



Research on Coyote Biology, Ecology and Effective Management Policies

This report, compiled by the Vermont Coyote Coexistence Coalition (VCCC), is our effort to provide the House Committee on Natural Resources, Fish, and Wildlife the latest research on coyote biology and management policies. It is our hope that this information will allow the Committee to make a more informed decision about the most appropriate way to regulate the hunting of coyotes in a way that respects the unique characteristics of this species and its value to Vermont.

The report is in response to Vermont House Bill 60, introduced in 2017 by Representative David Deen. The bill instructs the Vermont Fish and Wildlife Board to report to the General Assembly regarding the hunting of coyotes in Vermont. The bill solicits information about the coyote population as well as a summary of Vermont's hunting regulations with regard to coyotes. Additional information is requested including a report on how this issue is managed and regulated by other states, recommendations for additional regulations in Vermont, and whether the Board supports changes in coyote management, including a closed hunting season.

Following hearings last year in the House Committee on Natural Resources, Fish, and Wildlife, a letter (dated March 3, 2017) was sent by the Committee to the Vermont Fish and Wildlife Department requesting that they provide to the Committee responses to several questions that arose from those hearings. A separate document accompanying this report provides VCCC's specific responses to the questions in that letter.

Biology and Ecology of Coyotes:

A great deal of information in books, scientific journals, published studies, and online resources thoroughly documents the biology and ecology of the Eastern Coyote (*Canis latrans var.*). Analysis of DNA has demonstrated that this species evolved over the last century as a hybrid between the Western Coyote and the Eastern Wolf as the former extended its range eastward into the territorial void left as wolves were exploited and eventually exterminated by hunters. The resulting Eastern Coyote, weighing on average 35-55 pounds, is larger than its western counterpart. Although several other states have studied their coyote populations more recently (2, 8, 22, 31), no research has been conducted in Vermont since 1986 to measure or characterize Vermont's coyote populations. Now a vital and constant part of the rural and urban landscape, a better understanding of coyotes and a more science-based approach to management of this species seems imperative.

Coyotes play many roles in maintaining healthy ecosystems. Highly adaptable, omnivorous, and resilient, they provide a wide range of critically important and well-documented ecosystem services. Many studies have demonstrated their ability to limit, mostly by competitive exclusion rather than predation, mesocarnivore populations (fox, skunk, feral cat, raccoon) and, by doing so, increase bird diversity and abundance (4). The natural process known as the predator-prey cycle, if undisturbed, keeps both coyote and prey populations in check.

Depending upon the season, up to 90 percent of the coyote's diet consists of rodents and rabbits. This benefits farmers who lose annual crops, grazing grasses, and grain to rodents and small mammals. Suburban and city dwellers are also well-served by the coyote's removal of rats and mice from developed areas. Rodent consumption provides an important public health benefit: By consuming the rodent hosts for ticks, coyotes assist in the control of both rodent-borne diseases in urban areas, where plague and Hantavirus are concerns and in rural areas where tick-borne disease is becoming more problematic. Vermont has an extremely high incidence of tick borne illnesses. In fact, it had the second-highest rate of reported cases of Lyme disease in the US in 2016 (30). Coyotes also play a very important ecological role by dispersing native seeds, a critical service in light of the rapid invasion of non-native plants into ecosystems. Finally, coyotes clean the environment of carrion. During the winter, a major source of food is carrion from the carcasses of winter-killed white-tailed deer.

Coyotes generally live in territorial packs although transient or migratory individuals and/or pairs are not uncommon. The pack is lead by a mated alpha pair responsible for most of the hunting, breeding, social instruction, and discipline of the pack, which also consists of the alpha pair's older offspring, known as "betas" or helpers, and the alpha pair's pups (3,13). If an alpha learns to avoid confrontations with humans, after exposure to hazing, livestock guardian dogs, or other humane means of livestock and/or pet protection, that individual will typically pass on this acquired fear to the rest of the pack. But, if the alphas are killed rather than conditioned to avoid livestock, this lesson does not return to the pack and other aggressive animals will eventually replace the dead coyote (1, 8, 13). Therefore, the loss of the breeding pair changes pack social behavior and can result in greater aggression toward livestock and domestic animals.

Over-hunting or the loss of an alpha pair will also trigger an impressive adaptation to stress in which pack reproductive cycles are jump-started. Juveniles mature faster and litters increase in size and viability as a response to pack losses (13). Thus, hunting stress actually increases coyote populations and coyotes become more aggressive and more numerous if over-hunted. A notable study in Yellowstone National Park demonstrated that 80 percent of the female coyotes who inhabited the park, and were not hunted, never bred. Outside the park, where hunters constantly persecuted coyotes, a much greater proportion of the females produced pups. This groundbreaking study (Crabtree and Sheldon, 1999) proposed that the coyote's evolved resilience to exploitation and adaptability was probably the result of their co-existence with competing species, mainly Gray wolves.

In an article recently published in the Journal of Mammalogy entitled "Carnivore conservation: shifting the paradigm from control to coexistence" (1), the authors present data from a wide range of perspectives including wildlife biology and management, ecology, social science, ethics, law, and policy. They discuss why mammalogists and conservation biologists should be interested in shifting government agencies, as well as society at large, toward replacing predator removal with non-lethal means of wildlife conflict resolution. Numerous studies cited demonstrate that the lethal removal of predators results in loss of biodiversity and ecosystem resilience, unnecessary killing of non-target species (a common occurrence with trapping), and ineffective control of livestock predation. The authors conclude that nonlethal methods of preventing depredation of livestock by large carnivores may be more effective than lethal methods.

Management of coyote populations:

Given the overwhelming evidence that coyotes are important top predators in Vermont, careful management of the population is critical. Because it is omnivorous, the coyote impacts ecosystems on all levels, from seed dispersal of plants and grasses, to regulating the relative impact of mesocarnivores on biodiversity. Consequently, management decisions and policies will not only affect coyotes but will filter down through the layers of the ecosystems that are affected by their presence.

With no accurate population data on coyotes in VT, the current open season, which lacks any regulation of hunters, together with the tolerance of multiple means of hunting (trapping, shooting, hounding, and contests/ derbies) is ecologically dangerous and, to many Vermonters, morally and/or ethically wrong. The fact that hunters are not required to report coyote kills in VT negates whatever scientific contribution these kills could make to assist managers with studies of the state's coyote population. Under the present management system, it is impossible to establish any semblance of a precise population estimate.

In Vermont, coyotes can be killed year round, in almost any manner. And yet, there is no current or valid estimate of their population. Kim Royar, the Fish and Wildlife Dept. furbearer expert, estimates there are between 4500- 8000 coyotes statewide at this point in time (5, 20). This relatively wide range, which also appears on the Vermont Fish and Wildlife Dept. website, was derived from a study of the home range and habitat use of only 26 coyotes conducted in the Champlain Valley from July 1984 through December 1986 (19). In the subsequent three decades since this relatively small study was conducted, no further research has been carried out on Vermont's coyote population. The controversial issues surrounding all predators are important for scientists as well as wildlife managers to consider carefully right now as we, together with wildlife, confront effects of climate change (with the associated deleterious impacts on public health), habitat loss, and human encroachment.

Many recent studies as well as wide-scale public surveys have concluded that predator management needs to be readdressed and considered in light of changing climate, loss of biodiversity, and a change in the public perception of the role of wildlife. (1, 2, 11, 27). It has become clear that a growing majority of the public who appreciate wildlife, support national conservation efforts directed at public lands and resources, and who spend money on environmentally based past-times, are not hunters (25). A 2014 study challenged the popular notion that only hunters, trappers, and anglers bankroll wildlife conservation in the US. The conclusion of this thorough investigation of federal and non-profit funding sources, revealed that 94 percent of the total funding for wildlife conservation and management comes from the non-hunting public (25). Going forward, the perspectives of the public, both hunters and non-hunters, should be paired with sound research to implement policies and regulations that support healthy and resilient ecosystems and enhance maximal biodiversity.

Hunters frequently rationalize killing coyotes because they claim coyotes decimate the deer herd. However, the VT Fish and Wildlife Department (quoted below from their website) states emphatically that the deer population in VT is not endangered or even overly impacted by coyote predation:

“Coyotes are important members of the ecosystem and have evolved together with many of nature’s existing prey species. Conservation of the coyote is important to maintaining ecosystem integrity because of the vital role they play as predators...the eastern coyote is an omnivore; it is both a predator and a scavenger with a widely varied diet. The coyote’s diet and feeding habits can be more accurately compared to those of the fox than a wolf. ...At certain times of the year, deer meat can be a significant portion of its diet. Although a coyote may kill a fawn or deer in deep snow, it will also readily eat the carcass of a dead deer and other dead animals. Deer numbers are carefully monitored and there is no indication that coyotes are negatively influencing deer populations in Vermont...Research has shown that although the coyote does prey on deer fawns in the spring and deer in the winter, it is not a major controlling factor on deer numbers with the possible exception of areas where deer populations are already low or intense winters are extremely severe.” (29)

In most states coyote killing is done in the name of livestock or deer herd protection, but neither of these are major concerns for Vermonters. Rather, the Fish and Wildlife Department Commissioner, Louis Porter, and the Department’s furbearer expert, Kim Royar, have both stated that the most important reason to hunt coyotes is to keep them wary and fearful of humans (20). In fact, coyotes, like other wild animals, are born with a fear of humans and that has made coyote attacks on humans an exceedingly rare occurrence in Vermont. Information about coyotes on the VT Fish & Wildlife website attributes “instinctive wariness” to this species. In fact, the vast majority of reported attacks on humans in the entire United States have been attributed to animals habituated to humans through feeding and/or habitat encroachment (23). According to a New Hampshire sheep farmer, who coexisted peacefully with coyotes for 20 years after successfully utilizing the technique of hazing to scare them away from her flock, “A dead coyote learns nothing.” (21). As noted earlier, pack dynamics and structure affect coyote behavior

dramatically. An experienced alpha pair will reduce conflicts by influencing their pack's behavior. Killing coyotes does not keep them wary, but scaring them away can effectively accomplish this goal.

Killing is also rationalized by stating that populations need to be 'managed' to avoid starvation and disease---and that by killing the animal, the hunter is acting in the best interests of conservation...this notion clearly needs debunking.

Coyote management in neighboring states

Coyotes are perhaps the most misunderstood, feared, and persecuted native carnivores in North America. Their survival, in spite of consistent persecution, attests to their intelligence, adaptability, and resilience. It is estimated that across the US, over 500,000 coyotes are killed every year for fur, sport, or simply for fun or target practice (23). Elsewhere in the US, a great deal of research has been directed at the structure of coyote social order and population dynamics and a more comprehensive picture of the critical role coyotes play has been constructed (3). If one reviews the current literature on coyotes, it is clear that the majority of wildlife biologists and environmental scientists advocate for co-existence with coyotes over lethal management (1, 10).

By contrast with Vermont, both Massachusetts and New York have studied their coyote populations and have reacted to public opinion on hunting coyotes by instituting set seasons. A recently published study conducted in the summer of 2012 on Cape Cod (11), examined the knowledge of and attitudes toward current coyote hunting policies and practices in Massachusetts. The majority of those polled had concerns about the inhumane treatment of coyotes. Many people were unaware of the practices associated with hunting coyotes and the majority clearly favored a ban on the use of bait (65 percent), favored bag limits (57 percent), and supported the Massachusetts Wildlife Protection Act of 1996 which restricted the use of certain traps (for example body-gripping and foot-hold traps) on fur-bearers (68 percent support). The WPA also changed the structure of the Dept. of Fish and Wildlife board to include non-hunting members (14).

In northern New York, a major study was conducted in 1991 by the NY State Department of Environmental Conservation (DEC) to establish the impact of coyotes on wild and domestic animals (2). The study sought to determine the effect of hunting and trapping in controlling the coyote population. It also evaluated alternative, non-lethal, management techniques. Coyotes had been widely trapped and hunted in New York since their first appearance in the 1920's through 1976, when the first protections in the form of open and closed seasons were established. The 1991 project was initiated in response to a controversial bill, passed and immediately withdrawn in 1990, which would have enacted a year-round season on coyotes in New York.

As in many other similar studies conducted around the country, the New York DEC study concluded that coyote densities were rarely reduced through trapping or

hunting and that, in fact, their results confirmed “an increase in reproductive rates in areas where coyotes were intensively removed.” (2) The authors estimated that over 65 percent of the coyote population would have to be removed year after year in order to overcome the animal’s reproductive potential and achieve a decline in overall population numbers. This would mean that, as of 1991, 10,000 coyotes would have had to be killed every year in Northern NY. The study concluded that this was not a reasonable expectation and that “extended coyote hunting and trapping seasons will not reduce coyote densities or eliminate them from any area of the state.” The conclusions of this study were, among others, that a year-round season would not increase the coyote harvest or increase the deer population, that a year-round season would not be an effective technique in preventing predation on livestock, and that there was no strong public support for a year-round coyote hunting season. There was an additional recommendation to designate the coyote as a game animal with set seasons for hunting and trapping.

Because no studies have been done to characterize public opinion on hunting issues in Vermont, it is difficult to know what the relationship between the department and the non-hunting community is. Polling is an easy tool for collecting informative and helpful data on topical issues. Although there have been no polls about coyote hunting specifically, there was a recent poll that indicated changing attitudes in Vermont toward the management of wildlife. In February 2017, the University of Vermont’s Center for Rural Studies included two questions about trapping in their Vermonter Poll (28). Over 75 percent of the respondents expressed a desire to ban the use of leg-hold traps, body-gripping traps, and drowning traps for wildlife. Seventy percent of those polled also opposed the killing of wildlife without intent to consume or use the remains, unless targeted wildlife was causing damage to property. More public polls should be conducted in Vermont to obtain a better sense of where the stakeholders in public lands and resources stand on issues related to hunting and trapping. It seems that most Vermonters are unclear about hunting regulations and are ignorant about the manner in which our wildlife is managed. Whether or not a stakeholder is a hunter or non-consumptive user, the important decisions regarding wildlife should involve input from all participants. Greater public outreach by the department would be beneficial.

The North American Model of Wildlife Conservation

The North American Model of Wildlife Conservation (NAMWC), a set of principles used to guide and form wildlife management and conservation decisions since its inception in 2001, has its roots in the traditions of 19th century conservation and sportsmanship. The seven core tenets of the NAMWC are currently much debated and considered quite controversial as standards for designing policies and regulating management of wildlife. Unfortunately, they are still the current gold standard used to justify and evaluate policies and programs by most wildlife agencies, including VT F&W. Many wildlife biologists and environmental scientists challenge the fundamental premises of the Model and consider it to be seriously flawed and contradictory. A common criticism is that the interests of recreational

hunters are often in conflict with conservation principles and do not reflect current wildlife science. This is relevant to the discussion of coyote hunting because management that is designed in the interest of hunters “can lead to an overabundance of animals that people like to hunt, such as deer, and the extermination of predators that also provide a vital balance to the ecosystem.” (16, 32)

The Public Trust Doctrine (PTD) is the first tenet and, as such, is considered to be the cornerstone of the North American Model of Wildlife Conservation. It is based on the concept that certain natural resources, like wildlife, cannot be owned by individuals but are to be protected and conserved by the government in a manner that benefits both current and future generations. The VT Fish and Wildlife Department's mission statement, “To Protect and Conserve our Fish, Wildlife, Plants, and their habitat for the People of Vermont”, mirrors the intention of the Public Trust Doctrine. According to the NAMWC, wildlife belongs to all Vermonters but clearly Vermont's year-round persecution of coyotes does not represent the conservation ideals of many citizens nor does it protect wildlife responsibly. Rather, this unregulated approach appears to encroach on the public trust by enabling a minority of hunters and trappers to relentlessly pursue a species all year long with no reprieve. It is clear, from the Vermonter Poll that many, if not most, of Vermont's residents do not condone the treatment of these animals who are shot, hounded, chased, trapped, baited and killed in derbies and contests.

That wildlife should only be killed for a legitimate purpose is another core principle of the Model. This tenet exposes the real fundamental flaw in the department's promotion of coyote hunting. The NAMWC justifies killing wildlife only for food, in self-defense, for fur, and in the protection of property. Since most coyotes are killed for sport and not for fur, and are often left to rot where they die, coyote hunting is very rarely legitimate. More often than not these valuable animals are slaughtered out of sheer bloodlust and the historical mythology that vilifies coyotes. The wanton violence directed at coyotes is evident from the numerous graphic photos and posts on social media from hunters who shoot every coyote they encounter and celebrate the cruel suffering and torture inflicted on these animals. Deer hunters brag online of killing coyotes simply to relieve boredom. They refer to these animals as varmints, vermin, and 'yotes. Many coyote killers possess a passionate hatred of these apex predators. They vilify and objectify the species with a disturbingly intense hatred clearly based on myth rather than fact. Coyote killing contests and derbies make no sense scientifically, morally, or ethically. Hounding is also deplorable. It is particularly sadistic and inhumane, not only to the intended victim of the hunt, but also to the many domestic dogs who are put in harm's way.

If the goal of wildlife management is conservation, then hunting should only be legal if it supports or enhances conservation efforts and wide-ranging environmental programs. Wanton waste and persecution of predators is in direct conflict with the NAMWC, which prohibits the wasteful, frivolous killing of wildlife. These practices should be condemned. Trapping, perhaps the only means of killing coyotes that can be somewhat legitimized under the model because it involves fur, also clearly conflicts with the NAMWC which prohibits the commercial sale of wildlife.

Consequently, this privatization of a common resource should be illegal on public lands (26).

Conclusion and Recommendations

The North American Model of Wildlife Conservation (NAMWC) dictates that science is the proper tool for the discharge of wildlife policy. The VT F&W department owes the majority of Vermonters responsible, fact/research-based policies and programs that will embody current predator and environmental science and not be skewed to the desires of a demanding special interest group.

It is abundantly clear from the literature that coyotes are a necessary and important element to a functioning ecosystem. The evidence is compelling that co-existence is the most effective means of management for this adaptable species. Consequently, in order to keep Vermont's environment healthy, more research needs to be done to characterize the population size and density, current environmental role, and needs of Vermont's coyote population. This cannot be accomplished with the present system of unregulated open hunting of coyotes and no requirements to report coyote kills by trappers, hunters, or farmers.

Below are several recommendations relating to H. 60 and Vermont's policies regarding coyotes that would help restore the public's faith that this species will be treated with the respect it deserves and that all decisions related to wildlife and public lands will be based on solid science not just the desires of any special interest group:

Recommendations:

- The current open hunting season should be reformed to include closed periods based on the species' life cycle, specifically avoiding the spring and summer months when pups are born and reared.
- Activities that promote the wanton waste of an animal, including the all forms of wildlife hunting contests and derbies, should be prohibited.
- Mandatory reporting of coyote kills by hunters and trappers.
- Additional studies need to be conducted by wildlife biologists unaffiliated with the Fish and Wildlife Department.
- All policies regarding management should be designed according to and appreciating the current research findings that favor policies of co-existence.
- Wildlife managers should promote coexistence and focus on promotion and implementation of nonlethal solutions to predator control.
- The Fish and Wildlife Department should develop hunter education programming focusing on the important role of coyotes in ecosystems and as a top predator.
- The Fish and Wildlife Board should be restructured to include a representative number of non-hunting members. These individuals should have background in wildlife biology, ecology, conservation biology, and/or environmental science.

- The recommendations from the State Association of Fish and Wildlife Agencies (Vermont is a member) Blue Ribbon Panel Report (March 2016) should be assessed by the DFW and reported out to the FWC and Governor.