Predator Control: Here We Go Again

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Absract: Carnivores elicit a variety of responses from society, and predator management has a correspondingly diverse history in the wildlife management profession. Attempts to manage or control predators often create controversy, and therefore is a constantly contentious issue with wildlife managers. In many regards, views regarding predator management have changed considerably during the past few decades, but recent trends suggest that predator management strategies are being considered and/or implemented in various management scenarios. Societal changes, large-scale changes in landscape conditions, and the realization that predation issues are complex mandate careful consideration be given to predator management scenarios prior to implementation. We examine key issues pertaining to the issue of predation management, and summarize relevant issues regarding predator management across the southeastern region of the United States. Using empirical evidence, we recommend a protocol to assist land managers when considering predator management or during interactions with stakeholders and the laity. Our protocol specifically questions management goals, the correct identification of the offending predator species, the consideration of extrinsic factors and the careful evaluation of the alternatives for predator management. We recommend those considering predator management clearly define objectives of the proposed management scheme, thoroughly assess societal beliefs, and ensure that management activities implement best management practices for trapping.

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Predator management in the United States has been a controversial topic. We doubt there exists any other animal group which invokes such a diverse array of emotions as carnivores, from awe and deep admiration for their power and majesty, to intense hatred because of their efficiency in capturing and consuming game animals and livestock. Wildlife management has experienced a profound change in how carnivores are viewed and thus managed (see Historical Perspective section below), from intensive harvesting with bounties to recognizing carnivores as valuable components of ecosystems with subsequent restoration. However, recent trends during the past 15 years that relate directly to carnivore management has again invoked a rallying cry from sports people, landowners, and some wildlife biologists. This is especially true regarding changes in the fur industry and demand for fur resources. These individuals are calling for various forms of predator control to ensure huntable populations of game animals. Other critical factors (e.g., anti-trapping/fur move-

ments, state referendums, a more urbanized, less utilitarian society) have developed which contribute to the complexity of the issue of predator management. These "relatively recent issues" warrant serious consideration before predator management programs are implemented.

Here, we review relevant issues pertaining to predator management, more specifically, that part of predator management which involves population control. We expand upon concerns expressed by Silvy et al. (2000) who questioned the issue of predator control to benefit quail in Texas. In particular, we summarize the relevant issues on a regional level, and with supportive empirical evidence, develop a protocol that will aid wildlife biologists when considering predator control or discussing the issue with the laity. The basic premise of our paper is that relevant ecological and sociological issues must be reviewed prior to initiating predator control programs, and incorporated into the decision process.

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Historical Perspective

With the colonization of America, the large carnivores [cougar (*Puma concolor*) and wolves *(Canis lupus)*] were viewed with disdain. Colonial Americans depended on wildlife resources for sustenance, and thus carnivores were viewed as direct competitors with the potential to impact survival of colonists. Colonists carried with them traditional European dislike for carnivores, thus active predator control activities were widespread and contributed to the demise of cougar and wolves in the eastern United States. As people moved to the western United States, direct conflict with large carnivores occurred, but most aggressive programs to control predators were to protect livestock.

Aldo Leopold was strongly supportive of predator control during his early years as a forester. However, his perspectives concerning predator control changed drastically from the time he served as a forester in the Gila National Forest to the penning of his classic text (Leopold 1933). Leopold (1949) stated, "Harmony with the land is like harmony with a friend, you cannot cherish his right hand and cut off his left. That is to say, you can't love game and hate predators, the land is one organism." Regardless, it was not until the early 1970s that predator control in the United States saw significant changes. Two critically important reports served to change predator control, especially by federal agencies (Leopold et al. 1964, Cain et al. 1972). It was another Leopold (A. Starker) who submitted a comprehensive report concerning predator management in the United States (Leopold et al. 1964). However, it was the Cain Report (Cain et al. 1972) that prompted President Nixon, through an Executive Order, to cease use of all poisons to control predators on federal lands. Additionally, research

concerning the process of predation served to alter the prevailing perspectives concerning predators and predation (Errington 1946, Craighead and Craighead 1956, Mech 1966, Hornocker 1970). These actions, combined with other sociological developments (e.g., growth in animal rights movement), began to change how predators were perceived and managed in this country.

Recent Trends and Issues

Undoubtedly, the most important factor affecting predator management in the United States was the development of strong animal rights and animal welfare movements. Organizations such as Defenders of Wildlife, People for the Ethical Treatment of Animals (PETA), Greenpeace, and the more radical, militant-like group Earth First! were very successful during the past 15 years in elevating trapping, and to a lesser extent, hunting, in the nation's eyes. In addition, changes in consumer demand, European Union regulations, fashion trends, and the anti-trapping movement contributed to the collapse of the fur industry. For example, in Mississippi there were >1,500 trappers in 1985, but <200 in 2000 (Lovell et al. 1998). Similar trends may be cited for any southeastern state (Linscombe 1993). This profound decline in demand for fur and fur products resulted in concurrent drops in harvests, and thus license sales to trap furbearing mammals.

The profound decrease in numbers of trappers in the southeastern landscape was significant, as a major mortality factor for mesocarnivores [e.g., raccoons *(Procyon lotor),* bobcat] (trapping and hunting harvests) decreased. This change in trapping harvests has prompted many landowners, sportspeopole, and wildlife biologists to infer that with this reduction in mortality, that many predator populations [especially raccoon, opossum *(Didelphis virgiana),* skunk *(Mephitus mephitus),* and fox *(Urocyon cinerearogenteus)*], were increasing. It is assumed that these increasing populations pose a serious threat to many ground-nesting birds, some being important game birds [northern bobwhite (*Colinus virginianus*), and wild turkey *(Meleagris galopavo)*] as well as small game animals [rabbit (*Sylvilagus* spp), squirrel (*Sciurus* spp)]. Additionally, trends in game and non-game birds (e.g., Breeding Bird Survey, Christmas Bird Counts, state harvests) indicate declining populations in many parts of the southeastern United States, which many have attributed to, or partly so, to increasing populations of medium-sized predators (i.e., meso-carnivores). However, empirical evidence does not definitively support the hypothesis that this relationship is biologically linked. Definitive evidence is being collected through landscape-level studies, but current data are correlative at best (Burger 2001*b*) and cause and effect must be demonstrated, not inferred from such data sets (and will through manipulative experimental studies). Most studies or reviews of the predation issue question predator control as a definitive and sole solution [see The Wildl. Soc. Bull. Spec. Sect. on Avian Predation, Vol. 29(4)]. However, there are a few studies (e.g., Rollins and Carroll 2001) that suggest that predator control can be a part of an integrated pest management approach to predator management.

The Value of Predators

Ecological Value of Predators

As Leopold (1949) implied in his statement about predators in ecosystems, predators have numerous ecological values which must be considered prior to any program which has as its goal their removal. All native predators (excluding feral cats, hogs, etc.) are a natural component of ecosystems, and thus play important roles in ecosystem function, often providing stability or serving as keystone organisms (Henke and Bryant 1999). Although most predators are able to remove any individual from a population, they serve to remove the sick and injured from populations, thus aiding in reducing the spread of disease. Through their actions, predators aid to keep animals wild and wary, and this trait certainly has contributed to the desirability of many game animals (e.g., the wild turkey for its wariness and the difficulty of harvesting). On an evolutionary time scale, predation strongly influences a range of ecosystem-level characteristics, and many predators may serve as keystone species in a number of terrestrial ecosystems (Estes 1996).

Sociological Values of Predators

The sociological value of predators also is important, and how society as a whole perceives and values predators plays an important role in the types of management actions we may conduct. Recent studies have demonstrated that we must be cautious in promoting predator control programs, or minimally, how we convey the goals and objectives of the proposed program. Messmer et al. (1999) surveyed 1,500 households and found a majority of respondents believed that predators: (1) have a right to exist, (2) should be reintroduced to former ranges, (3) do need to be managed, but with conditions, (4) should not be hunted or trapped unconditionally, (5) are not the cause of game population declines, and (6) play an important role in maintaining balanced natural systems. It should be noted that these individuals also supported control of common mesocarnivores to increase the declining populations of game birds.

Before We Repeat History

With the current issues at hand (reduced trapping, implied increases in predator populations, declines in the recruitment of game birds), many individuals are seriously considering predator control, on a local, or even a landscape level. It is therefore essential that we examine the important components of this complex issue to ensure that any implementation of a predator control program is sound and justified.

The Complexity of the Predation Process

Many early studies (e.g., Errington 1946, Craighead and Craighead 1956, Mech 1966, Hornocker 1970) of predator-prey relationship, particularly where the prey was an important game animal, concentrated objectives on understanding the prey (or game animal) and the primary predator thought to be impacting that prey species. Re-

grettably, to fully understand the interaction, it is critical that all factors affecting the predation process be investigated (Leopold and Hurst 1994) and during a time period long enough to ascertain true trends and interrelationships (Leopold et al. 1996). Such a complete understanding requires assessing impacts of weather, diseases, other predators on the predator species of interest and other prey, other prey on the prey and predator species of interest, habitat conditions, and the role of sociological values (influence of hunting and non-hunting publics). We admit that such comprehensive studies are difficult to do because of funding or logistical limitations. However, our point is that when such comprehensive studies are not possible, the researchers must frame their management recommendations within the limited inferential bounds of the study because they did not examine all components that may have affected observed predation rates, etc. Additionally, such limited studies when only one of several explanatory hypotheses exist have been questioned as true science, and in fact, wildlife biologists have been admonished for conducting such studies (Romesburg 1981).

Considering Sociological Viewpoints

We have already discussed sociological values of predators in the context of predator management. These values will play an increasingly important role in the acceptance of predator management by the laity. Wildlife biologists must consider that we cannot often defend predator control in the context of providing more hunting opportunity. Such a defense is dangerous as it conveys an untenable message: we wish to reduce greatly the population size of one group of organisms (the naturally occurring predator species) so that we humans can harvest more of the prey (quail, turkey, etc.) ourselves. This line of reasoning has been questioned recently by the Southeastern Section of the Wildlife Society and the National Wild Turkey Federation when they passed resolutions that they do not support predator removal if the intent is to enhance a single game species.

Humans as Predators

We must not forget that an important source of mortality to many important game animals is not predators, but hunting (legal and illegal) of these game populations. Traditional viewpoints about the compensatory nature of hunting are being questioned as long-term datasets are being examined. The Adaptive Harvest Modeling (AHM) process of analyzing mallard *(Anas platyrhynchos)* harvests suggests that waterfowl hunting is additive to natural mortality (U.S. Fish and Wildl. Serv. 2001). More definitive data are needed to examine the role and interaction of human versus non-human predation of game populations.

Our Management as Part of the Problem

In addition to the significant role hunting may play concerning population dynamics of many important game birds, many management actions we implement also affect these populations. Several examples are available, but we will state 4 clear situations in which our management predisposes game animals for increased predation rates. We often plant logging roads, decks, and access roads in grasses and legumes,

primarily to reduce erosion and provide supplemental food. However, such pathways may serve as travel corridors for predators (Hall and Newsom 1976, Conner and Leopold 1998) and, coincidentally, may be used as foraging sites for many ground-nesting birds (Hurst 1992, Burger 2001*a*). The underlying concept of planting food plots in many areas is to concentrate wildlife for harvest or viewing. Although this practice is the subject of widespread speculation, this concentration of selected species may make prey more predictable and thus susceptible to capture by predators. Notably, many game birds require disturbed, early successional habitats for nesting and brood-rearing; these sites also are conducive to small mammal production [e.g., cotton rat *(Sigmodon hispidus),* deer mice (*Peromyscus* spp)], which are principal prey of many meso-carnivores (Chamberlain and Leopold 1999). Several studies have demonstrated that areas under intensive quail management, after 3–4 years, have reduced survival rates for bobwhite because of increased predation (Taylor et al. 2000, Szukaitis 2001).

Human actions on a broader scale also have been shown to affect predation. For example, forest fragmentation has been attributed to greater rates of predation. Most notably, smaller tracts of forest have greater predation rates than larger tracts, especially for ground or near-ground nesting birds (Andren et al. 1985, Wilcove 1985, Temple and Cary 1988). This relationship also has been found in Missouri for northern bobwhite in prairie fragments (Burger et al. 1994). Small and Hunter (1988) found that size of forest fragments, as well as distance of nests from edge and land use bordering fragments, were important variables in nest depredation. Lastly, Storch (1991) found that stand size was unimportant in nest depredation risk, but that successional stage (i.e., vegetative condition) and distance from edge were important. Consequently, it is important to examine a diverse array of landscape metrics when investigating the complex process of predation.

Identifying the "True Culprit"

The diversity of avian (e.g., raptors), reptilian (e.g., snakes), and mammalian carnivores (e.g., felids, mustelids, canids) in the southeastern United States is great, and consequently prey species face numerous perils. Additionally, identifying the true cause of death, even under the most rigorous research project, is extremely difficult. This is confounded by many carnivores also being scavengers, as well as the rapid decomposition rates caused by the southeastern climate. Also, predation rates by any individual species of carnivore may vary by habitat conditions, diversity, and abundance of buffer species of prey, etc., and thus generalizations on regional scales about the propensity of any 1 species of carnivore to secure any single species of prey is difficult, at best. Consequently, it is important to discern that the true cause of mortality (the ultimate rather than the proximate) be determined before any management decision regarding control be implemented. For example, recent studies with remote cameras at northern bobwhite nests have shown that in some years, snakes are primary agents of mortality, rather than the more traditional mammalian predators (Staller et al. 2002) and that relative importance of individual predators varies relative to landscape context.

Coyote *(Canis latrans)* populations have expanded eastward through the southeastern states, largely because of anthropogenic influences to southeastern landscapes (Hill et al. 1987). It is often speculated that this expansion has had detrimental impacts of turkeys, other-ground-nesting birds, and white-tailed deer *(Odocoileus virginianus)* in the southeastern United States. Notably, several comprehensive studies of coyote diet have revealed uncertainties regarding impacts of coyote predation on either wild turkeys or white-tailed deer. In each study, the occurrence of wild turkey in coyote diets is practically non-existent, and minimal during any season (Wagner and Hill 1994, Chamberlain and Leopold 1999). Furthermore, there is considerable uncertainty regarding the determination of whether the occurrence of white-tailed deer in coyote diets results directly from predation or from scavenging (Hilton 1978, Chamberlain and Leopold 1999). For instance, Chamberlain and Leopold (1999) reported peak occurrences of white-tailed deer in coyote diets during fawning and legal deer hunting seasons. They concluded that although coyotes certainly preyed on fawns during the summer, it was unlikely that coyotes regularly captured and killed adults during fall and winter. Rather, it was more plausible that coyotes were scavenging carcasses discarded by hunters in various places around their study area (Chamberlain and Leopold 1999), as suggested earlier by Wooding (1984) and Edwards (1996).

Decimating versus Limiting Factors

Also of importance when considering predator management programs is ensuring that predation losses of eggs, young, or adults actually impacts the population to the point of causing a decline. Often, high loss estimates are immediately assumed to be limiting (maintaining population numbers below carrying capacity) because of their magnitude, when they may be simply decimating (i.e., loss to population but with no effect on numbers relative to carrying capacities, or on harvest opportunities). Using the wild turkey as an example, a 13-year research project on Tallahala Wildlife Management Area, Mississippi, found nest depredation rates of nearly 50% across the study, with hen success of 25% (Miller). While superficially these figures suggest high predation rates, it is worthy to note that harvest of gobblers, although variable, tended to increase over time (Chamberlain 1999). Thus, from a population standpoint, wild turkeys were able to withstand high nest losses from predation, and relatively low hatch rates, and still maintain harvestable populations increasing over the long term.

Prey Adaptations–Coevolution

Biologists, sports-people, and landowners also must realize that great losses of nests, young, and even adults to predation may be "natural" for many game and nongame animals, and that species have evolved mechanisms to counter these losses. Any organism faced with intensive and frequent predation pressures exhibits co-evolutionary interactions with their predators. Again, using wild turkey as an example, it has evolved numerous adaptations to elude predators and to counter predation pressures, including (1) having a large body size, especially for gobblers (although social

dominance is also important), (2) being long-lived and thus able to have another year to "try again," (3) roosting in trees at night, (4) forming flocks to allow greater likelihood of detecting an approaching predator, (5) having large clutch sizes (12–14 eggs) compared to tree nesting birds (2–4 eggs), and (6) preferring "open" habitats, again to aid predator detection. The Northern bobwhite, another species subjected to intensive predation pressures, also show tremendous adaptations, including a flexible mating system, multiple reproductive strategies, large clutch sizes, and high physiological capacity for renesting (Burger 2001*a*). Consequently, many prey species (including those we view as game animals) have evolved naturally with predation, and attempts to disrupt the process through intensive predation management may have negative effects.

Density-dependent Predator Responses

Many of the predator species of concern in the southeast (coyote, bobcat, raccoon, fox) have strong intrinsic social and/or physiological population regulatory mechanisms to maintain numbers consistent with limited available resources. These regulatory mechanisms include territoriality [as with raccoons (Fritzell 1978, Lehman 1984, Gehrt and Frtizell 1997), coyotes (Windberg and Knowlton 1988), bobcat (Lembeck and Gould 1979, Miller and Speake 1979), and fox (Tucker et al. 1993, Chamberlain and Leopold 2000)], social dominance hierarchies [as with coyote (Bekoff and Wells 1980)], and/or compensatory reproduction [e.g., bobcat (Stys and Leopold 1993)]. This is not unique to Southeastern carnivores, such mechanisms are commonplace with most large carnivore species [e.g., wolves, African lion *(Panthera leo),* hyenas *(Crocuta crocuta)*] and is ecologically essential for upper trophic level organisms (Krebs 1985). These mechanisms are density-dependent and often behavioral in nature and the upper population limit has been referred to as "tolerance densities", although Leopold (1933) referred to this as saturation point density. Consequently, most carnivore species are regulating themselves, and predator management may disrupt these natural processes.

As an example, Knowlton (1972) found that under intensive coyote control, the remaining coyotes produced litters averaging 7.2 pups, under moderate control, 4.5 pups, and under light control, 3.5 pups. Thus, under intensive predator control, the high reproductive potential of the coyote is such that they will produce more young to balance losses. A well-nourished coyote (faced with overly abundant resources because competition from con-specifics has been reduced from coyote control) has the potential to produce 10–12 pups to compensate for the reduced density (Leopold and Chamberlain 2001). It is plausible that such responses are possible for other southeastern carnivores. It is therefore imperative that we examine such responses and their impacts before disrupting natural regulatory mechanisms exhibited by carnivore populations.

Interspecific Competition

Not only do individual carnivore species exhibit strong intraspecific density-dependent population regulation, but they also interact with other species, often to the

betterment of important game and non-game animals. For example, the coyote's recent range expansion in the southeastern United States (Hill et al. 1987) has resulted in local extinction of red foxes *(Vulpes fulva),* a phenomenon noted elsewhere in the United States (Dekker 1983, Voigt and Earle 1983). Most biologists would agree that coyotes are preferable over red foxes regarding their impact on ground-nesting birds, as red foxes are perhaps more adept at preying on nesting birds and their young. It is thus wise to ensure that the role of the carnivore in the ecosystem is well understood before actions are taken to remove it. The classic example of this is the current situation in the northern prairies where the elimination of the wolf (a keystone predator), contributed to increased populations of meso-carnivores (e.g., raccoons, skunks, red fox) and increased waterfowl predation. Similarly, coyotes in Texas have been found to be keystone predators in desert grassland systems, where their presence and actions enhance rodent richness and species diversity, and are related to abundance of other major carnivores of the area (Henke and Bryant 1999).

When is Predator Control Warranted?

We are not advocating that wildlife biologists cease all considerations to implement predator control programs. On the contrary, predator control as part of a predator management program is a viable and sound wildlife management action when conditions warrant it. Our caution is that it should not be implemented hastily, simply because more predators are noted, predation rates of game animals seem high, and/or harvest of game animals has declined.

The Wildlife Society via a position statement (Position Statements Comm., pers. commun.) stated that predator control is warranted when 1) introducing a species to former habitat, 2) when enhancing or protecting endangered or threatened species, or 3) when the system has been disrupted by human action and external actions are required to restore balance.

Why Should Predator Control be Applied Cautiously?

Numerous studies have demonstrated the significance of predation as a mortality source for a diverse array of game species including deer and turkey (Beasom 1974), ducks (Greenwood et al. 1995, Beauchamp et al. 1996), pheasants (*Phasianus colchicus;* Chesness et al. 1968, Trautman et al 1974), northern bobwhite (Guthery and Beasom 1977), eastern wild turkeys (Kurzejeski et al. 1987, Vander-Haegen et al. 1988), and grey partridge (*Perdix perdix;* Tapper et al. 1996). However, research has also indicated that predator control is costly, labor-intensive, requires long-term commitments, and/or is ineffective in the long term (Knowlton 1972, Beasom 1974, Connolly and Longhurst 1975). Consequently, there are numerous costs involved with predator control programs, and we advocate strongly that biologists examine alternatives.

Alternatives to Predator Control

Studies have demonstrated that with many game animals, habitat management may reduce predation, often without harvesting a single carnivore. For example, providing adequate herbaceous cover allows wild turkey hens and poults, ducks, and other ground nesting birds to better escape detection by predators (Beasom 1970, Glidden and Austin 1975, Everett et al. 1980, Metzler and Speake 1985, Thomas 1989, Kadlec and Smith 1992). Baker (1978) detected significant differences in predation rates of artificial nests relative to the type of grazing system, pasture deferment time, plant community, and degree of coyote exclusion.

The concept of managing habitat to minimize predator-prey encounters is not new and has been cited as an alternative to predator control. For example, Barrett (1981) found that reduced grazing, which allowed grasses to attain greater heights, increased survival rates of pronghorn kids *(Antilocapra americana)* by reducing predation by coyotes. However, exceptions also exist: Sargeant et al. (1984) reviewed various habitat and predator population management strategies designed to increase duck recruitment, but concluded that red fox and other predator management schemes should be developed and evaluated. Alternatively, Chamberlain (1999) found that by increasing frequency of burning upland pine forests from 6–7 years to 3–4 years, turkey nesting success could be enhanced as raccoons infrequently occupied such sites because of reduced cover and abundance of soft mast. Consequently, there are numerous examples for a variety of species that demonstrate that habitat manipulations or changes in land-use practices have the potential to manipulate the predation process and subsequently increase game animal reproduction and survival, often without removing any carnivores through an active species management program.

Recommended Protocol–Predator Management

From the review presented above, it becomes evident that numerous factors affect (directly or indirectly) predation management. Our intent was to summarize concisely these components and develop a protocol for biologists, sports-people, and landowners to consider seriously prior to implementing a predator removal program. Again, our intent is not for biologists and landowners to cease active predator management programs, but to ensure that such programs are ecologically and socially sound and justifiable. We have cited numerous examples where predator control has disrupted natural systems to, perhaps the detriment of the system, as well as potential outcomes. We also have raised the issue of societal beliefs and concerns regarding predator control programs. Regrettably, many of these beliefs were caused by a select few who for various reasons provided anti-hunting and anti-trapping organizations the "ammunition" to place a negative spotlight on a sound wildlife management tool (e.g., use of illegal poisons, non-selective removal, inhumane treatment of captured animals). Consequently, we present the following protocol that we hope will be used as a decision tree whenever predator control activities are being considered. Our protocol expands upon the decision tree presented by Connolly (1978):

1. *What are the management goals and thus management objectives for the prey (game animal)?* Are they reasonable and biologically sound?

2. *Has predation been identified as the ultimate mortality factor rather than a proximate factor?*

3. *Has the predator species been identified correctly?* Has appropriate "evidence" been collected and identified reliably (tracks, photographs, sign on carcasses or eggs, etc.)?

4. *Have extrinsic, contributing factors been examined thoroughly (habitat condition, weather effects, land management activities) that may have, in the short-term, caused an imbalance in predator and/or prey species abundance(s)?*

5. *Has the target predator species role within the system been evaluated thoroughly to ensure that the control operation will not likely further disrupt existing balances?*

6. *Have alternatives to active predator removal been examined based on evaluation conducted in No. 3 above?*

– can habitat manipulation achieve desired goals?

– can subtle changes in current land management be implemented?

– can more "desirable" predator species be enhanced to counter "more detrimental species"? [Note: enhanced can simply mean to cease trapping that predator species (e.g., coyote versus red fox)]

7. *Clearly define the objectives of the predator management program. This is particularly important when addressing issues raised in No. 8 below.*

– what is the desired population response (e.g., density) of the prey (game animal)?

– what is the desired percentage reduction in the target predator population?

– what monitoring program(s) will be implemented to monitor response of prey species and target predator species?

8. *Have societal beliefs (especially local and regional) been examined and considered?*

– if potential problems are identified, develop a concise response that provides empirically-based data (see No. 7 above), program objectives, and target species.

– all staff should provide a consistent response when inquiries are made about the predator management program, or inquiries should be redirected to one individual.

9. *Ensure that Best Management Practices (BMPs) for control practices (based on draft BMPs under development) are developed and implemented.* These include

– appropriate traps that minimize injury to animal,

– appropriate frequency of trap-line checking,

– maintaining a trap-line size consistent with available resources,

– capture of non-target species is monitored and minimized. If excessive, trapping procedures should be reevaluated and modified, and

– appropriate euthanasia procedure(s) for animals are implemented.

10. *Inapprooppriate behavior by staff should not be tolerated.* Deviation from selected BMPs and objectives should be stopped immediately.

11. *Carcasses should be disposed of properly, discreetly, or used appropriately (e.g., food, museum specimens, etc.).*

Concluding remarks

Gone are the days when wildlife biologists, landowners, and sports-people may simply implement management procedures (particularly if they have been contentious in the past) without ensuring that ecological and societal values are evaluated and considered seriously. Our clientele is very different than the clientele faced by Aldo Leopold and his peers. We are faced with a society that, for the most part, does not hunt or trap, or is not likely to support such activities without reservations. With virtually instant access to volumes of information via internet sites, our clientele is better informed, more emotionally charged about environmental issues, extremely skeptical of state and federal wildlife management programs, and more prone to litigate or take other action (e.g., state referendums) (Minnis 2001). These characteristics pose serious challenges to wildlife biologists and landowners. The historically controversial and emotional issue of predator control is a management tool that must not be implemented haphazardly nor without serious and thorough evaluation. Hopefully the concepts we have presented here and the protocol suggested will aid wildlife biologists, managers, and sports-people in continuing to use this viable management tool in a manner that deserves and garners support from this clientele.

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