study.

Our study also revealed how challenging working with wildlife control professionals can be. We found that our small stipend ($5.00 per test) did not measurably increase compliance or participation. Compliance with study protocols was exceedingly difficult even though participants were asked to review the protocol prior to joining the program. One participant, whose findings were excluded from this report, simply ignored the protocol, stating that he could identify that some of the bottles contained water, and consequently decided not to use them. He then proceeded to use the test bottles in a manner inconsistent with study protocols, such as in attics and crawl spaces. Several participants stated that they had not received any jobs that met the study requirements, some for multiple years. Others were initially eager to participate in this study, but when the time came to perform the work, they decided to not participate. We believe that a significant part of this behavior stemmed from the study occurring during the spring, the

busiest period for wildlife control operators. Operators may have found it difficult to suspend their traditional service procedure for the purposes of the study, or they did not comprehend study design or protocols. We caution future researchers to avoid initiating studies during the busy season, to consider whether the study protocol accords with traditional operator practices, or to ensure that a research technician accompanies the wildlife control operator to assist with following protocols and ensure that high quality data are collected.

CONCLUDING REMARKS

Our findings have several important implications for the control of raccoons bearing young. First, when homeowners request that raccoons and their young be removed in a non-lethal fashion, professionals will have a tool that allows them to effect the desired result. Furthermore, this technique could be an option in states where translocation of raccoons is illegal (e.g., MA, CT, NE). Where translocation of raccoons is legal, this method could provide a less expensive option to professionals and their clients. Second, there may be an improvement to animal welfare as the need for direct removal and probability of harm or abandonment of young may be decreased. Third, research findings would provide skeptical professionals the confidence needed to employ this tool in their businesses, especially when the setting prevents alternative control methods.

Although biologically-based-repellent use among professionals may not be common, we believe that the potential of these and other repellents to modify or discourage certain animal behaviors through passive discouragement is high. We also wanted to quell unsubstantiated claims against all forms of repellents and encourage use of biologically-based raccoon repellents by professionals through confirmation of their efficacy and humaneness. We hope that further research in the area of biologically-based repellents will continue.

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Aiso, S., H. Arito, T. Nishizawa, K. Nagano, S. Yamamoto, and T. Matsushima. 2005. Thirteen-week inhalation toxicity of p-dichlorbenzene in mice and rats. Journal of Occupational Health 47:249–260.

DeClementi, C. 2005. Toxicology brief: moth repellent toxicosis. Veterinary Medicine Online Magazine. http://veterinarymedicine.dvm360.com/vetmed/Medicine/Toxicology-Brief-Moth-repellent-toxicosis/ArticleStandard/Article/detail/141744?contextCategoryId =8696&ref=25. Accessed 11 November 2008.

Gehrt, S. D., G. F. Hubert, Jr. and J. A. Ellis. 2002. Long-term population trends of raccoons in Illinois. Wildlife Society Bulletin 30:457–463.

Howard, W. E., and R. E. Marsh. 1985. Ultrasonics and electromagnetic control of rodents. Acta Zoologica Fennica 173:187–189.

O'Donnell, M. A., and A. J. DeNicola. 2006. Den site selection of lactating female raccoons following removal and exclusion from suburban residences. Wildlife Society Bulletin 34:366–370.

Pest Control Technology. 2002. Online extra: top 10 wildlife pests. http://www.pctonline.com/ features/feature.asp?ID=296&AdKeyword=top+10+wildlife+pests. Accessed 11 November 2008.

Prange, S., S. D. Gehrt, and E. P. Wiggers. 2003. Demographic factors contributing to high raccoon densities in urban landscapes. Journal of Wildlife Management 67:324–333.

Prange, S., S. D. Gehrt, and E. P. Wiggers. 2004. Influences of anthropogenic resources on raccoon (*Procyon lotor*) movements and spatial distribution. Journal of Mammalogy 85:483–490.

Ryan, J. 1995. Eviction fluid: it moves them. Wildlife Control Technology 2:2 (Mar/April):36-39.

Sprock, C. M., W. E. Howard, and F. C. Jacob. 1967. Sound as a deterrent to rats and mice. Journal of Wildlife Management 31:729–741.

Williams, O., and J. McKegg. 1987. Nuisance furbearer management programs for urban areas. Pages 156–163 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, editors. Wild furbearer management and conservation in North America. Ontario Trappers Association, North Bay, Ontario, Canada.