NONLETHAL CONTROL OPTIONS FOR PREDATION MANAGEMENT ON WILDLIFE

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Abstract: Changing mores about predators and their management over the last thirty years have prompted the need for nonlethal approaches to predator management. Considerable effort since that time regarding cultural practices (e.g., shed-lambing), fencing, and guarding animals have provided management alternatives for livestock producers who suffer losses from predators. However these alternatives may not be applicable or effective when attempting to minimize wildlife losses to predators. We discuss (a) current efforts on the use of immunocontraceptives as a means of reducing coyote (*Canis latrans*) populations, and (b) general guidelines for habitat management as a means of dissipating predator-induced mortality on upland game birds and deer (*Odocoileus* spp.).

WHY LETHAL CONTROLS?

Stricter controls on traditional predator management techniques, an expanding human population, changing land use patterns, the adaptability of some wildlife species to urban and suburban environments, and changes in the sheep and goat industry in Texas have increased the need to develop effective nonlethal approaches to predation management. In this paper we discuss some new and old approaches to reducing predation losses to deer (*Odocoileus* spp.) and quail (*Colinus virginianus* and *Callipepla squamata*).

It is important to note that predator control to protect wildlife has some inherent differences than that designed to protect livestock (Connolly 1980). Certain management schemes such as guarding animals, fencing, or night-penning may provide no direct impact on predators affecting wildlife populations, e.g., nest depredation by raccoons (*Procyon lotor*). Further, tools like the Livestock Protection Collar offer control for the specific coyotes that are causing livestock damage, but such technologies are outside the realm of protecting wildlife species. The only remedy for excessive predation on big game animals is the wholesale reduction of predator populations in the problem area (Connolly 1980).

IMMUNOCONTRACEPTION

Immunocontraception is the latest in a series of approaches aimed at inducing contraception or sterility in coyotes. The basic concept of immunocontraception is to introduce a contraceptive that blocks reproduction by disrupting various hormonal controls of the reproductive process (DeLiberto et al. 1998). Research, funded in part by Sheep and Goat Predator Management Board, has been conducted at National Wildlife Research Center Predator

Behavior and Ecology Field Station in Millville, Utah and Utah State University since 1995 to test immunocontraceptives in coyotes. Lethal techniques to resolve livestock-predator conflicts are becoming less acceptable to the public due to changing social values, and this research can assist in mitigating an ongoing and escalating situation. This research was undertaken with the hope of developing immunocontraception for area-specific control of coyote populations which is a socially-acceptable and environmentally-safe alternative to lethal control techniques.

Currently, research at National Wildlife Research Center (NWRC) is being conducted on two drugs to terminate pregnancy and on one hormonal compound to induce sterility in both sexes. These studies are undertaken based on the premise that provisioning of pups is a key factor in increased predation levels and resulting human-predator conflicts (Till and Knowlton 1983). Coyotes tend to prey on livestock away from the core of their established territories (Bromley 2000). This behavior often results in coyotes located on one ranch where they are acceptable to land use demands preying on livestock on adjacent properties, with resulting wildlife-human and human-human conflicts.

Cabergoline is a potential agent identified to reduce fertility in coyotes. It is currently labeled in Europe to terminate pregancy in dogs, and patent rights will soon lapse on this drug. Research at NWRC the last two years was unable to document the ability of cabergoline to terminate pregnancy. Recent work in Australia in red foxes suggested that higher doses may be more effective. Research at NWRC is currently underway to determine whether a higher dose is effective, or if coyotes use a different biological pathway not affected by cabergoline.

Bromcriptine, a similar ergot derivative, is also being evaluated as a means for pregnancy termination in coyotes. Bromcriptine, although structurally similar to cabergoline, differs in its affinity for dopamine receptors, and may yield more efficacious results in coyotes than cabergoline.

Both cabergoline and bromcriptine should be deliverable by an oral route, such as the method used for oral rabies bait drop, which has been so successful in south Texas. Both cabergoline and bromcriptine appear to have potential usefulness only on female coyotes, when administered during pregnancy, to terminate only the current pregnancy. This type of a reproduction management tool would be useful, but research is being conducted to relax the constraints of contraception based on time and sex of target.

The hormonal agent under study is a superactive analog of gonadotropin releasing hormone (GnRH) coupled to a cytotoxin. This compound should target luteinizing hormone (LH) and follicle stimulating hormone (FSH) producing cells of the anterior pituitary gland. Damage to these cells has the potential to induce sterility of both sexes, perhaps permanently.

This research is in the initial year and is designed to investigate necessary drug levels and efficacy. A second experiment is contemplated in 2002 to initiate development of an orally-deliverable GnRH cytotoxin.

All of these reproduction control studies are directed at the development of a safe, legal, and ethical population control tool for use in a responsible manner to reduce human-wildlife conflicts.

CONDITIONED TASTE AVERSION

A nonlethal alternative for reducing nest depredation may be conditioned taste aversion (CTA). CTA is the process by which animals associate the taste of a food with an illness that occurs after its consumption. The predators show that they have acquired this learning or, conditioning, by avoiding the taste of the particular offending food wherever it is encountered long after they have fully recovered from the illness (Nicolaus 2000).

The earlier uses of CTA were directed at providing a nonlethal means of reducing coyote predation on sheep (Gustavson et al. 1974, Ellins et al. 1977). Results have been mixed (Burns 1980, Nicolaus 2000). Conover (1995) and Nicolaus (2000) provide a review of various CTA trials to reduce livestock predation and the biology of how CTAs are developed and implemented. Similarly, Conover (1989) and Nicolaus (1987) provide reviews of using CTA for reducing egg depredation by various predators.

Conditioned taste aversions have been proved effective in reducing egg depredation by crows (Dimmick and Nicolaus 1990) and raccoons (Semel and Nicolaus 1982, Conover 1989). Of the aversive chemicals tested, emetine hydrochloride appears to be one of the most promising, but emetine is hazardous to use and thus it's potential for field applications is limited (Conover 1989, 1990). Semel and Nicolaus (1992) used an estrogen-based compound (17-alpha-ethinyl-estradiol) to create CTA to eggs by free-ranging raccoons. However, Ratnaswamy et al. (1997) used the same estrogen compound and failed to demonstrate a CTA of raccoons for reducing depredation of eggs of sea turtles.

Hernandez (1995) evaluated the effectiveness of lithium chloride-treated eggs to develop CTA among egg predators in Tom Green County, Texas. His results were equivocal; one study site demonstrated a successful CTA and the other did not. Hernandez recognized that additional refinements with dosage, and perhaps other chemicals, may have provided better results. Also, the mesomammal community was complex at Hernandez' study sites, and thus complicated his ability to successfully achieve CTA throughout the mesomammal community.

The best opportunities to use CTA as a means of deterring nest predators will likely be achieved with the following circumstances (Nicolaus and Nellis 1987, Conover 1990):

(a) predators need to be of relatively small size;
(b) predators need to occupy small, overlapping home ranges;
(c) the predator community needs to be rather simple, i.e. low species diversity;
(d) the are to be treated needs to be rather small.

FENCING

Fencing, particularly netwire fences, can be a valuable deterrent to predator movement (e.g., coyotes). Net-wire spacings no larger than 6 inches are preferred and the bottom of the fence should make uniform contact with the soil. Sometimes modifications to the fence, e.g., a buried net-wire "apron", or an offset electric tripwire (or 2) spaced about 6 inches outside the fence and about 10 inches high, can substantially enhance the fence's effectiveness. Fences are not generally not effective deterrents for foxes, bobcats, and raccoons because of their tendency to climb or crawl through fences.

HABITAT ENHANCEMENT

The "natural" approach to minimizing predation management on one's target species of wildlife is to tailor the habitat in such a way that it facilitates the prey's needs more than the predator's. This maxim is easy to comprehend and visualize, but more difficult to quantify. Generally speaking the best recommendation is to provide a greater quantity of suitable habitat across the landscape rather than try to improve the quality of smaller patches within the landscape. In such a way, the predators' search efficiency is diluted, and a comparative advantage is provided the prey.

Quail

For quail, one's efforts should focus on improving nesting success. Nesting success is typically "low", e.g., less than 30 percent, over much of Texas (see Rollins 2001*b*, this volume). Bobwhites tend to nest in past-year's growth of a bunchgrass like little bluestem *(Schizachyrium scoparium*; Guthery 1986, Lehmann 1984). Scaled quail in Pecos County nested almost entirely in tobosa (*Hilaria mutica*; Buntyn et al. 2000). Both species will also nest in prickly pear, especially if conventional grass microhabitats are limited (Slater et al. 2001).

General recommendations hold that good nesting habitat should contain 250 suitable nesting clumps per acre. A suitable nest clump will be about the diameter of a basketball and at least 18 inches in height. This is about one bunchgrass clump every 13 feet. Slater et al. (2001) reinforced this threshold when they found that simulated nests placed in prickly pear had no higher survival than grass nests at sites that featured at least 300 grass clumps per acre. At lower bunchgrass densities, nests in prickly pear survived higher than those in nest sites. Slater et al.'s data suggest that the best offense against nest predators is a good defense. By allowing a quail the opportunity to nest at a number of locations across the landscape, it complicates the predators' ability to locate the nest. Anyone who has ever played a "shell game" can relate to how such laws of chance operate. The more "shells" the better the odds that the "dealer" (in this case the quail) will win. Conversely, as the number of grass clumps diminishes, it only enhances the predator's odds of locating a nest. The latter situation is currently a topical problem in quail management over much of Texas.

The quail manager should strive for fairly monotonous landscapes for good nesting habitat. Lehmann (1984:96) reported a 73% nest success rate for bobwhites when the nest site and surroundings were "largely indistinguishable", but only 28% for nests situated in clumps of grass conspicuously better than their immediate surroundings. Buntyn et al. (2000) reported nest success rates of 78% for scaled quail during the

1999 nesting season. This high success rate exemplifies Lehmann's observation about unremarkable nesting landscapes; tobosa often forms large expanses of uniformly monotonous cover.

Although prickly pear is maligned on several fronts relative to ranching, we believe it does provide an important nesting substrate for quail, and especially in drought years. Much quail range in the Rolling Plains is currently (i.e., nesting season of 2001) devoid of suitable nesting microhabitat if not for prickly pear. While we can offer no specific recommendations of prickly pear density for quail nesting, a "good" mix of prickly pear and perennial grasses seems to provide a quality nesting situation (Hernandez 1999).

There are no quick fixes for rehabilitating nesting cover. Good grazing management which may entail rest, reduced livestock stocking rates, and various rotational schemes should be incorporated to promote a higher range condition, i.e., typically the taller-growing bunchgrasses that bobwhites prefer.

Aside from nesting cover, quail also need generic "escape cover" which includes herbaceous cover (i.e., grass), screening cover (e.g., low brush and broomweed), and escape cover which may include some areas of dense brush. Guthery (1997) and Kopp et al. (1998) discuss management philosophies that center on structural components of quail habitat needs. They describe the "cone of vulnerability" of quail from avian predators and the "disc of vulnerability" for threats from ground-dwelling predators, and how these parameters relate to brush and herbaceous cover needs.

Rollins (1999) described a method using a "softball model" for assessing habitat deficiencies in the field. He recommended that suitable loafing coverts, e.g., lotebush (*Ziziphus* sp.), be spaced no more than a softball-throw apart (ca. 150 feet). For proper nesting habitat, a softball tossed pitching distance (46 feet) should not be visible to the thrower. Such conditions will be satisfied by bunchgrass densities of about 250 plants per acre and about 15 inches in height or in fairly dense tobosa flats.

Deer

Fawns are vulnerable to predation by coyotes, especially until they are about eight weeks of age. Although coyote predation on fawns can be a management constraint in some areas of Texas, comparable thresholds for delineating good fawning habitat are not available. The general consensus is that "some is good and more is better" (R. Lehman, Texas Parks and Wildlife Department, personal communication). Generally areas of taller grasses, e.g., higher range condition or ungrazed blocks of Conservation Reserve Program pastures, are recommended to provide good fawning cover.

Another source of fawning cover is the downed slash that follows mechanical brush control. Rollins (1983) reported that fawns often bedded in and around downed Ashe juniper (*Juniperus asheii*). Such sites may be important until grass cover increases to suitable levels to provide protection for fawns. Accordingly, raking of such individual trees into brush piles, and their subsequent burning, may be undesirable for good fawning habitat.

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