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SUITABLE AND EFFECTIVE COYOTE CONTROL TOOLS FOR THE URBAN/SUBURBAN SETTING

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Abstract: Increases in the incidence of human conflict with coyotes in urban/suburban environments fuel a need for suitable coyote tools and methods to reduce these conflicts. Traditional tools, such as foothold traps and snares, face continued problems of acceptability in urban/suburban situations because of public anxiety about the risks to non-targets as well as other animal welfare concerns. We review the major categories of methods and tools used to prevent or reduce urban coyote-human conflicts, including exclusion (fencing), environmental and habitat modification, capture devices (traps, snares, and related devices), and shooting. We briefly discuss future technologies current under development: fertility control, toxicants, and electronic trap monitoring. Among capture devices, we describe recent advances in technology as exemplified by three devices: the KB Compound 5.5™, the Bélisle™ footsnare, and the Collarum™, which have gone a long way to address both capture efficiency and animal welfare concerns. We caution those involved in advising legislators, or in drafting legislation, to be aware of developing technologies, so as to avoid writing laws that are so broad as to ban future capture devices that improve on current devices in terms of humaneness and animal welfare.

Key words: Bélisle™ footsnare, *Canis latrans*, capture devices, Collarum™, coyote, coyote control, exclusion, fences, fertility management, KB Compound 5.5™, legislation, nuisance wildlife, pets, shooting, snares, trap regulation, trap monitors, traps, toxicant, urban and suburban habitats

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INTRODUCTION

The growth and distribution of coyotes (*Canis latrans*) since the 1940s (Parker 1995) has placed state wildlife biologists in the middle of three competing interests. First, biologists have sought, appropriately, to manage coyote populations in sustainable ways. Secondly, however, they have been hindered by the public's desire (and political action) to restrict or eliminate traditional coyote management tools, such as foothold traps and snares (Purwin and Oliver 2000). These restrictions have been ostensibly motivated by concern for the humane treatment of coyotes (Shivik et al. 2000), as well as fear over potential injuries to pets and children. Statistics and facts aside, everyone agrees that the general public has clearly demonstrated its opposition to the capture of coyotes using traditional tools.

The third competing interest is that of residential homeowners concerned about coyotes. As residences continue to be built in rural areas, contacts between homeowners and wildlife (including coyotes) have continued to increase (Derr and McNamara 2003, Timm et al. 2004). While these encounters for the most part have been innocuous, incidents of pet predation, stalking behavior, and actual coyote-on-human attacks have been on the rise. Homeowners who left the cities in search of the suburban lifestyle are now facing the dangers posed by coyotes towards their toddlers. While the grounds of this parental fear can be disputed, the fact these parents have this fear has been clearly heard by wildlife biologists.

Ultimately, biologists have to find ways to satisfy the public's interest in humane treatment of coyotes that are suitably efficient in the capture and removal of coyotes. Clearly, there is no one single tool or technique presently available to handle every known human-coyote conflict.

Many of the tools used to manage coyote damage in rural, agricultural, and other non-urban settings have been developed and improved for the purpose of effectively and efficiently preventing or reducing coyote depredation on livestock, particularly on sheep and goats in the West. Excellent reviews of the tools, methods, and approaches currently employed, as well as their history of use, can be found in United States Fish and Wildlife Service (1978), United States Department of Agriculture (USDA 1994), Green et al. (1994), and Knowlton et al. (1999). However, many of the techniques suitable for dealing with livestock depredation are impractical, unsuitable, or illegal for use in control of coyote conflicts in urban and suburban areas. Nevertheless, methods and tools employed to date in order to solve human-wildlife conflicts in suburbia have been adapted from a number of strategies used in rural areas.

In this paper, we discuss several coyote control methods and tools that have been utilized in urban and suburban settings, as well as providing some evaluation of their pros and cons in such settings. As with any such approach, the effectiveness, selectivity, and ultimately the success of the tool or method will depend in large part on the expertise and good judgment of the user.

EXCLUSION: FENCES AND OTHER BARRIERS

On private properties, it can at times be possible to completely exclude coyotes by means of fences and other such barriers, presuming the fence design and materials chosen take into account the coyote's abilities to defeat a fence by going under, over, or through certain types of fences. Fences that are effective in excluding coyotes from livestock pastures have been developed and studied during the past several decades (see de Calesta and Cropsey 1978, Shelton 1984).

To exclude coyotes, fence height should be a minimum of 7 feet and should be higher on sloping terrain. Net wire mesh should be no larger than 6 inches wide. To deter coyotes from digging under the fence, bury a galvanized wire mesh apron, attached securely to the bottom of the fence, 4 to 6 inches below the soil and extending outward at least 15 inches. An extra degree of protection against coyotes scaling a fence can be obtained by installing a wire mesh overhang of at least 18 inches, slanted outward. Recently, a commercial device called the Coyote Roller™ has been manufactured and marketed for attachment to the top of fences (Roll Guard™, Inc., Santee, CA). This roller-type device is said to be effective in preventing coyotes from getting a foothold in their attempts to climb or jump over. Electric fences of various designs have been effective in excluding coyotes, but they may be inappropriate for use or even illegal in some residential or suburban areas.

In residential areas, it is also important to close off crawl spaces under mobile homes, porches, decks, and garden sheds, as coyotes can use these areas to rest and to rear their young. While fencing may not prevent all coyotes from entering an area, it will often result in coyotes leaving evidence of where/how they penetrated the fence, which can make the use of other control devices, such as snares or traps, more effective.

Fences and other such physical barriers can be expensive to install or modify so as to effectively exclude coyotes. However, once installed, they can be effective over a long period of time, with normal inspection and maintenance. Thus, the initial high cost can be spread over a period of perhaps 10 to 20 years or longer.

HABITAT AND ENVIRONMENTAL MANAGEMENT

Residential and other suburban areas that have lush landscaping provide abundant food, water, and shelter for coyotes, resulting in a carrying capacity that exceeds most areas of wild or natural vegetation and prey base. Clearing or thinning vegetation and removing brush and dense weeds from the landscape deprives coyotes and their prey of shelter and cover. Landscape plants that produce fruits and seeds should be discouraged, and fruit should be picked from trees before it falls to the ground to avoid attracting coyotes. Compost piles and bird feeders must be managed carefully so they will not encourage rodents, rabbits, and other prey that are attractive to coyotes. Where possible, available water sources for coyotes and other wildlife should be eliminated.

Anti-Feeding Ordinances

Some cities, counties, or states have regulations or legislation that prohibits intentional feeding of certain kinds of wildlife. Because intentional feeding of coyotes is thought to be a significant factor in their becoming habituated to humans, and therefore, more likely to come into conflict with people, this behavior should not be tolerated. While law enforcement agencies seldom have the time and resources to enforce such ordinances, knowledge of their existence can be an effective motivator in residential areas, such as when homeowner associations or residents of neighborhoods use collective peer pressure to stop one resident or household from continuing intentional feeding of nuisance wildlife.

Pet Management

Because cats and small dogs are seen as potential prey by urban coyotes, they need to be kept indoors, in enclosed kennels, or kept under close supervision. If allowed to roam freely in yards, they are only safe from coyote attack if the yard is surrounded by an appropriate fence. Medium to large dogs can also attract attacks, as coyotes likely perceive them as a territorial threat, particularly during the seasons of denning and pup-rearing.

When exercising pets, they should be kept on a leash. Daily routines and walking routes should be altered so they are not repeated at the same time, as coyotes will learn and take advantage of people’s routines. Exercising pets in mid-day may be safer than in early morning or late evening when coyotes are sometimes most active.

When feeding pets, never feed more than will be consumed in a single, short feeding. The presence of pet food is an attractant for coyotes, as well as for other wildlife that are potential coyote prey, and therefore also serve as attractants.

CAPTURE DEVICES

Foothold (“Leghold”) Traps

Of the traditional tools for capturing coyotes, the foothold (also called “leghold”) trap has had both the longest history and the greatest use. This history of foothold trap development and modification, as well as some of the controversy that has surrounded this important tool, was summarized by Linhart (1985). Today, some states and municipalities prohibit the use of foothold traps, although in some such cases exceptions are allowed in situations which are considered human health and safety emergencies.

Improvements to traps have focused on improving the humanness of devices towards the target animal, eliminating non-target captures, complying with regulations, and meeting political correctness. Modifications to foothold traps through time have included padded jaws, laminated jaws, pan-tension devices, inline springs, multiple swivels, and center-mounted chains to increase effectiveness, humaneness, and to reduce non-target capture. Houben et al. (1993) reported that using laminated trap jaws reduced injury scores over padded-jaw traps. Lamination provides for greater surface area over the jaw face, thus reducing the incidence of injury to coyotes. As an improvement to pan-tension devices, M-Y Enterprises (Homer City, PA) developed the Paws-I-Trip™ pan-tension device, which is capable of reducing non-target captures without adversely impacting performance of several popular coyote traps, the No. 3 Victor SoftCatch®, Victor 3NM, and No. 4 Newhouse (Phillips and Gruver 1996).

No. 3 Victor SoftCatch® or other padded leghold traps can be very effective when used by experienced trappers. When modified with double swivels, shock springs, and a short (12 to 16-inch) chain, the risk of injury to captured animals is minimized. When trapping is conducted in urban and suburban environments, the trapper typically places traps only in those locations where coyote activity is known to occur, and if possible, where free-roaming dogs and other such animals are not present. Residents in the immediate area can cooperate by keeping their dogs and cats confined while the trapping effort is under way. The trapper may choose to activate trap sets only from dusk to dawn, remaining in the vicinity and conducting frequent trap checks throughout the night. This permits prompt release of any non-targets accidentally captured, usually without harm. Further, frequent trap checking decreases stress on captured animals and reduces the opportunity for someone to approach a trapped coyote. Captured coyotes typically are humanely euthanized at the site of capture.

Baker and Timm (1998) and Timm et al. (2004) noted that of all techniques used in controlling problem coyotes in southern California, trapping had the greatest observed effect of re-instilling a fear of humans into the local coyote population. When 2 to 5 coyotes were trapped in a problem locality, the remaining coyotes would often disperse. Although this response was partially dependent on the size of the area, the number of coyote family units resident, and the existing level of wariness in the animals. At locations where leghold trapping had been used successfully, coyote problems typically did not reoccur for at least 2 years and usually longer (Timm et al. 2004). They speculated that the use of other capture devices, such as the Collarum® and foot snares, would have a similar effect.

Recently-Developed Devices

Three recently-developed traps have greatly expanded the options available to biologists for managing coyotes in urban areas. Each of these traps has the following advantages: 1) They are more likely to be accepted by the public because they are free of, or mitigate elements of, the "foothold stigma." In fact, they may be legal in states where snares and foothold traps have been banned; 2) Traps can be used in areas where guns are either illegal or unsafe; and 3) They pose a lower risk of inflicting long-term injury to non-target captures.

KB Compound 5.5™

In 2006, KB Manufacturing of Fort Plain, NY introduced a foothold trap for coyotes called the "KB Compound 5.5™." The trap weighs about 2.5 pounds, boasts four 1/8-inch coil springs, a 3/16-inch gap in the offset jaws, and a 5.5-inch jaw spread (inside-jaw measurements). By using a dog-less style trap pan, a larger portion of the pan (approximately 95%) remains sufficiently sensitive to spring the trap. Traditional dog-style trap pans do not distribute the jaw pressure evenly around the pan, meaning that pressure exerted on some parts of the pan will fire more easily than others, resulting in fewer catches. The trap currently comes in standard and laminated jaw versions. The standard version has a jaw surface area of 3/16 inch. Coyotes caught in this trap will sustain some cuts to the foot. The laminated version substantially decreases cutting to the foot by adding another 1/16-inch surface area to the jaw.

The most unique feature of the trap is the way the springs are incorporated into the overall design. Traditional foothold traps have to use strong springs in order to hold a coyote. The KB uses a lever mechanism to convert the coyote's pull into a stronger hold. This change allows the trap to use weaker springs than traditional coyote traps. Kurt Beauregard, trap inventor and manufacturer, equates the action of the KB Compound 5.5™ to that of a Chinese Finger Game: "The more the coyote pulls against the trap, the more pressure applied to jaws." Please note that the pressure is limited to the point at which the offset jaws completely close. The advantage of offset jaws is how they limit the amount of pressure exerted on a coyote's foot. The weaker springs take less effort to set, too, permitting easier release of non-targets. Additionally, shoulder injuries to coyotes are reduced, because the coil springs act as an inline shock absorber.

The KB Compound 5.5™ will be undergoing controlled field studies, possibly as early as 2007. The manufacturer will also be producing a padded-jaw version in 2007.

Bélisle™ Footsnare

The Bélisle™ footsnare operates very much like a traditional foothold, except when activated the jaws slip away, leaving a 3/32-inch cable to lasso the animal's leg. Like a foothold, the footsnare is behaviorally passive, requiring the animal to step on the pan to activate the device. Its similarity to the foothold may help trappers more easily adopt its use (Shivik et al. 2000). In a 1996 Texas study, the footsnare achieved a 64% capture rate (NWRC 1997). In a later study, the footsnare presented a capture rate of 78% (n = 49), which approached the rate of traditional footholds. However, the selectivity of the trap was only 70% (n = 44), as it captured 6 non-coyote species (Shivik et al. 2000). While not widely used in the United States, the Bélisle™ has been certified by the Fur Institute of Canada for the fall 2007 season for the capture of lynx, coyote, and bobcat (see http://www.fur.ca/indexe/trap_research/index.asp?action=trap_research&page=traps_certified_traps). This certification meets the humane requirements imposed by the Agreement on International Humane Trapping Standards. Despite this certification, coyotes caught in the footsnare did exhibit leg swelling with one fracture, along with many teeth injuries (Shivik et al. 2000).

The Collarum™

The Collarum™ captures coyotes by throwing a cable-loop around the neck of the coyote. The coyote triggers the device by biting and pulling on a baited bite-piece. By utilizing the biting-then-pulling behavior of canines, it is no surprise that the Collarum™ is extraordinarily canine-specific. In two different studies, it was the only device able to capture only coyotes (Shivik et al. 2000, Shivik et al. 2005). No non-target captures were observed. While modifications to the device in 1998 more than doubled its capture efficiency rate, it still only boasts a capture efficiency of 87%, 13 percentage points below the SoftCatch® trap's efficiency of 100% (Shivik et al. 2005). Nevertheless, it is likely that the species-specific nature of the device, along with improved user training, the device's efficiency may continue to increase.

The humaneness of the Collarum™ is striking. The most recent study showed that 12 of 13 coyotes captured exhibited no injuries indicative of poor welfare. They presented only minor tooth injuries. The exceptional coyote died due to the cable cinching over its head and neck causing it to choke (Shivik et al. 2005). In further testimony of the trap's humaneness, more animal control officers are beginning to use the Collarum™ to capture stray and lost dogs (Purwin and Oliver 2000).

Cage Traps

It is usually believed that coyotes are too wary to enter cage traps, and that these tools cannot be effectively used to capture problem coyotes. Shivik et al. (2005), in reviewing both the literature and practical experience of trappers who utilized such cage traps, concluded that for optimal success, such traps needed to be greater than 1.6 m in length, baited with carcass parts attached to the inside of the trap, and having a trap floor covered with a natural substrate. Even so, they noted that in their tests as well as in previous tests by Way et al. (2002), cage traps performed poorly in relation to species selectivity. Shivik et al. (2005) speculated that coyotes in suburban areas are more accustomed to traveling around and through human-constructed obstacles than area coyotes in rural or agricultural environments, and therefore are more vulnerable to cage traps; they noted that one trapper in suburban Los Angeles reported having capture 545 coyotes in cage traps during his career. They concluded that it was "exceedingly difficult to capture coyotes in cage-traps… in animal damage management circumstances," except in suburban nuisance trapping (Shivik et al. 2005:1380). Cage traps have perhaps the most utility for use in urban and suburban situations where foothold traps cannot be used.

Snares

The use of snares for capture of predators did not come into vogue until the late 1970s; prior to that time, there were issues with the quality of cable and locks used to manufacture snares (Boddicker 1982). The advantage of using snares lies in their simplicity and effectiveness in all weather types. A major factor in capture success, as with traps, has been user experience, along with the quality and type of snare employed. During the last two decades, efforts to improve devices for wildlife have intensified, due to regulatory factors and humaneness.

For capturing coyotes, snares have been used both as lethal and as non-lethal tools; the latter is more common in urban and suburban settings, when there is a need to release non-target captures unharmed, or when using snares to capture coyotes alive for research purposes.

Roy et al. (2004) recommended that longer (> 12 ft) and smaller-diameter (1/16-

inch) snares be used on coyotes, to allow the coyote a good run at the snare and to set the snare deep in the neck muscles of the coyote to increase killing effectiveness; the snare loop should be greater than 10 inches off the ground and no more than 12 inches in diameter to more effectively target the neck of coyotes and avoid deer. Modifications to snares to permit live capture of coyotes and other animals include selecting the appropriate cable, adding a stop on the cable so that the wire noose will not tighten past a certain diameter, and addition of a swivel, which reduces the risk of suffocations (Nellis 1968).

A main disadvantage of using snares in urban and suburban settings is the potential for capturing non-target species, particularly free-roaming domestic pets. As with traps and other capture devices, they require considerable expertise for effective use. Snares can be very useful in situations when problem coyotes' travel routes are obvious, such as when coyote follow a defined pathway from an undeveloped area into a suburban neighborhood, or pass through or under a fence, into which a snare can be set.

Shooting / Calling and Shooting

Shooting coyotes has limited utility in urban and suburban areas, because of the safety hazard present when firearms are used in close proximity to people in such settings. Shooting must always be coordinated with local law enforcement agencies.

Today's marksman uses a variety of rifles, shotguns, cartridges, and shells to remove problem coyotes. Space does not permit a full discussion of coyote rifles or shotguns of choice, or the appropriate ballistics to use. In fact, the "perfect" coyote rifle or shotgun is still up for debate; several varmint-type rifles and shotguns can be effective. What needs to be considered is experience of the shooter, comfort of the shooter, target, back drop, sound, how a bullet reacts upon hitting the target, shooting position, ability to maneuver or carry in the field, weight of the device, and, first and foremost, safety.

Only experienced personnel should be involved shooting control operations. Night-vision equipment (Maestrelli 1990), infrared illumination or laser sights, sound suppressors on rifles, and safer types of ammunition can make shooting operations more efficient and less disturbing in residential areas.

The advantage of using shooting is that it is highly selective: individual animals are removed, and risk to non-targets is eliminated when this technique is employed by an experienced shooter.

Additional techniques, such as calling and decoy dogs, can improve the ability of using firearms to remove problem coyotes. Calls are used to locate coyotes, dens, or to bring coyotes within range of a firearm (Coolahan 1990). During the breeding and pup-rearing seasons, coyotes will often become somewhat aggressive toward other canines near their den sites or in their territories, so decoy dogs are useful in drawing the coyotes out into areas where firearms can be used safely and effectively. Also, because problem coyotes in urban and suburban areas are often so thoroughly human-habituated that they ignore the presence of people, these problem coyotes are at times very easy to encounter at close range, thus making their selective removal via shooting quite efficient.

FUTURE METHODS

Fertility Management

Previous studies have indicated that a significant amount of coyote predation on livestock may be in response to the reproductive pair's need for increased food during late gestation and for provisioning pups (Till and Knowlton 1983, Bromley and Gese 2001). To the extent that urban coyotes kill pets as a source of food, attack small children as potential prey (Carbyn 1989, Timm et al. 2004), or exhibit other aggressive behaviors in conjunction with breeding and pup-rearing activities, stopping or reducing reproduction in urban coyotes might reduce such conflicts.

Progress on several immuno-contraceptives for coyotes has been reported in recent years (DeLiberto et al. 1998, Miller et al. 2006), but such solutions are a number of years away from availability. Among the hurdles yet to be overcome for their practical application are development of effective and efficient delivery systems, and the registration of such products (Eisemann et al. 2006, Fagerstone et al. 2006).

Toxicants

Current research is focusing on finding environmentally-friendly predacides. The USDA, Wildlife Services, National Wildlife Research Center is evaluating a mixture of methylxanthines, a class of chemical compounds that are naturally found in such food substances such as tea, coffee, and chocolate products. Johnston (2005) identified a 5:1 theobromine:caffeine mixture as a potential toxicant for coyotes. The mixture appears to have the potential to be developed into an effective toxicant for coyotes; further, it is currently thought to be selective for canids and harmless to other mammalian species, and it results in a humane death within a few hours of ingesting a lethal dose. While development and registration of this toxicant remains a number of years away, it would appear to have application for both urban and rural environments, provided methods of bait application can be developed that will reduce the chance of accidentally poisoning non-target canids, such as foxes and domestic dogs.

Electronic Trap Monitors

Field tests to allow electronic monitoring of foothold traps and other capture devices have been conducted in recent years, and improving technologies suggest such techniques can be made practical and cost-effective (Halstead et al. 1995, Sabick and Larkin 2006). Such remote monitoring technologies will save time in monitoring traps by reducing travel time, also allowing an increase in the number of devices that can be checked by one individual. They will also permit more immediate response to activated devices, thus reducing stress to captured animals and permitting timely release of non-targets. Implementation and further development of such technologies is expected in the coming years.

REGULATORY RESTRAINT

One desired message of this paper can be stated as follows: wildlife biologists should exercise extreme caution when asked to help legislators define allowable devices for wildlife control. Lack of specificity regarding regulatory language can easily result in the inadvertent prohibition of future development of humane traps and species-specific devices. While trap development is incremental, the need of nuisance wildlife control operators to have tools appropriate for human-impacted settings has hastened trap development and research. Animal damage controllers are inherent tinkerers. A trap deemed inappropriate today may be modified and become more acceptable tomorrow.

To demonstrate what can happen when legislation is written too broadly consider the following real-life example: In 1996, the citizens of Massachusetts were confronted with a ballot initiative in which they were asked (among other things) to ban snares and any trap that grips the body of an animal. These traps were targeted because they were deemed inhumane. In fact, the bumper sticker motto of the initiative proponents was "Ban Cruel Traps." Only mouse and rat type traps and Conibear-style traps were exempted. The referendum passed by almost a 55% to 30% margin (Massachusetts General Law 1996). Little did the public know that traps like the Collarum™ were on the horizon. Yet, the law's use of broad and inclusive language effectively banned traps that had not even been invented yet, irrespective of their humaneness or species-specificity.

In light of this wildlife management debacle, it behooves legislators to enact restrictions on specific formulations of traps rather than on the mechanism of the trap, because later developments and inventions could permit the trap to ultimately pass humane standards. While it may seem daunting for biologists to be tasked with the responsibility to "educate" the public about how one trap differs from another, Timm and Schemnitz (1988) show that with sufficient support, attitudinal change is possible.

CONCLUSION

Biologists and regulators need to keep abreast of advances in equipment involved in wildlife damage management. While technology will never resolve the underlying philosophical arguments of individuals at the extreme end of the animal rights/welfare view point, technology can provide some common ground where those of good will can find workable solutions.

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