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ANIMAL DAMAGE CONTROL RESEARCH CONTRIBUTIONS TO COYOTE MANAGEMENT

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Abstract: The Animal Damage Control (ADC) program spends approximately one-fourth of its annual Federal appropriation on methods development research, which is conducted or coordinated by the Denver Wildlife Research Center (DWRC). DWRC activities are well integrated into the ADC program, with researchers providing many management services and many operations personnel participating in research projects. Approximately 20 percent of the DWRC budget is devoted to predator methods development. Many of the coyote management techniques currently used or recommended by ADC personnel have been developed or improved by DWRC studies.

INTRODUCTION

Management of human/wildlife conflicts involving coyotes is a major activity of the Federal-cooperative ADC program. Accordingly, methods development for coyote damage management is a high priority activity at the DWRC, which is the research component of the ADC program. The DWRC mission is to develop methods and strategies to prevent or reduce wildlife damage and human/wildlife conflicts, and to communicate these methods to ADC operations personnel and other users. This paper offers a current perspective of DWRC predator methods development research and the role of research personnel in ADC predator management activities.

The DWRC has been engaged in predator management research since 1940, and many reviews of predator research have been published over the years by DWRC scientists and administrators. For examples, see (Linhart 1977, 1984a; Sterner and Shumake 1978a; Connolly 1982; Fall 1984, 1990; Phillips and Fall 1990).

DWRC receives approximately one-fourth of the Federal funds appropriated to USDA by Congress each year for Animal Damage Control. The control methods development budget for Fiscal Year (FY) 1995 totals approximately $8.6 million, and about $2 million of this will be spent on methods development for predator (mostly coyote) management. Our predator management studies include work on biology and behavior, development and improvement of damage control methods, assessments of the environmental impacts of control methods, development of data to support EPA and FDA registrations of predacides, and communication of research findings to clients inside and outside the ADC program.

PREDATOR MANAGEMENT METHODS

Predator-resistant Livestock Fences

DWRC and other researchers have conducted many studies of predator-proof or predator-resistant fencing. The introduction of improved electric fence energizers and fencing materials in the late 1970s stimulated several evaluations of energized fences to protect livestock from predators (Linhart et al. 1982; Nass and Theade 1988). Linhart and his colleagues found that a fence had to be 5.5 to 6 feet high to keep coyotes from jumping it.

We currently have no studies in progress on predator fencing. Many good fence designs are available, and ADC personnel routinely recommend their use to livestock producers.

The "Electronic Guard"

DWRC scientists have worked on several kinds of frightening devices including strobe lights and sirens (Linhart 1984b; Linhart et al. 1984, 1992). These studies led to the development of the "Electronic Guard", a battery-powered, siren-and-strobe scare device that has been available from ADC's Pocatello Supply Depot (PSD) since 1991. As of May 1995, the sale price is approximately $260 each. Two hundred seventy five units have been sold to date.

A light-sensing device activates the Electronic Guard at nightfall and turns it off about 2 hours after dawn, thus conserving battery life by operating the device only at night when coyotes are most likely to attack. Field tests of prototype siren/strobe devices on high mountain summer range yielded average reductions of 60 percent in coyote predation, compared to pre-test periods (Linhart et al. 1992). For best results, it is recommended that at least 2 units be used in small fenced pastures and 3 or 4 units in large pastures. Experience has shown this approach to be very effective in interrupting patterns of predation, allowing time for other control measures to be implemented. ADC personnel are currently using and recommending this device.

Repellents and Aversive Agents

Livestock producers and wildlife researchers have long sought a magic elixir that could be sprayed on sheep to repel predators. Many potential repellents have been tried over the years, but a practical and effective coyote repellent has yet to be found.

The most recent predator repellent device investigated at the DWRC was the Vichos Non-lethal Livestock Protection Collar©, a rubber neck collar that contains a solution of noxious, pepper-like material. When punctured, the pressurized collar discharged a capsaicin solution that was expected to repel coyote attacks. Pilot tests at Logan, Utah did not validate the collar's effectiveness (R. J. Burns, personal communication).

Aversive conditioning with lithium chloride (LiCl) in prey meat baits was a major research thrust at the DWRC and elsewhere during the late 1970s. DWRC studies followed the pioneering lead of Gustavson et al. (1974) who suggested that coyotes would refuse to attack sheep after they experienced physiological illness induced by consumption of sheep-meat baits containing LiCl.

Unfortunately, we were unable to develop this attractive concept into a practical coyote depredation management technique. Our coyotes disliked LiCl and developed aversions to meat baits containing this compound, but they made no transfer of avoidance from baits to live prey (Griffiths et al. 1978; Sterner and Shumake 1978b; Burns 1980; Burns and Connolly 1980). Following these negative findings, the DWRC terminated its studies of LiCl.

Livestock Guarding Animals

Guardian animals have received much research attention over the past 25 years. Guarding dogs, in particular, have been studied intensively and now are well established (Green and Woodruff 1990). DWRC scientists early studies (DeGrazio 1973; Linhart et al. 1979) but the major work on guard dogs was performed by others; see Green and Woodruff (1987) for a review. During the late 1980s, the ADC program implemented a plan to encourage the use of guard dogs in concert with other means of depredation control. This initiative was successful and most livestock producers served by the ADC program have tried or are using guard dogs.

Recently, some rancher reports of apparent decreases in guard dog effectiveness have appeared in public media. Systematic surveys of guard dog users, however, continue to confirm that the dogs are rated as effective by most livestock producers but, for many producers, guarding dogs alone are not adequate to keep predation within acceptable limits (Green et al. 1994).

Other kinds of livestock guardians, such as donkeys and llamas, have received much less attention from researchers. The DWRC currently is formulating plans to evaluate the efficacy and practicality of llamas.

Foothold traps and snares

Despite all efforts to develop and implement new and improved methods for coyote damage management, foothold capture devices remain among the most important capture techniques used by ADC. DWRC scientists have worked with ADC field personnel for many years on modifications to increase the selectivity and humaneness of these devices (Linhart et al. 1981). Many of the innovations originated with trappers or ADC specialists.

Capture device modifications studied recently by DWRC scientists include:

- Trap pan tension devices. Several types of pan tension devices were evaluated (Turkowski et al. 1984; Phillips and Gruver 1995). The results led to adoption of an ADC policy requiring pan tension devices to be used on all leghold traps set on land, unless such use would preclude capture of the intended target animal.

- Padded-jaw traps. DWRC and other ADC personnel have devoted much effort to comparative evaluations of padded and unpadded foothold coyote traps (Linhart et al. 1981, 1986, 1988; Linhart and Dasch 1992; Phillips et al. 1992; Phillips and Mullis 1995). Current models of padded traps can provide equal capture efficiency with much less foot damage to captured animals, compared to unpadded traps.

- Tranquilizer Trap Tabs. Another innovation toward improved humaneness is the tranquilizer trap tab, a concept that has been around for at least 30 years (Balser 1965). Practical delivery mechanisms and effective tranquilizers have been developed (Zemlicka and Bruce 1991) and the DWRC currently is preparing an application for a Food and Drug Administration (FDA) investigational registration of tranquilizer trap devices containing propiopromazine hydrochloride.

- Breakaway snares. DWRC researchers have evaluated several types of breakaway snares in an effort to find or develop the snare that will best hold coyotes but release most larger nontarget animals (Phillips et al. 1990; Phillips 1995). This work has resulted in the development of an improved snare lock that is nearing commercial production.

- Transmitters for remote trap checks. ADC research and operations personnel have modified and evaluated radio telemetry gear for use in monitoring trap and snare sets (Halstead et al. 1995). Such monitoring has the potential to improve both the humaneness and efficiency of these capture devices, as the sets can be monitored frequently or even continually from a convenient location so that the trapper can know almost instantly when any set has been disturbed or sprung. The technology is available now, but the costs of radiotelemetry gear currently preclude routine use of this equipment on a large scale in wildlife damage control work.

Contraception and Fertility Control

Limiting coyote numbers by inhibiting reproduction has long been a theoretically attractive concept for use in conjunction with lethal removal methods to control coyote numbers in local populations (Balser 1964). However, 5 years of field studies with baits containing diethylstilbestrol did not result in development of an operational technique for control of coyote reproduction (Linhart et al. 1968). The apparent limiting factor was failure to deliver baits to a sufficiently large fraction of the coyote population. The narrow window of effectiveness (approximately 3 weeks) during which stilbestrol must be ingested to be effective also may have contributed to the lack of detectable effects on ovulation rates. Studies with markers indicated that approximately 28 to 34 percent of coyotes consumed baits.

Population modeling studies have shown that birth suppression could help reduce coyote numbers if a sufficiently large fraction (probably over 60 percent) of the females could be prevented from bearing young (Connolly and Longhurst 1975), and some recent baiting trials have yielded bait take rates in this range (Linhart et al. in press). Other studies suggest that sterility could be used to reduce predatory behavior by territorial pairs of coyotes provisioning pups (Till and Knowlton 1983; Knowlton 1989).

The DWRC is currently planning new work on contraception in coyotes. The objective is to develop an orally deliverable immunocontraceptive vaccine to produce antibodies that will interfere with reproduction. This approach may overcome or circumvent the problem of timing bait delivery to the coyote reproductive cycle, and also may provide species specificity. Of course, further work on bait delivery also will be needed to produce a practical fertility control technique.

Oral Rabies Vaccination

In February 1995, the Texas Department of Health with many cooperators dropped more than 800,000 baits containing rabies vaccine on 15,000 square miles of south Texas in an attempt to curtail a canine rabies epizootic (Meehan 1995). APHIS and the ADC program participated in several aspects of this effort.

An important contribution from DWRC was the verification, using captive coyotes, that coyotes would be immunized if they consumed baits containing the rabies vaccine. In cooperation with the Texas Department of Health, CDC, and Rhone-Merieux, Inc., dog food and fish meal baits were tested. Efficacy was judged on development of a primary response in unvaccinated coyotes or a dramatic rise in rabies antibody titer levels in previously vaccinated coyotes. The 2 baits were equally effective; 81 percent of the coyotes were immunized (F. Knowlton, personal communication).

The Compound 1080 Livestock Protection Collar

The 1080 livestock protection collar (LPC) is one of the few genuine innovations in predator management technology to emerge over the past 25 years. Invented by Roy McBride, the LPC works by intercepting coyotes in the act of attacking sheep and goats. When the attacking coyote punctures a collar, it ingests toxicant and dies in 2.6 to 9.1 hr (average = 4.8 hr).

The LPC offers a significant advance in selectivity compared to other lethal control methods which at best are selective for the target species. The LPC is selective not only for the target species, but for individual animals that attack livestock. The risks to humans and nontarget animals are very low (Connolly 1993).

The LPC was registered by EPA in 1985 for use on lambs less than 50 pounds in weight. In 1993, the registration was expanded to include a larger collar for use on large lambs and goats, based on additional data provided by DWRC scientists. To date, the LPC has been used by state-certified, rancher applicators in 4 states (TX, NM, MT, WY) and by ADC personnel in 2 states (TX, NM). The ADC program currently is attempting to expand its use of LPCs.

Improving the M-44 Cyanide Ejector

The M-44 cyanide ejector is an important coyote damage control tool for the ADC program (Connolly 1988). It is used primarily to protect livestock from coyotes and other wild canids, and also can be used to protect Federally designated threatened and endangered wildlife and to control vectors of communicable diseases such as rabies.

When ADC research on the M-44 began in 1981, the confidence of ADC field specialists in the M-44 device was at a low ebb due to chronic performance failures of ejector mechanisms and cyanide capsules. An M-44 improvement effort was started to evaluate existing equipment, identify necessary improvements, and implement these improvements into the manufacture M-44 components at PSD.

Successful pursuit of these goals (Connolly and Simmons 1984; Connolly et al. 1986) led to increased M-44 use by ADC specialists as well as improved M-44 performance. As a result, the number of coyotes taken by this method in the western ADC program doubled from FY 1981 to 1986 (Connolly 1988), and doubled again by FY 1992.

Predator Population Indices

The westwide scent station survey of relative predator abundance, conducted annually for a 10-year period beginning in 1972 by ADC and many cooperators, was developed by DWRC biologists (Linhart and Knowlton 1975). This technique was intended primarily for monitoring coyote population trends, but its use also has provided useful information on bobcats (Knowlton and Tzilkowski 1981) and other furbearers. Continued work on coyote indexing procedures has produced significant improvements to scent station survey techniques and also revealed that indices based on scat counts may provide better information than scent station indices (Roughton and Sweeney 1982, Knowlton 1984).

Although ADC discontinued the annual, westwide scent station surveys in 1981, some state agencies such as the Minnesota Department of Natural Resources have continued them. The scent station survey has come to be regarded as a basic population indexing technique. Predator survey disks and attractants continue to be available from the PSD.

CONCLUSION

The management of coyote/human conflicts as practiced today relies on many methods and method improvements developed by research. The DWRC functions as an integral part of the ADC program with research and operations personnel working together on methods development and improvement projects. Many control methods innovations originate with ADC field personnel, and the participation of ADC specialists is essential in field trials to compare or evaluate the efficacy of technical innovations.

Just as ADC operations personnel are essential to methods development research, DWRC personnel also contribute to management by providing non-research services such as assisting in the preparation of NEPA documents and training ADC personnel in the use of specialized predator damage control and population monitoring techniques.

The development and implementation of new methods takes time. The livestock protection collar, for example, was conceived around 1969 but not registered until 1985. It still cannot be used in most states. Even the nontoxic, nonlethal Electronic Guard took more than 10 years to develop and bring into production. Oral immunocontraceptive coyote baits clearly will not be available for widespread use for many years. In view of the long time periods required for development and implementation of new technology, it is essential that researchers also work to maintain and improve the use of existing methods until new ones become available.

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