Predator control controversy in Montana and the West

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THE PREDATOR CONTROL CONTROVERSY
IN MONTANA AND THE WEST

By
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B.S., University of Montana, 1970

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CHAPTER I
INTRODUCTION

Predatory animals, particularly coyotes, are an important concern of the livestock industry in the Western and Southwestern United States. Each year livestock losses to predators run into the millions of dollars, as do expenditures aimed at preventing these losses.

Although predation by the larger carnivores has long troubled man, no predator control problem has churned up more human emotions, aroused more political furor, and demanded more unwarranted expenditures than the one involving predators that prey on domestic livestock (McCabe and Kozicky, 1972).

For the past three decades an emotional confrontation has developed between livestock producers and segments of the general public. The central point in contention is whether or not poisons should be allowed for use in predator control operations; however, other issues are also involved. From the beginning of the controversy lack of adequate information has prevented a final solution, while emotional claims and counterclaims by the opposing groups have further clouded the issues.

Governmental predator control programs exist primarily for the protection of the western sheep industry. The coyote (Canis latrans) is the number one target of control operations and the arch enemy of
domestic sheep. Complaints of coyotes attacking calves have increased in recent years, although predation on cattle is probably not a serious problem in most areas (Fitch, 1948).

Efforts to control the coyote's predation on sheep and other livestock began during the mid-nineteenth century. Since then, coyotes have been killed by the millions. However, even in the face of advancing civilization and man's efforts at eradication, the resilient coyote has adapted to human proximity and increased its range (USDI, 1973).

The purpose of this paper is to examine the various issues involved in the predator control controversy, review recent research, and offer possible solutions to present conflicts. The paper will be primarily concerned with the relationships between coyotes and domestic sheep, although many of the principles discussed will be applicable to other predators and livestock as well.
CHAPTER II

THE ISSUES OF PREDATOR CONTROL

The prospect of attempting a rational discourse on the coyote management controversy is somewhat unnerving. The ambiguous role of coyotes within natural schemes is frustrating to interpret in itself. When coupled with our inadequate knowledge of the biology, behavior, and ecology of the beasts, and economic liabilities of one segment of society and charismatic endearment to another, it becomes perturbing. By adding the political uncertainty of who should have the responsibility for managing, and at the same time changing the ground rules so that no one really wants it, the situation is ripe with confusion (Knowlton, 1973).

The above statement is an accurate, although brief, summary of the major elements involved in the current controversy over predator control. The complexity of the issue is almost beyond comprehension because it touches upon such a wide variety of disciplines, all of them interrelated. It is the variety of components in the coyote management problem that forms the basis for the existing confusion. Human emotions have polarized opinions of the opposing groups and it is questionable whether any middle ground can ever be found.

Regarding the coyote management controversy, the line of division between the opposing factions is not always clearly defined. There are points of disagreement between organizations and even within
organizations. However, one can separate the opposing groups according
to broad beliefs. Generally speaking, livestock producers and in-
dustries connected with livestock production favor intensified predator
control efforts and reinstatement of toxicant use. Representatives of
these viewpoints include the National Wool Growers Association,
National Cattleman's Association, American Meat Institute, comparable
State organizations, and individual stock producers.

Taking the opposite side in the controversy (usually favoring
reduced coyote control, more selective control, or at the extreme, no
control) are the groups which might be collectively labeled as
conservationists, environmentalists, or preservationists. Siding with
these is a considerable portion of the public at large who find the
coyotes to be of aesthetic value. This group of people is partially
represented by the following organizations on the state and national
levels: Sierra Club, National Audobon Society, Defenders of Wildlife,
Friends of the Earth, and the National Wildlife Federation.

Solutions to the coyote management problem would become simpler
were it not for the fact that there is so much variety in the points of
interest involved. Urban people are interested in the aesthetics of
coyotes, ecologists in the ecology of coyotes, economists in the
expenditures and savings involved, and stockmen in the eradication of
the coyote. The various points in contention are so numerous that
there is even disagreement as to which are more important and need to
be resolved first, and which are unimportant.

At this point, I will enumerate the issues and side issues which
I consider to be the most important in the coyote (predator) control
controversy.
Administration of the Control Program

It is fair to say that the majority of the groups on both sides believe that a coyote control program of some type is necessary in the West. Given this, the question of who should administer the program is raised. Since 1939, the Federal Government, United States Department of the Interior has been responsible for overall administration, supplying the manpower, and providing cooperative funds and research capability. The individual States have supplied cooperative funds, some manpower, and some research into the program. Legislation currently before Congress would transfer responsibility for predator control activities to the individual States. The proposed legislation provides for Federal funding for the States to conduct control activities now being done by the Fish and Wildlife Service. The total State funding would derive from a combination of Federal funds and funds contributed from the user interest (sheep, cattle, and other livestock producers), and responsibility of administration would fall to individual Fish and Game Departments, Livestock Departments, or Agriculture Departments. Under this plan the Federal Government would still supply the major research efforts needed, provide supervision, and enforce the program.

The idea of transfer of control responsibility to the States is not a new one. This viewpoint has been shared by the Department of the Interior (Reed, 1973), (Berryman, 1973), and (McCabe and Kozicky, 1972), among others. Cain et al. (1971), Howard (1974), and other people involved with predator control have taken the opposite viewpoint and believe that control activities should remain the province of the Federal Government.
As a sidelight, Howard (1974) has raised the point that predator control activities do not belong in the Department of the Interior at all because this department also has the responsibility of protecting the country's wildlife resources. Instead, Howard suggests that predator control should be transferred back to the Department of Agriculture. The responsibility for control programs, originally delegated to the Department of Agriculture, was transferred to the Department of the Interior under the Federal reorganization in 1939 because it was felt that all wildlife management functions belonged in the same department. Howard maintains that predator damage control belongs in the Department of Agriculture along with insect damage control and weed control.

**Use of Toxicants for Predator Control**

One of the major points of disagreement, if not the major point, centers upon toxicant use in predator control programs.

Since the Presidential ban on toxicant use in 1972, livestock producers and especially wool growers, have consistently complained of increased stock losses to coyotes. They attribute these increased losses directly to the fact that poisons are no longer available for use in controlling coyotes. Ranchers feel that poisons should be allowed until more acceptable alternative controls are available. In addition, the ranchers point out that use of poisons is more economical than trapping, or other means of control, because bait placement is easy and baits do not have to be tended.

Opponents of the stockmen feel that the dangers involved in poison use far outweigh any benefits to the livestock industry.
Conservation groups argue that adequate protection can be given to livestock by mechanical control methods and that the ranchers' claims of increased losses never have been substantiated. They also feel that poisons are generally inhumane and non selective wildlife killers. In regard to selectivity, opponents of toxicants are particularly upset about the number of nontarget species which have been killed by poisons in the past. The West contains a number of birds and animals which are on the Department of the Interior's Rare and Endangered Species List including: the Utah prairie dog (Cynomys parvidens), San Joaquin kit fox (Vulpes macrotis mutica), grizzly bear (Ursus horribilus), black-footed ferret (Mustela nigripes), California condor (Gymnogyps californianus), Prairie falcon (Falco mexicanus), and peregrine falcon (Falco peregrinus anatum). In addition, other western animals whose status is presently undetermined may already be rare or endangered. Following are animals whose status is not known at this time: Arizona prairie dog (Cynomys ludovicianus arizonicus), Chiricahua squirrel (Sciurus chiriacaiae), pine marten (Martes americana), northern swift fox (Vulpes velox hebes), Texas kangaroo rat (Dipodomys elator), fisher (Martes pennanti), wolverine (Gulo gulo), and Canada lynx (Lynx canadensis).

All of these birds and mammals in the West could conceivably be adversely affected by direct or secondary toxicant consumption.

Another point in contention when considering poisons is whether they should be used for emergency control of wildlife diseases transmissible to man and domestic animals. Toxicants can presently be used in "emergency situations" with permission from the Environmental Protection Agency. Strychnine-injected eggs for rabid skunk control
are now being used in eastern Montana where a number of rabid skunks have been found in the past few years. Individuals who oppose any toxicant use whatsoever believe that poison use cannot be justified even for rabies control.

The Economics of Predator Control

The economic considerations involved in the total livestock-coyote management controversy present some of the most important and complex questions which have yet to be answered. Economics as related to predator management and the livestock industry encompass many different areas including value of livestock lost to predation, damage assessment, value of predators, costs versus benefits of control programs, and costs of livestock operations.

There is no doubt that coyotes and other predators annually inflict heavy financial losses on segments of the livestock industry, most notably the wool growers. How these losses are distributed and the extent to which they affect the economic well-being of the industries in total are points in contention. Sheep ranchers attribute the decline of their industry mainly to the financial losses inflicted by coyotes. A frequently heard statement is, "The coyotes are driving me out of business." One study in Montana attempted to find the major economic factors affecting the State's sheep industry. Fifty percent of the wool growers responded and stated the major factors (in order of importance) were (1) predators, (2) prices, (3) weather, (4) disease, (5) lambing complications, and (6) parasites (Seyler, 1973).

Conservation groups counter the sheep raisers' claims by saying that the industry has been on the decline for the past thirty years
and that the decline had started while predator control programs were in full effect. Conservationists generally attribute the decline of the sheep industry to various factors other than predators. Some of these factors are (1) labor shortages and increased operational costs in sheep ranching, (2) competition from foreign markets, (3) low prices for wool and lamb, and (4) sheep ranchers turning to cattle raising. In addition, control opponents state that the sheep industry has declined even with predator control, wool incentive payments, and wool tariffs all in effect. If the industry were economically viable, it should be able to survive with all this assistance.

As a final point, conservation groups believe that when coyote control programs are initiated, little or no thought is given to the economic value of the coyote to the ecology of the range. They point out that the coyote is extremely valuable in removing rodents and in helping to keep their populations in check.

**Effectiveness of Control Programs**

A main issue within the predator control controversy centers around the problem of characterizing the sheep loss situation. Of equal importance is determination of the extent to which coyote controls have reduced or prevented livestock losses, and the extent to which coyote controls have affected coyote populations. Until recently, little or no attempt has been made to evaluate coyote controls. It was merely assumed that since livestock losses were occurring, coyote control was necessary and justified.
Prevention of Livestock Losses

Sheepmen and other livestock producers have consistently criticized predator control operations for not providing adequate protection from depredations. Even with chemical controls in effect, most wanted more intensive efforts made. Claims of skyrocketing losses have increased markedly since the abandonment of chemical controls, and confidence in the alternate, mechanical methods is lacking.

Opponents of present control programs believe that the losses claimed by sheep ranchers are usually inflated purposely as one means of perpetuating controls and having more intensive control measures initiated. Conservationists also note that the natural animosity of ranchers towards coyotes often causes the rancher to blame the coyote for losses brought about by other factors such as disease or inclement weather. In further argument against coyote controls, the opposing faction feels that the available government sources of livestock loss data are inaccurate and biased, depending too much on reports from the stockmen themselves. It is to the rancher’s benefit to inflate his losses for income tax purposes. In addition, future funding levels for Federal control programs are usually based on past or anticipated losses, so to get more money it is advantageous to claim more losses. Even the government field agents do not escape the conservationists’ attention, they believe that the agent often inflates loss claims himself in order to justify his position as a predator control agent.

As a final point, opponents say that livestock losses for the industry as a whole are acceptable. Only a few ranchers are suffering heavy losses of stock while the majority sustain light losses, which should be considered one of the risks involved in livestock production.
Reduction of Coyote Numbers

The overall effectiveness of coyote control programs is determined not only by livestock-loss prevention, or reduction, but also by the success in reducing coyote numbers.

One of the major questions is the effectiveness of coyote reduction to date. Both livestock interests and environmentalists generally agree that the coyote population of the West has increased from previous levels with reduction programs in effect. The debate here is whether the high coyote populations are a function of inadequate controls or other factors. Ranchers, of course, tend to blame ineffective controls.

The groups holding the opposite view blame current control, but for other reasons. Most opponents are of the opinion that high coyote numbers simply reflect normal population fluctuations in response to an increased food base. It has been shown that range damage caused by sheep often gives rise to rodent irruptions which, in turn, result in corresponding increases in coyote numbers. Control efforts have attempted to increase coyote mortality but become ineffective if reproduction proceeds at higher rates. Those opposing present management policies center most of their arguments on the ineffective philosophy of general coyote suppression. Not only has this policy failed, but loss reports have increased. It would be far better to concentrate on the coyotes doing the actual killing rather than on the population as a whole. Equal or better effectiveness could be achieved from a policy of this type and present controls could be scaled down considerably. It has been maintained that only a few coyotes in any locality are stock killers and, therefore, mass population reduction is
neither justified nor desirable.

Private Interests Versus Public Interests

In Coyote Control

Another of the seemingly endless areas of disagreement within the issue of predator control involves certain moral questions. This conflict revolves around two points: (1) funding of the animal damage control program, and (2) management of public lands.

Funding

Criticism has recently been leveled by the public and various environmental groups over the financing of coyote control programs. These individuals point out that public funds are being used to help support the privately owned livestock industry, an industry that favors eradication of the coyote. The funds are of two types; wool incentive payments (derived from Federal appropriations), and public monies spent for predator control (derived from Federal appropriations and hunting license fees at the State level). Most critics do not strongly oppose the wool incentive payments; however, they do object to use of public monies for control work. Critics state that if livestock interests want predator control they should finance it themselves, in total. Coyote control should not be a government obligation just because sheep and cattle graze on public lands. Coyote depredations should be considered one of the risks of producing livestock.

Management of Public Lands

Public lands in the West are used extensively for grazing by private livestock interests. Critics maintain that the livestock industry unfairly benefits from the practice because of the lower than
average grazing fees charged on public lands and also because of control of coyotes on public lands. The important objection concerns the killing of the public's coyotes on the public's lands, for the benefit of private interests. Opponents of control find the coyote to be of aesthetic value and claim that this value is not taken into consideration when policy for public land management is planned.
CHAPTER III

HISTORY OF PREDATOR CONTROL

Federal

Predation on domestic livestock began with the pioneers' first settlements in this country. In the colony of Massachusetts, lawmakers passed the first bounty law in 1630. As the country expanded westward, other bounty systems were initiated as the range livestock industry developed. During the earliest periods of the country's growth the only means of controlling predators was through individual hunting and trapping efforts.

Because of pressure brought to bear on the Federal Government to assist in alleviating livestock losses, the Bureau of Biological Survey conducted field studies on wolf and coyote populations between 1907 and 1914. At this time the newly formed Forest Service was collecting grazing fees for the private use of public lands under its administration. Because of this, the Federal Government felt obligated to offer protection to the livestock grazing on public lands. Thus, in 1915, Congress authorized $125,000 for the Bureau of Biological Survey to enter directly into predator control activities.

In 1931, Congress passed the Animal Damage Control Act. The current predator control program is based upon this act which directs the Secretary of the Interior to conduct campaigns for the control of animals injurious to agriculture, livestock, and people. The program
was to be conducted in cooperation with the States and with local cooperators.

Under federal reorganization in 1939, responsibility for predator control was transferred to the Fish and Wildlife Service of the Department of the Interior. This was renamed the Bureau of Sports Fisheries and Wildlife.

Once fully involved in animal damage control activities, the government found numerous and very complex problems to be solved. Administrative mistakes occurred as did mistakes at the field level. Charges of indiscriminate killing of wildlife and over-control were leveled at the Bureau. Predator control had become such a hot issue at this time that a professional investigation was initiated into control activities by the Secretary of the Interior’s Advisory Board on Wildlife Management. Their final report, commonly called the Leopold Report, became a partial basis for future Federal policy. The 1964 report to Secretary Udall led to the formation of the Division of Wildlife Services of the Bureau of Sports Fisheries and Wildlife. The Leopold Report was based upon a philosophy of minimum effective control. The stated tenets were; (1) all native animals are resources of inherent interest and value to the people; consequently, basic governmental policy should be one of husbandry of all forms of wildlife, and (2) at the same time, local population control is an essential part of management policy where a species is causing significant damage to other resources or where it endangers human health or safety. In such cases, control should be limited strictly to the offending species, preferably to the troublesome individuals, and only to the localities where danger or damage exists. (Leopold, et al., 1964).
At the conclusion of the study, the Leopold Committee felt that predator and rodent control, as practiced by the government agencies, was considerably in excess of the amount that could be justified in terms of the total public interest. Therefore, the Committee recommended that before predator control activities were initiated, a clearly demonstrated need should be shown. Other major recommendations of the Leopold Committee were as follows: (1) the appointment of a predator and rodent control board advisory to the Secretary of the Interior, (2) improvements in predator and rodent control operations, (a) explicit criteria to guide control decisions, (b) continued cooperative programs to be maintained with other agencies, (c) proof of control needed (documentation), (d) extension trapper programs replacing bounty schemes, (e) flying squads of control agents to be maintained to cope with rabies outbreaks (in the eastern U.S.), (3) greatly amplified research programs for specific control devises, and (4) legal controls to regulate the use of poisons in control operations, and to prevent shipment of such poisons to foreign countries lacking adequate controls.

The Leopold Committee was opposed to broadcast poisoning of rodents because of the danger to non target species; however, they found nothing wrong with using 1080 poison bait stations for coyote control. The Committee recommended that one 1080 station be used per township in control areas.

The Leopold Report brought few changes in the governmental control program mainly because of resistance to change at administrative and field levels and also because the livestock industry continued to give their support to the old system. This was not popular with the
general public because of a growing environmental awareness and concern over animal damage control programs. At this time, an incident occurred which aroused the public to such an extent that another government commission was formed to study predator control activities. Twenty-two bald and golden eagles were found dead from thallium poisoning in Wyoming. These birds were killed when they ingested poison bait meant for coyotes. Further investigation showed that numerous other species of nontarget animals had also been victims of either direct or secondary poisonings in the West.

The 7 man committee, formed to reevaluate the predator control program, was headed by Dr. Stanley Cain. It was commissioned by the Secretary of the Interior, Rogers Morton, and the Chairman of the Council on Environmental Quality in May of 1971. Their findings, referred to as the Cain Report, were published in January of 1972 and formed the basis for Executive action immediately thereafter.

The Cain Committee found numerous failures in the administration of the federal control program at both the administrative and field levels. It also noted that the government program did not take into account the full spectrum of public interests and values not only in predators but in all wildlife. These values will be discussed later in the paper.

The Cain Committee recommended the following solutions to the problems in predator control: (1) continued federal-state cooperation in predator control, and with all funds in its support to come from

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Congress and by the state legislatures, (2) immediate Congressional action should be sought to remove all existing toxic chemicals from registration and use for operational predator control. Also, these restrictions should extend to those toxicants used in field rodent control whose action is characterized by the secondary poisoning of scavengers. Pending, and in addition to such Congressional Action, the Secretary of the Interior should disallow use of poisons in the Federal predator and rodent control program, and that this ruling be made a standard in cooperative agreements with the States. It is also recommended that the individual states pass legislation to ban the use of toxicants in predator control, (3) the field force of the Division of Wildlife Services be professionalized to emphasize employment of qualified biologists capable of administrating and demonstrating a broadly-based program of predator management, (4) all states establish a cooperative trapper-trainer extension program as a means of aiding landowners in the minimum necessary control of predators on private lands, (5) it is recommended that Congress provide some means of alleviating the economic burden of livestock producers who experience heavy losses by predators, (6) grazing permits and leases written by Federal land management agencies should provide for possible suspension or revocation of grazing privileges if regulations governing predator control are violated, (7) all methods of predator control should be prohibited on statutory Wilderness Areas, (8) federal and state legislation should be passed that would make the shooting of wildlife from aircraft, including predators and game animals, illegal except under exceptional circumstances and then only by authorized wildlife biologists of the appropriate Federal and State agencies, (9) the
Federal Aviation Authority should make a provision for suspending or revoking the license of a private pilot and the confiscation of the aircraft when the pilot knowingly carries a passenger whose acts lead to conviction for illegal predator control, such as shooting from the aircraft or distributing poisons, (10) it is recommended that action be taken by Congress to rule out the broadcast of toxicants for the control of rodents, rabbits, and other vertebrate pests on federal lands, and that the possibility of correlative action be explored for private lands as well, (11) it is recommended that a long term research program be based in the Division of Wildlife Research, Bureau of Sports Fisheries and Wildlife, that would cover the gamut of ecological problems associated with predators, (12) the Divisions of Wildlife Research of the Bureau of Sports Fisheries and Wildlife should undertake a detailed socio-economic study of cost-benefit ratios of predator control as a means of evaluating the need for and the efficacy of the program and its separate parts, (13) the Division of Wildlife Research of the Bureau of Sports Fisheries and Wildlife should be delegated the responsibility for the study of the epidemiology of rabies in the field by a team of specialists provided with adequate funding, (14) Congress should give the Secretary of Interior authority to take measures necessary to protect all species of predators that have been placed on the Endangered List by the Federal Government, 2nd (15) it is recommended that the several States take measures to supplement the federal protection of rare and endangered species by enacting laws and taking measures to protect locally rare populations.

One month following publication of the Cain Report, the President of the United States, in response to the committee's second
recommendation, issued Executive Order #11643 (Appendix 1). The Executive Order of February 8, 1972, removed all toxic chemicals from registration and use in operational predator control on federal lands. The Executive Order also prohibited federal participation the use of such toxicants, but it did provide that under Section 3b (1, 2, and 3) the heads of Federal agencies may authorize the emergency use of chemical toxicants for the purpose of killing predatory animals for: (1) the protection of health or safety of human lives, (2) the preservation of wildlife species threatened with extinction, and (3) the prevention of irretrievable damage to nationally significant natural resources.

On March 9, 1972, William Ruckleshaus, then the administrator for the Environmental Protection Agency, issued "Pesticides Regulation Notice 7202" (Appendix 2). This notice suspended the registration for all products containing sodium cyanide, sodium monofluoroacetate (1080), or strychnine for use against mammalian predators, and stated that they be cancelled and suspended at once. In addition, the notice prevented the interstate commerce of predacides.

The activities of the Bureau's Division of Wildlife Services were directly affected by the ban on toxicants and Pesticides Notice 72-2. The Bureau remained responsible, however, for fulfilling the Federal responsibility of controlling animal damage as directed by Congress (Act of March 2, 1931; 46 Stat. 1468, 7 U.S.C. 426-426b). In order to fulfill this responsibility the Secretary of the Interior ordered an accelerated program of animal damage control services. This program has the following objectives: (1) conducting a carefully planned special effort to reduce depredations in the most critical
areas, using nontoxic methods, from the spring natality period through the fall marketing period, and (2) to maintain liaison and relationships with appropriate State officials, land managing agencies, other cooperation agencies, and representatives of the livestock industry. To accomplish this, Bureau funds were reprogrammed to increase the capabilities to control predator damage by increased use of non-chemical tools (USDI, 1973).

From April 17 to June 30, 1972 a total of $278,500 was authorized to be expended by the Division of Wildlife Services. The Division was also authorized to increase first quarter spending during Fiscal Year 1973 by an additional $70,000. Therefore, from April 17-September 30, 1972, the total funds made available for the special program amounted to $349,500.

As of January 1, 1972, it was estimated by the U.S. Department of Agriculture that there were 13,190,000 sheep and lambs valued at about $300,000,000 in the 15 States where the accelerated program was conducted. By April, these population figures had nearly doubled because of lambing.

A comparison of the confirmed losses identified by Wildlife Services personnel in the major livestock classes during the April 1-September 30, 1972, period indicated that the numbers of confirmed losses of sheep, goats, and poultry killed increased when compared to the same period in 1971. During the five month period, 14,750 sheep, 796 cattle and calves, 1,376 goats, and 8,131 head of poultry valued at $521,427 were confirmed as killed by predators.

The emphasis in the special program was on reducing livestock depredations caused by coyotes, though needs varied from State to State.
Main reliance was placed upon the increased use of aircraft, both helicopters and fixed wing, although all other methods of mechanical control were used.

During the five month period, 8,149 coyotes were taken by all methods, although aircraft gunning accounted for the majority.

Results of the special effort showed that in many areas losses were definitely controlled and/or prevented; however, in other areas depredations were not controlled or prevented. In taking everything into account, the Bureau felt that it had conducted an effective, selective, efficient, and safe non-chemical program of coyote damage control in parts of most States. Without using toxicants, and in full compliance with the Executive order, the program was successful in effecting a significant reduction in anticipated depredations in highly critical areas over the West. This success is conditioned by the fact that toxicants had been employed prior to February 8, and some reduction in the coyote populations had already been accomplished. In most areas where the accelerated effort was applied, however, depredations were held at a level comparable to or lower than previous years (USDI, 1972).

The information gained by the Department of the Interior was not accepted by most livestock producers who wanted use of poisons reinstated for predator control. They felt that poisons were the most important weapon that was available to protect their stock. Stockmen have combined their political power in the past two years in the effort to have poisons reinstated. Last year, more than 20 western senators, using figures supplied by the sheep industry, blamed the Interior Department for the loss of over 800,000 sheep ("mostly young lambs")
as a result of the toxicant ban (Reiger, 1974).

Most of the livestock producers' arguments have been countered by conservation groups but it is clear that the predator control controversy is far from settled. In the meantime, the Department of the Interior has experienced budget cuts that severely threatens their ability to carry out an effective non-chemical predator control program. Congress, therefore, is now faced with repealing the Executive order in response to ranchers' demands for greater protection, or enacting legislation that will enlarge the available funding and manpower by transferring predator control responsibility to the States with cooperating Federal funds.

Numerous bills were introduced in the 92nd Congress concerning animal damage control; however, the issue was unresolved. The issue is now under consideration in the 93rd Congress. Following are the bills presently before Congress and the hearings which have been held thus far:

**Legislation**

H.R. 38. Mr. Dingell, et al.; 1/3/73

*Merchant Marine and Fisheries*

A bill to authorize the Secretary of the Interior to assist the States in controlling the damage caused by predatory animals; to establish a program of research concerning the control and conservation of predatory animals; to restrict the use of toxic chemicals as a method of predator control; and for other purposes.

H.R. 4759. Mr. Dingell, et al.; 2/27/73

*Merchant Marine and Fisheries*

A bill to authorize the Secretary of the Interior to assist the...
States in controlling damage caused by predatory and depredating animals; to establish a program of research concerning the control and conservation of predatory and depredating animals; to restrict the use of toxic chemicals as a method of predator control; and for other purposes.

S. 819. Mr. Bayh, et al.; 2/8/73

Commerce

A bill to authorize a national policy and program with respect to wild predatory mammals; to prohibit the poisoning of animals and birds on the public lands of the United States; to regulate the manufacture, sale, and possession of certain chemical toxicants.

S. 887. Mr. Byrd, et al.; 2/15/73

Commerce

A bill to authorize the Secretary of the Interior to assist the States in controlling damage caused by predatory and depredating animals; to establish a program of research concerning the control and conservation of predatory and depredating animals; to restrict the use of toxic chemicals as a method of predator control.

Hearings


U.S. Congress. Senate. Committee on Appropriations. Predator Control and Related Problems. 92nd Congress, 2nd Session, December 14-17, and December 20, 1971

U.S. Congress. House. Committee on Merchant Marine and Fisheries,


The question of the need for new predator control legislation had been debated extensively during the predator control hearings of 1972 and before. Witnesses representing livestock interests during the 1973 hearings again focused their statements primarily on the issue of need. Generally centering on the essentiality of chemical toxicants in controlling damage caused by predatory animals, testimony by the livestock industry attested to the growing number of losses due particularly to coyotes during the past few years and especially since the Federal ban on the use of predator poisons. They emphasized the need for these chemicals and the ineffectiveness of alternative methods of control.
In further testimony, livestock interests were often of the opinion that there was no need for further legislation. It was pointed out that the necessary statutory authority to permit supervised use of toxic chemicals for the control of predators is available under the provisions of the Federal Environmental Pesticide Control Act of 1972 (Public Law 92-516).

Briefly, the bills presently before Congress authorize the Secretary of the Interior to assist the States in controlling damage caused by predatory animals, to establish a program of research concerning the control and conservation of predatory animals, and to restrict the use of toxic chemicals as a method of predator control. This last provision would enact into law the February 1972 Executive Order 11643 banning the use of chemical toxicants for the control of predatory animals on Federal lands and in Federal programs. In addition, the proposals would repeal, in its entirety, the 1931 Act pertaining to the eradication and control of predatory animals.

The administration's bill, H.R. 4759 has three main differences from the other proposals. First, it would not, as would the other bills, require the wildlife agency of a State to be the agency to administer the predator control program authorized to be carried out under the Federal financial assistance plan. It would leave to the individual States the decision on which State agency would administer the program. Second, it would eliminate a provision in the other bills that specifically authorized the use of chemical toxicants in emergency situations to prevent major damage to domestic livestock. And third, the Administration's bill would provide that the Secretary of the Interior "may" (at his discretion) rather than "shall", as designated by other
bills, provide Federal operational assistance as he may deem necessary (Musgrove, 1974).

On November 6, 1973, the Subcommittee on Fisheries and Wildlife Conservation and the Environment, of the House Committee on Merchant Marine and Fisheries, introduced H.R. 11266. This bill is intended to be a compromise bill to H.R. 38 and H.R. 4759. H.R. 11266 specifically allows the use of sodium cyanide in its provisions for emergency use. The bill also provides that any other toxicant as defined under its provisions may also be used under the conditions, provided it has no secondary poisoning effects and kills animals quickly and painlessly.

Passage of any predator control legislation during the 93rd Congress is unlikely. This is unfortunate because the Bureau of Sports Fisheries and Wildlife budget for control activities in Fiscal Year 1975 includes an additional $2 million for research and control activities. Its use is contingent upon passage of the legislation under consideration.

**Montana**

Predator control began in Montana in 1879 when the Territorial Legislature authorized County Commissioners to pay bounties on certain predatory animals (Mitchell and Greer, 1971). In 1925, the Fish and Game Commission, for the first time, transferred $7,500 to the Livestock Fund for bounty control work. This was not successful in controlling the predators which killed livestock. Even so, bounty payments were halted in 1962, Carter County still pays a bounty on coyotes.

When Congress passed the Animal Damage Control Act in 1931, the Bureau of Biological Survey, in cooperation with the Montana Livestock
Commission, and cooperating counties developed a State predator control program.

From 1947 to 1971, the Montana Department of Livestock was advised by a Governors Advisory Committee on Predatory Animal Control. The Committee was established by the 1947 Legislative Assembly consisting of representatives from the Montana Stockgrowers Association, Montana Wildlife Federation, Montana Fish and Game Commission, and the United States Fish and Wildlife Service. This committee advised the Department of Livestock regarding practical methods for control, expenditure of funds, and development of a statewide predator control program whereby the most efficient results could be derived. Under State Reorganization in 1971, the Advisory Committee was abolished (Montana Department of Livestock, 1974).

Currently the Montana Department of Livestock enters into agreements with the U.S. Department of the Interior, Bureau of Sports Fisheries and Wildlife, and the Montana Department of Fish and Game for the purpose of formulating and conducting a practical predatory animal control program in Montana. The Montana County Commissioners, Montana Woolgrowers Association, U.S. Forest Service, U.S. Bureau of Land Management, and local livestock associations have direct input into the planning of the program (Montana Department of Livestock, 1974).

Over the years, cooperative funds spent for predator control activities have increased markedly from the original $7,500 spent in 1925 to the proposed $451,071 for 1974. Funds for the program are derived from four sources; Montana Fish and Game Department - $40,000 (accumulated from hunting license fees), counties - $88,000 (derived
from license fees at 10 to 15 cents on all sheep one year or older),
Montana Department of Livestock - $165,821 (derived from 4½ mill levy
on sheep, and a 2 mill levy on other livestock), and Bureau of Sports
Fisheries and Wildlife $157,250. A full breakdown in expenditures for
fiscal year 1974 may be found in Appendix-3.

Individual ranchers usually are responsible for initiating
predator control operations within a given locale. If the rancher
feels that coyotes are killing his sheep, he files a Request for
Services Form with the Bureau of Sport Fisheries and Wildlife Office in
Billings, Montana. Upon receipt of the form, the Bureau dispatches a
field agent from the rancher's district to kill the offending animals.
Theoretically, if he is successful, predation upon the rancher's stock
will cease.

Stockmen in Montana were vigorously opposed to the ban on toxi­
cant use in 1972, as were stockmen in other states throughout the West.
By using their combined political power, the West's livestock producers
influenced the Environmental Protection Agency to authorize an
experimental program using the M-44 poison dispensing device for coyote
control. In January 1974, the EPA announced that it would permit the
experimental use of the M-44 to collect data for use in
possibly registering sodium cyanide for predator control purposes.
Texas was the first state designated to implement the program, because
its lambing season is earlier than most states (Washington News, 1974).

In Montana, the experimental M-44 program is being carried out
in the 21 largest sheep producing countries, and will be continued
until October of 1975. Control counties will be chosen to monitor
predation without the M-44 in use. According to an order issued by
James L. Agee, acting assistant administrator for water and hazardous materials, the following 21 counties will be used to test the M-44:
Carter, Custer, Garfield, Petroleum, Phillips, Powder River, Rosebud, Beaverhead, Madison, Carbon, Fergus, Judith Basin, Musselshell, Stillwater, Sweet Grass, Teton, Wheatland, Dawson, McCone, Gallatin, and Meagher (Missoulian, May 31, 1974). The M-44 may be used in these counties only, its use banned by federal law everywhere else.

According to the EPA plan, the cyanide capsule, to be used in the M-44 ejector mechanism, will be made available to state-licensed trappers under the supervision of the Montana Department of Livestock.

The EPA stated that the main purpose of the experimental program is to determine the effectiveness of using the poison in preventing or reducing livestock losses when used in conjunction with trapping, denning, shootings, serial hunting, and other methods.

The antidote, amyl nitrate capsules, must also be made available in all locations where the sodium cyanide is used in case of accidental poisonings (Missoulian, May 31, 1974).

Montana wool growers almost unanimously favor intensified control efforts and desire the reinstatement of poisons for coyote control.

The latest action by the stockmen has been a campaign to allow aerial hunting for coyotes by private citizens. Ranchers told the Montana Livestock Board that, unless aerial hunting of coyotes and foxes is allowed, the State's sheep industry could be wiped out by the predators. The testimony was presented as the Board considered rules to license and regulate year-round hunting of predators from aircraft. Ranchers feel that, since poisons are banned, increased aerial hunting is the most effective means of regulating coyotes. The Montana Wool
Growers Association submitted a statement noting that aerial hunting will be controversial, and applauding the Board for drafting rules which are claimed to include extensive safeguards.

The rules would allow hunting of coyotes and foxes only to protect livestock and not for recreation. All aircraft pilots involved in the program would have to be licensed by the Livestock Department and gunners would be limited to using shotguns no larger than 10 gauge. Aerial hunting would be allowed only on lands where permission had previously been given by landowners.

On April 8, 1974, the Montana State Department of Livestock issued an Environmental Impact Statement on the Montana Predatory Animal Control Program. Hearings were held in Polson, Lewistown, and Miles City to test public reaction to the proposed program. Elements of the plan included increased aerial hunting, trapping, and denning of coyotes. The Department proposes to hire 17 full-time trappers, 4 part-time trappers, and 10 pilots to implement the program. The Impact Statement said that the State's sheep losses have increased markedly since the toxicant ban. No adverse environmental effects are anticipated from the proposed predator control program.
CHAPTER IV

METHODS FOR PREDATOR CONTROL

Historically, relatively few methods have been used to reduce predatory animal populations. Methods to date have been aimed at killing the animal causing the damage or, more commonly, at general population suppression (prophylactic control). Only recently, has research turned to non-lethal means for controlling animal damage.

Bounty Systems

A bounty may be defined as a predetermined amount of money paid to an individual upon presentation of satisfactory evidence of the destruction of a specified animal.

The bounty is the oldest wildlife management technique still in existence. Ancient writings tell of bounties paid for wolves nearly 3,000 years ago by the Greeks in attempts to protect their domestic animals.

The bounty system was brought to North America by the first settlers and it eventually became widespread throughout the United States and Canada. The town of Dover, New Hampshire, paid bounties on wolves to both Indians and white men as early as 1657. Since that time, more than one-hundred species of animals have appeared on North America bounty lists (Laun, 1971).
Bounties are still being paid in various States for a variety of animal species although the practice has been largely discontinued. The two main objectives of bounty systems, (1) keeping coyotes and other predators at low population levels, and (2) protection of livestock, have not been accomplished.

While bounties are still being paid in many states, the practice is objectionable to most wildlife scientists for the following reasons: (1) the bounty system is based on a "shotgun" philosophy for control; it is wasteful of both animal life and money, (2) bounty payments have failed to keep predator populations at low levels, (3) high to induce hunter participation. At a certain point bounty payments may equal or exceed the value of the livestock being protected, and (4) current bounty systems usually have loopholes which invite fraudulent claims (e.g., raising coyotes to turn in for payments or bringing animals from outside bounty areas for payments).

Nielsen (1973), suggests that if bounty systems are to be used, they could be made more effective in several ways. First, a uniform bounty system covering several states would be necessary to optimize effectiveness. This would limit the problems of coyotes being killed in one state and bountied in another and the problem where coyotes move from heavily hunted states to states where hunting pressure is light. Secondly, a bounty on female coyotes only or a higher bounty on females could, in the long run, be more effective than a general bounty. Thirdly, a very high bounty might be paid for pregnant females only. Of course, identification of pregnant females in the field would be difficult.
Extension Systems

The Missouri System of Extension Predator Control has been in effective operation since 1945. It has been highly satisfactory from both the public relations and economic standpoints. Its effectiveness is due primarily to a logical, direct simplicity. Essentially, it consists of training the landowner suffering damage to eliminate the specific individual doing it (Nagel, 1972).

An important and desirable point of the Missouri Extension System is that it concentrates on the individual doing the damage while the rest of its species, (by far the majority), remain to contribute their benefits as parts of the animal community.

An analysis of the extension system, following eight years of operation, found the annual costs to be about $11,500 (with two trapper instructors) in comparison with annual coyote bounty payments ranging from $55,000 to $165,000. It was also found that the trained farmer averaged 17.8 hours trap-tending time to catch a coyote, while the government trapper average was 60.3 hours. For the 26 years that this program has been operating in Missouri, ranchers have reduced their damage losses an average of 80 per cent.

Although this system works well in Missouri and Kansas, there is a question whether it would work as well in the West where ranches are much larger and coyote populations are very high.

Shooting

Shooting predators from the ground is the oldest, and probably least effective means for reducing their populations. Even
trained hunters often have difficulty because of the intelligence and elusiveness of the larger carnivores. A variety of methods are used including: calling (imitating the sound of a prey species to attract the predator), hunting from horseback, and using dogs. Although lacking in effectiveness, ground shooting is entirely selective for the species being hunted.

Aerial hunting has proven to be a very effective means of taking coyotes in some locations; however, it is subject to several limitations. The cost of hunting from aircraft can be prohibitive. Following the poison ban in 1972, the Department of the Interior attempted to evaluate mechanical control methods in a section of the Bridger National Forest in Wyoming. They found that the cost of operating a helicopter was $125.00 per hour. Costs for fixed-wing aircraft were not as high; however, they were not as effective as the copters. Average costs for all aircraft in the Bridger Study amounted to $61.01 per adult coyote taken.

An evaluation of aircraft use in 14 states revealed that helicopters were 93 per cent more effective and 214 per cent more expensive than fixed-wing aircraft. In addition, aerial control was used effectively in the spring and summer, in lower more open country, and mainly on coyotes. Aerial hunting was not effective (1) in protecting poultry, (2) in rugged terrain, (3) in dense vegetation, (4) in bad weather, and (5) on small carnivores (USDI, 1972).

Aerial hunting has been used effectively in Montana in the eastern half of the state where the terrain is relatively flat and open. However, hunting from aircraft in the mountainous, western half of Montana is difficult and not as effective.
Advantages of aerial hunting are that it is selective for the species being hunted, and it allows the hunters to cover large areas. Effective hunting from aircraft usually includes a ground crew to locate the coyote and direct the plane. Coyotes are located, on the ground, using a technique called howl elicitation where a hand siren, electric siren, or recording of a coyote is sounded, causing coyotes in the area to howl in response. Coyotes may be located from aircraft using grid searches of a particular area. When the coyote is located, a gunner in the aircraft, usually equipped with a 12 gauge shotgun, kills it.

Trapping

Trapping is one of the most widely used methods for taking coyotes and other predators. The steel-hold trap is the most effective type of trap, and has been in use for about 300 years. Trapping has continued in its popularity as a coyote control method because of its effectiveness in taking troublesome animals which may have become "educated" to control procedures. With most other methods, the coyote must not only be aware of the implement or material being used, but must react in a certain way to it; the trap works successfully against such animals because they are unaware of its presence (Robinson, 1962). Even so, some coyotes are not easily trapped. There is evidence that coyotes can learn to avoid traps (Robinson, 1948).
Major disadvantages of using traps are the time and attention necessary for their operation; their inefficiency during periods of wet and freezing weather; and the fact that other animals are often unintentionally trapped.

Trapping has been used extensively by both government agencies and private individuals who purchase trapping licenses from the State. Although trapping has been effective in the hands of trained personnel, objections have been raised concerning the practice. Probably the main complaints heard are that traps are non-selective and inhumane. Traps may be made more selective in the hands of trained professionals, using knowledgable placement. Devices making them more humane include; padded jaws, off-set jaws, and tranquilizer tabs attached to the traps (Balser, 1965).

**Denning**

This is a coyote control method used in the spring. Following whelping of the coyote pups and location of the den, the pups are destroyed. Although simple in principle, denning can be extremely difficult in the absence of good tracking conditions on the ground. Coyote dens can also be located from aircraft in open country. Under ideal conditions for locating the coyote's lair, denning can be an effective control technique. High predation by coyotes often coincides with pup rearing during the spring and summer because the adults must kill more frequently to feed the pups. Removing the young, during this period, can have a beneficial effect for the livestock in the area.
Toxicants

Experiments using poison bait stations for coyote control began in 1937. These experiments were carried out by the Control Methods Research Laboratory of the U. S. Biological Survey Agency. In the beginning, strychnine, thallium sulfate, and sodium monofluoroacetate (Compound 1080) were the only toxicants used for predator control work. Poisons used for government predator and rodent control programs (not available to the general public) are manufactured and stored in the Pocatello Supply Depot in Pocatello, Idaho. The depot is still producing strychnine and sodium cyanide for emergency predator control situations and experimental purposes. Poisons are also produced for bird and non-predatory animal control which was not affected by Executive Order 11643.

Following are the major poisons which have been used in predator control, their properties, methods of application, and their objectionable characteristics.

Strychnine

Six products containing strychnine were registered for use in controlling predatory animals. Strychnine, an extremely bitter tasting, white crystal, is a complex, naturally occurring, organic compound. Although the poison will probably bind to soil and decompose over a period of time, information on its persistence is limited. Strychnine is highly toxic to humans and animals. A 35 milligram dose is considered a threat to the life of an adult human and deaths have been reported from doses as little as 5 to 10
milligrams. Only small amounts of strychnine are needed to poison most animals.

Strychnine acts by interfering with the animal's normal neural processes, causing extreme muscle contractions and convulsions. Death due to respiratory failure follows. There is no true effective antidote for strychnine poisoning.

In predator control work, strychnine is usually placed in lard or tallow drop baits and distributed along coyote travelways or near carcasses.

Initially, strychnine was a very effective predator control poison and was credited with nearly exterminating the wolf in the United States. However, its original effectiveness diminished as coyotes and wolves learned to avoid its taste and smell. Strychnine is still in use for rabid skunk control.

The major arguments against strychnine use are that it is inhumane (the death process being long and painful), that it is nonselective, and that it can be responsible for secondary poisoning (scavengers may be killed by feeding on another animal killed by strychnine poisoning).

**Thallium Sulphate**

Thallium sulphate was first used in predator control programs in the late 1940s. However, because of its high toxicity and unselectiveness, its use was discontinued in the early 1950s. An incident involving thallium in Wyoming was responsible for focusing public attention on poison use more than anything else. This
occurred when 22 bald and golden eagles were killed from feeding on antelope carcasses injected with the poison. Subsequent investigations showed that thallium had been responsible for numerous other poisonings of non target species.

Thallium sulphate is a non selective toxicant, being poisonous in the same degree to all species. Death from thallium poisoning is slow and painful (usually 2 to 5 days, depending on dosage). Animals consuming sublethal doses may require two weeks for full recovery. There is no effective antidote for thallium poisoning following the onset of its symptoms.

**Sodium Monofluoroacetate (1080)**

Sodium monofluoroacetate was first used in the late 1940s and its use for predator control persisted until the ban on toxicants in 1972. After initial applications in the West during the 1940s, stockmen reported marked reductions in losses from coyote predation in Colorado and Wyoming (Robinson, 1948).

Four products containing 1080 were registered for use as mammalian predacides, and 1080 was also used in broadcast poisoning of rodents. 1080 use was restricted to west of the 100th meridian and to personnel of the Division of Wildlife Services or people under their direct supervision.

Compound 1080 is a white powder, soluble in water. It is very stable and, therefore, very persistent in ground water. The poison acts rapidly on the central nervous system and cardiovascular system with cardiac dysfunction resulting.
When 1080 was used in coyote damage control operations, the bait material, a carcass or portion of a carcass weighing 50 to 100 pounds, was treated at the rate of 1.6 grams of the poison per 100 pounds of bait material (35 ppm). Baits were then placed at established crossings and driftways having maximum use by coyotes, in habitats having minimum use by most non-target carnivorous species. This practice, in conjunction with the Bureau policy of low density bait placement (normally no more than one per township), and the much smaller home ranges of most non-target carnivores, precluded a large percentage of these non-target animals from even encountering the baits. Studies indicated that populations of non-target carnivorous species did not measurably decrease in the vicinity of Bureau control operations in the past 30 years (Denver Wildlife Research Center, Unpublished data) (Atzert, 1971).

According to Bureau policy, baits were placed as late in the fall as practicable and removed early in the spring. Bait locations were described in writing, and to further insure recovery, were attached to immovable objects. To protect domestic animals and man, baits were placed only after written agreements were signed with the landowner, lessee, or land administrator requesting coyote control. The baits were placed only in sparsely inhabited areas, area residents were notified, and appropriate warning signs posted.

The Bureau's use of sodium monofluoroacetate resulted in but 37 known incidents of domestic animal poisoning from 1959 through 1969. No human deaths have ever resulted from 1080 poisoning (Atzert, 1971).
Sodium monofluoroacetate was a widely used toxicant in predator control programs mainly because it was much more toxic to canine species than to other predators. For example, the LD50 (average dosage required to kill one-half of a very large population of animals) for coyotes is .1 milligram of 1080 per kilogram of body weight while it is 1.25 to 5.00 milligrams for the golden eagle. However, non target species may be killed if they consume enough material containing 1080. 1080 is 180 to 250 times as toxic to coyotes as thallium sulphate (Robinson, 1948).

For the five years preceding the toxicant ban, the following amounts of 1080 were used by the Bureau of Sports Fisheries and Wildlife for predator and rodent control (Balser, 1973):

<table>
<thead>
<tr>
<th>Year</th>
<th>Rodents</th>
<th>Predators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>287 lbs.</td>
<td>37 lbs.</td>
</tr>
<tr>
<td>1969</td>
<td>242 lbs.</td>
<td>27 lbs.</td>
</tr>
<tr>
<td>1970</td>
<td>105 lbs.</td>
<td>39 lbs.</td>
</tr>
<tr>
<td>1971</td>
<td>111 lbs.</td>
<td>22 lbs.</td>
</tr>
<tr>
<td>1972</td>
<td>70 lbs.</td>
<td>17 lbs.</td>
</tr>
</tbody>
</table>

Objections to 1080 use were mainly that it was inhumane (death coming usually after several hours from cardiac and/or central nervous system failure) and relatively unselective. Evidence has shown that non target species may be killed by consuming 1080 directly with the bait material, by eating 1080 killed coyotes, or by eating the vomit of a poisoned coyote (Robinson, 1948) (Atzert, 1971). There is no effective antidote following onset of the poison's symptoms.
**Sodium Cyanide**

Sodium cyanide is a water soluble, white solid which reacts with acids to form hydrogen cyanide gas. This chemical is among the most toxic and rapidly acting of all known poisons. Ingestion or inhalation of a very small dose (as little as 300 micrograms per liter of air) may result in rapid death. Recent data show four incidents involving cyanide compounds in Fiscal Year 1970, in three of which, human beings were injured by cyanide guns (devices placed in the field to dispense the cyanide) (Ruckleshaus, 1973).

**Coyote-getters**

The coyote-getter is a baited explosive device designed to kill coyotes by expelling a charge of sodium cyanide into the mouth when the bait is tugged. The "getter" (now replaced by the M-44 device) consists of a hollow metal stake closed at the bottom, a firing mechanism, a cartridge holder, and a 38 caliber cartridge containing sodium cyanide.

To set the coyote-getter, the stake is driven into the ground; the firing mechanism is attached to the top of the stake; and the cartridge holder containing the cartridge (covered with paraffined wool, cloth, or similar material to form the bait) is attached to the top of the firing unit and scent is added. When the coyote grasps the bait and lifts, the cyanide is discharged into the coyote's mouth. Death results in 30 to 60 seconds (Robinson, 1962).
Advantages of coyote-getters include quick, humane action and close recovery of the poisoned animal. In addition, Robinson (1943) found that coyote-getters were more efficient than steel traps because they did not need to be tended as often and, hence, more and longer "getter" lines could be used. In the same study, it was found that the coyote-getter was essentially as effective (99.6 per cent) as the steel trap in the number of animals taken and many times more selective (traps took 441 non predatory animals while the coyote-getters took only 26).

Objections to the coyote-getter were the danger to humans and non target animals from the poison and the top wad from the cartridge when it was fired.

The M-44 Device

In order to improve safety in field operations and to increase public acceptance, the Bureau of Sports Fisheries and Wildlife developed the M-44 as a replacement for the coyote-getter. The principal difference between the two is a substitution of a spring operated ejector mechanism for an explosive propellant.

The M-44 case is loaded with 12 grams of sodium cyanide, an additive to reduce caking, and a fluorescent tracer. There is a white plastic plunger wad and rubber follower at the bottom and a rubber wad at the top. Both top and bottom are sealed with a clear flexible sealant.

The trigger for the M-44 is the same as that used in the coyote-getter. Thrust is provided by a 40 pound spring.
The M-44 device is driven into the ground and baited with a scented tuft of wool or other animal hide. When the coyote tugs the bait the M-44 is triggered, ejecting the cyanide capsule into the animal's mouth.

The main advantages of the M-44 over coyote-getters are in reduced danger from the top wad to humans and other non target species of animals, and the reduced initial alarm of the coyote, resulting in recovery of the animal close to the device.

The M-44 was banned in 1972 along with toxicants; however, an experimental program has been initiated in Montana and other States to gather information for the possible registration of sodium cyanide by the Environmental Protection Agency.

Fences

Fencing of pastures with "coyote-proof" fences has been tried for many years in some areas. The results of the fencing in protecting sheep have varied, but generally, fences have been unsuccessful because of many limitations (Robinson, 1962). A "coyote-proof" fence usually consists of an above ground section (too high for a coyote to jump) and a below ground portion (to prevent digging under). Limitations to this type of fencing include: (1) high cost of materials and installation for large acreages, (2) weak spots along water courses and ravines, and the ability of many coyotes to enter a pasture by climbing over the fence.

Jardine (1911) learned, in a one year study, that the advantages of a "coyote-proof" fencing system included: (1) increase in the
percentage of lambs saved, (2) decrease in the amount of labor necessary to manage the sheep, (3) better condition of both ewes and lambs at the end of the lambing season, and (4) a decrease in acreage of range necessary to handle small flocks of sheep. Jardine also noted that the cost of fencing and successfulness depended upon location and individual operation.

Coursing With Dogs

According to Robinson (1962), chasing coyotes with "running hounds" of the greyhound, Russian wolfhound types has given striking results in the past but is becoming increasingly less effective with settlement of the country. Fences that accompany settlement are barriers to horses or cars that may be used in following the dogs. Robinson feels that this method is generally more of a sport than a coyote control measure; however, some ranchers have had extraordinary success in protecting their flocks using the large hunting dogs (Missoulian, 1974).
CHAPTER V

COYOTE MANAGEMENT RESEARCH

In the past, predator management programs have primarily been limited to attempts to curtail economic losses to domestic livestock, disease suppression, or reducing predator populations in an effort to enhance other wildlife populations. Following Executive Order 11643 and general dissatisfaction with the results of control operations, the Department of the Interior increased and redirected its research efforts. In 1974, an additional $800,000 was reprogrammed into predator damage research, for a total of $1,100,000. With 20 Fish and Wildlife Service personnel involved in the research and contracts at seven Universities in support, the research program is divided into three major areas: (1) the identification and measurement of damage, (2) predator ecology and behavior, and (3) development of means of reducing livestock losses (USDI, 1974).

Following are explanations of the major research areas together with summaries of some of the investigations to date. It should be realized that these are by no means all of the research programs being undertaken. In addition to federal research, research is proceeding at many universities, and investigations are also taking place at the state level. In 1973, the first issue of an unofficial publication of the Bureau of Sports Fisheries and Wildlife, the
Coyote Research Newsletter, listed 92 on-going and planned investigations. The second issue, August 1974, details more than 26 coyote research endeavors initiated in the past year as well as more than 140 literature citations in regard to coyotes since 1970. The newsletter was generated in the interest of expediting contacts and communications within the research community studying coyotes, predation ecology, depredation control, and coyote management.

**Damage Assessment**

Efforts at characterizing the degree and nature of livestock losses are at the heart of the predator control controversy. Intensity levels of coyote management operations are based, to a large extent, on assessed or anticipated damage caused to stock. For this reason it is imperative that accurate measurements of predation be made. Unfortunately, damage estimates in the past have often been questionable. In the West, major problems have been, (1) failure to locate livestock carcasses, (2) failure to accurately assess the cause of stock mortality, (3) bias on the part of ranchers (eg., a coyote is seen scavenging on a disease killed animal, so a predator kill is reported), (4) deliberate inflation of loss figures by ranchers, field agents, or both, and (5) confusion regarding statement of loss figures (eg., losses can be stated as a percentage of total sheep lost to predators, a percentage of total lambs lost to predators, or a percentage of predation losses to total losses).

With regard to sources of loss figures, Balser (1974) lists six available sources. These sources were also commented on by Cain et al.
(1971), and Leopold et al. (1964). Following are the more important sources of livestock loss data together with some of the problems associated with using them: (1) United States Department of Agriculture Statistical Reporting Service. This data consists of total losses by states for ewes and lambs as reported by questionnaires. The SRS total loss figures do not assign causes but at least set an upper limit on predator losses. The SRS figures may be too low for lambs because of the lack of fetal birth rate counts (number of lambs actually born) for either range or shed lambing operations. Rather, they are based on standing lamb counts or counts at the time of tail docking, (2) Questionnaire surveys in Texas, Colorado, Wyoming, and Montana reported in a review by Reynolds and Gustad (1971). This data gave an overall estimate of 5.3 per cent average predator loss to the sheep industry, (3) United States Forest Service. Data consists of reports to the Forest Service by grazing permittees on total losses, including predation. Bias exists because losses are stated only for the summer grazing season and also because the Forest Service counts only adult animals; females with young under six months are counted as one animal unit, (4) Personal interviews by Nielson and Curle (1970). The interview information from two studies revealed that approximately 50 per cent of the ranchers reported less than 5 per cent predator losses, 25 per cent of the ranchers reported 5 to 10 per cent predator losses, and 25 per cent reported over 10 per cent predator losses, (5) Division of Wildlife Services Records. These records have information such as the magnitude of control efforts in terms of dollars spent, total numbers of animals taken by control operations, and in some cases, observations on sheep losses. Recent
attempts by the Division to tabulate loss data to determine the number of signed control agreements in relation to numbers of sheep operators in each state, the acreages under control, the number of sheep and calf loss complaints, or the number of confirmed and unconfirmed sheep and calf losses have not met with success. A problem has been the slowness of ranchers in reporting losses. Delayed loss counts cannot be verified.

Another source of loss data is surveys carried out by individual organizations or States. Livestock organizations and many other groups frequently conduct loss surveys in order to keep abreast of the predation situation.

Because questionnaire and interview studies do not yield the reliable data gained from biological field studies, current Department of the Interior research is orientated towards field investigations patterned after investigations by Davenport, Bowns, and Workman (1973). In these field studies, attempts are being made to locate and necropsy all dead animals to determine actual predator kills. Proper identification of livestock loss and accurate measurement of loss are prerequisites to solution of the animal damage problem.

Four studies are now underway in the States of Idaho, Wyoming, Montana and New Mexico to measure livestock losses on 16 selected herds of sheep by daily searches on foot, horseback, and 4-wheel drive vehicles. All dead animals found are necropsied and predator losses are separated from other causes of mortality.
Idaho

In the Idaho shed-lambing operations, nine bands of sheep suffered a minimum confirmed predator loss of 1.1 per cent in 1973 and 1.6 per cent in 1974. The maximum predator loss was 4.4 per cent in 1973 and 4 per cent in 1974. The reason for the increase in minimum confirmed loss and decrease in maximum predation loss is the increased intensity of search and experience of the crews which reduced the unknown losses. The new result is no significant change in losses between 1973 and 1974 in the Idaho studies (USDI, 1974).

Wyoming

Five bands of sheep have been tracked for 1.5 years. The results show a confirmed 1 per cent predator loss on the lamb crop in 1973. Total losses were 5.6 per cent. Lamb losses from predation in the first part of 1974 were 2.1 per cent, while total losses were 14 per cent. No significant changes have occurred between 1973 and 1974.

Mortality-detecting telemetry equipment will be used in this study which will enable researchers to locate dead lambs within a few hours of death wherever they are. This equipment should greatly reduce the magnitude of unidentified losses reported in other studies.

Duplication of the Idaho and Wyoming studies are planned in 3 to 5 locations in the western United States (Knowlton, 1973).

Montana

A study is currently underway, by contract with the University
of Montana, to determine sheep losses in the absence of any predator control. The study, being conducted on the Bill Cook ranch near Florence, in Western Montana, has resulted in the loss of 354 lambs as of Dec. 3, 1974, from coyote predation out of 477 total deaths since April 1, 1974. This loss is from a lamb crop of 1300 lambs, a 27 per cent loss to predators. No significant change in the rate of predation between 1973 and 1974 has occurred even without predator control in 1974.

New Mexico

This is a comparable study to the one being carried out in Montana although it is being monitored with telemetry. While this was intended to be a study without predator control, the ranches surrounding the study area exert heavy control and definitely reduce losses on the study herd. Results to date reveal that from a lamb crop of 339 lambs, there were 50 confirmed predator kills out of 130 deaths or 14.7 per cent of the flock was lost to predation even with perimeter predator control.

If all data from the above studies are grouped together, it appears that predator losses are from 1 per cent to 4 per cent under intensive predator control. Also, in general, about 20 per cent of the ranchers may sustain heavy losses while the remaining 80 per cent under an intensive control program have a loss range somewhere between 1 and 4 per cent. Without predator control, losses may run 15 to 25 per cent (Balser, 1974)
In a Utah study in 1972 sponsored by Utah State University, verified predator losses, as a percentage of total losses, on 10 herds of sheep (on spring and summer range) ranged from 1.8 per cent to 40.3 per cent. Losses expressed as a per cent of the total lamb crop ran from .2 per cent to 4.1 per cent.

This study also attempted to evaluate factors affecting the magnitude of losses. Five of the sheep herds were accompanied by a fulltime herder while the other five were untended. The number of sheep in each category were approximately equal.

The unherded group had a verified predator loss of 192 lambs or 71.4 per cent of the total. The herded group had a verified loss of 77 lambs or 28.6 per cent of the total. The physical presence of the herder and his dogs probably accounted for the difference in damage. Other factors considered to reduce predation were field agents, bounty hunters, and trappers all of which removed a number of coyotes (Davenport, Bowns, and Workman, 1972).

Future research will need to examine (1) measurement of extreme losses compared to average loss to determine if there is a managable characteristic or vulnerability in heavy loss situations, (2) extent of calf losses, and (3) damage assessment on a broader range of damage problems and to determine, on a percentage basis, the number of ranchers suffering heavy, medium and light losses.

Predator Ecology and Behavior

Predator ecology is the study of the natural functions of predator populations, the effects the environment imposes on predators, and the effects predators impart to the rest of the biota.
In order to assess the effects of control programs on coyote populations and range ecology, and in order to formulate effective control programs, it is necessary to more fully understand the coyote's ecologic and biologic role in nature.

Although limited coyote research has gone on for many years, comparatively little is known about the species at this time. The natural intelligence and elusiveness of the coyote, the vast expanses of the coyote's range, and variety of environments within it have caused difficulty in sampling coyote populations and handicapped research efforts to date. Notwithstanding, the majority of predator control oriented research at this time is aimed at coyote ecology. Although determining the coyote's role in the natural scheme of things is probably the most difficult problem in animal damage research, it is extremely important. Natural functions of coyote populations must be fully understood before their role as predators on domestic sheep and cattle will become clear. In addition, economic evaluation of predation is impossible without a thorough understanding of the biology of predation (Craighead, 1951).

Inquiries into coyote ecology are numerous and varied; however, certain areas are currently receiving proportionately more interest. The more important fields of investigation follow.

Coyote Population Dynamics

Determination of coyote population densities is an extremely difficult but necessary task for researchers. Knowledge of densities should be an integral part of formulating control strategy for a given
locales (e.g., type of control, level of control needed, and duration of control). Without prior knowledge of coyote densities, evaluations of control efforts are both difficult and incomplete.

Methods of determining coyote density in the past have been crude and lacking in reliability. These methods have relied mainly on trapcatch ratios (Robinson, 1961) (Linhart and Robinson, 1972), although other techniques have been used such as track counts, scat counts, elicited howling responses, and aerial surveys.

In an effort to obtain more precise measurements of carnivore densities and population trends, an annual index of carnivore abundance was initiated in 1972 (Linhart and Knowlton, 1973). Through the cooperative efforts of the Bureau of Sports Fisheries and Wildlife, the Bureau of Land Management, the United States Forest Service, State Fish and Game Agencies, and some academic institutions, a scent post indexing technique was utilized on some 328 census lines located throughout 17 States west of the 94th meridian. The main reason for the survey was to gain information on coyote density although other carnivores were also included.

Indices of relative carnivore abundance were obtained for each survey line by totaling the number of operable scent post stations visited by each species for a succession of five night periods. The total number of "scent station nights" was derived by subtracting from a maximum of 250 station nights (50 stations x 5 nights) all those that were inoperable because of human interference, weather, or animal interference. The index was then calculated as follows:

\[
\text{Index} = \frac{\text{Total Number of Animal Visits}}{\text{Total Number of Operable Station Nights}} \times 1,000
\]
In 1973, the same techniques were used to determine abundance indices although five new survey lines were added. Results of the 1972 and 1973 indice surveys follow:

<table>
<thead>
<tr>
<th>State</th>
<th>1972</th>
<th>1973</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington</td>
<td>91</td>
<td>85</td>
<td>-7</td>
</tr>
<tr>
<td>Oregon</td>
<td>128</td>
<td>97</td>
<td>-25</td>
</tr>
<tr>
<td>California</td>
<td>128</td>
<td>138</td>
<td>+8</td>
</tr>
<tr>
<td>Nevada</td>
<td>92</td>
<td>91</td>
<td>-2</td>
</tr>
<tr>
<td>Idaho</td>
<td>85</td>
<td>68</td>
<td>-20</td>
</tr>
<tr>
<td>Montana</td>
<td>61</td>
<td>73</td>
<td>+20</td>
</tr>
<tr>
<td>Utah</td>
<td>76</td>
<td>50</td>
<td>-35</td>
</tr>
<tr>
<td>Wyoming</td>
<td>51</td>
<td>62</td>
<td>+22</td>
</tr>
<tr>
<td>Colorado</td>
<td>110</td>
<td>136</td>
<td>+24</td>
</tr>
<tr>
<td>New Mexico</td>
<td>80</td>
<td>122</td>
<td>+54</td>
</tr>
<tr>
<td>North Dakota</td>
<td>49</td>
<td>47</td>
<td>-4</td>
</tr>
<tr>
<td>South Dakota</td>
<td>66</td>
<td>111</td>
<td>+68</td>
</tr>
<tr>
<td>Arizona</td>
<td>152</td>
<td>149</td>
<td>-2</td>
</tr>
<tr>
<td>Nebraska</td>
<td>102</td>
<td>237</td>
<td>+131</td>
</tr>
<tr>
<td>Kansas</td>
<td>159</td>
<td>147</td>
<td>-8</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>143</td>
<td>207</td>
<td>+44</td>
</tr>
<tr>
<td>Texas</td>
<td>135</td>
<td>148</td>
<td>+10</td>
</tr>
</tbody>
</table>

Following comparisons of the 1972 and 1973 indices, there were indications that coyote numbers had declined in the inter-mountain area but had increased in many of the States east of the Continental Divide. These changes were considered within the range of normal
fluctuations attributed to food base.

In 1974, the same survey methods were used as before; however, the number or census lines exceeded 425. Data from the 1974 survey are currently being tabulated.

It should be noted that these indices express only relative abundance, there being no way to relate them with actual coyote numbers at this time.

The above study will be extremely useful in determining long term coyote population trends and in evaluating the effectiveness of lethal controls, although it will not assign absolute numbers to coyotes. A current computer study suggests a reasonable degree of reliability in the use of scent station indices in assessing coyote abundance.

At this time, ideas of absolute densities for coyotes are frequently limited to educated estimates. A breeding population of 1.5 per square mile and a postwhelping population of 2.0 per square mile in a six county area of Kansas was established by Gier (1968). Clark (1972), estimated postwhelping season densities in Curley Valley, Utah at one coyote per 2 to 4 square miles. According to Knowlton (1972), coyote densities appear to range as high as 5 or 6 per square mile under extremely favorable conditions, with 0.5 to 1.0 per square mile seemingly realistic over a large portion of their range.

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In 1972, Connolly (1972) formulated a coyote population model using data from Knowlton (1972) and Gier (1968). Following computer analysis his conclusions were: (1) coyote populations have a high rate of natural annual turnover, (2) coyote populations can persist or even increase when subjected to high levels of control mortality due to compensatory adjustments of reproductive and natural loss rates, (3) of the compensatory adjustments, the amount of reduction in the natural loss rates may be the more critical parameter determining the ability of the population to withstand control efforts, (4) in terms of coyote population dynamics, birth reduction may give more effective control than killing coyotes, and (5) all these population parameters fluctuate over time. It would be useful to know which parameters are most sensitive to changes in the natural food base as well as alternative food supplies (livestock).

The Department of the Interior will initiate further density studies in the future. In addition, other aspects of coyote population dynamics will be investigated. Current interests are in documenting reproduction and dispersal and mortality patterns among unexploited coyote populations. The latter studies will serve as a basis for interpreting the effects and reactions within populations exposed to various degrees of exploitation. Of particular interest are the causes of mortality among coyotes within populations free from human interference (Knowlton, 1973).

Coyote reproductive biology is of interest for several reasons. Researchers would like further information about natural population increase as well as the factors that affect this increase. This information would be useful in conjunction with recent studies using
antifertility drugs in reducing coyote reproduction. Studies by Kennelly (1972) and Linhart et al. (1968) have added to the available information, but more study is needed.

**Predator-Prey Relationships**

Another area of importance is predator-prey relations. Predator-prey interactions need investigation from the standpoint of density. Studies have been started to determine the relationships between coyote density and prey biomass. The converse of the predator-prey interaction, namely, the influence of predators on prey populations, must also be taken into account. Studies by Knowlton (1968), Balser et al. (1968), Clark (1972), and Wagner and Stoddart (1972) suggest that, under some conditions, predators may significantly affect prey population parameters.

With respect to domestic sheep, it has long been assumed that coyote predation is in direct proportion to coyote numbers and density. Further research is needed to clarify this question; however, some preliminary work suggests that this might not be the case (Balser, 1973).

**Coyote Behavior**

According to the Department of the Interior (USDI, 1974), coyote behavior studies will include the sensory capabilities used by coyotes in seeking and selecting prey as well as the mechanisms used to regulate intraspecific interactions. While a major part of these efforts may appear very basic, they will serve as cornerstones for
utilizing behavioral technology as a means of resolving management conflicts. Defensive behavioral mechanisms employed by prey species will also receive attention.

**Depredations Control Methods**

Historically, Federal predator control research has concentrated on the development of effective lethal chemicals and devices. Since Executive Order 11643, however, the Department of the Interior has redirected research efforts to provide increased attention to development of nonlethal control methods. Although the emphasis is now on nonlethal tools, work is going on to find selective lethal techniques as well. In this regard, scientists are experimenting with a cyanide collar to be worn by sheep. If this concept works, it will not only be almost totally selective for coyotes, but it will also affect only those coyotes killing sheep. This would be an ideal control method.

Generally speaking, research into nonlethal control methods is still in the planning or preliminary laboratory stages. Much more work will be needed before most of these methods will be evaluated and tested on coyotes in the field. Following is a summary of the nonlethal coyote management methods presently under study.

**Antifertility Agents**

The search for nonlethal coyote control methods prompted investigation of antifertility agents to limit reproduction. By suppressing reproduction in a population, to a level below that of natural mortality, a population may be controlled with greater certainty than by
increasing one or more mortality factors (Balser, 1964). To this end, an investigation was started by the Denver Wildlife Research Laboratory. Researchers chose the following criteria for a good antifertility agent for field use: (1) preferably, the agent should be effective in a single oral dose on either or both sexes at one or more vulnerable stages of reproduction; (2) there should be a wide margin of safety between the effective and lethal dose to preclude the chance of any animal picking up a lethal dose; (3) it should be relatively stable, inexpensive, and effective in doses under 500 milligrams for practical field application; (4) it should be relatively tasteless, odorless, or capable of being masked so it will not cause aversion to baits. Acceptance without side effects, such as nausea, is important for the same reason; and (5) the sterility effect should be temporary, for one breeding season or one year, depending on the animals breeding habits. Suppression of reproduction can then be applied or withdrawn at will without permanently affecting either the target species or the other species that might be exposed.

Following review of the literature and consultation with drug companies, the drug diethylstilbestrol was chosen as best meeting the above requirements.

In penned tests with diethylstilbestrol (often referred to as stilbestrol), pregnancy was terminated in six coyotes, using a 100 milligram oral dose of the drug. Linhart and Enders (1964) obtained similar results using a 50 milligram dose of stilbestrol for captive red foxes. In both of the above tests the time of application of the drug was critical. It was found that stilbestrol could be very effective during or just after mating in suppressing reproduction. A
limiting factor in the wild, however, is that reproduction is spread over a period of time among individuals so application of an agent effective at short, critical periods, such as ovum transport, fertilization, or implantation would mean that only a small proportion of females would be affected at any one time.

In field tests during 1963 in New Mexico, tallow drop baits with 100 milligram doses of stilbestrol were used to test the drug’s effects on coyote reproduction. Results showed that only 20 per cent coyote reproductive success occurred in treated areas (Balser, 1964).

Further field tests were made until 1967, using stilbestrol and incorporating a long-term marker, demethylchlortetracycline (DMCT). DMCT induces a golden yellow fluorescence in the bones and teeth of coyotes eating the bait for at least 5 months (Linhart and Kennelly, 1967). This procedure permitted investigators to obtain both treated (marked) and untreated (unmarked) samples from the same population and eliminated differences in reproductive success resulting from density-dependent or ecological factors.

Results of this particular study were inconclusive. Reproductive success was only 20 per cent in one treated area; however, in other treated areas reproductive success was comparable to the untreated control areas. It was recommended that development of other antifertility agents besides stilbestrol be undertaken because stilbestrol exerts its primary effects between ovulation and implantation, a relatively short period of time. Therefore, to be effective, this compound must be eaten by females during this limited period (Linhart et al., 1968). Results in this study might have been better had better methods of bait placement been used. Rodents and birds
removed large numbers of the tallow baits in some test areas.

Results of the above tests with stilbestrol indicated that wild coyote populations can be successfully treated. Whether or not this would occur to a large extent under a wide variety of field conditions is not known.

Recent developments in England indicate that certain alkylating agents, such as isopropyl methane may be effective in causing male sterility for a sufficient period of time when given a single oral dose. Tests have been planned.

Another antifertility drug, mestranol, has been tested on dogs with promising results. Mestranol interfered with embryo survival in female beagles when administered either 6 or 21 days after the female first accepted the male. The long term effects or the side effects of the drug were not determined. Mestranol could possibly be applied in suppressing reproduction in other canines including the coyote (Kennelly, 1969).

Aversives

Research into aversive agents to be used in depredations control programs has been going on for a number of years. Although aversives hold promise as an excellent nonlethal technique for protecting sheep from coyote attacks, they are still in the pen testing stages.

A most promising study was begun in 1973 by Gustavson and Garcia (1974) who attempted to initiate a conditioned response to the taste of food in captured coyotes. It was reasoned that if coyotes became sick following a meal of meat, they might be conditioned to
avoid this type of meat in the future. If this approach worked in
pen tests it could conceivably work in field operations.

The aversive agent used in this study was lithium chloride. It
probably holds the most promise for eventual field use. Results
showed that coyotes learned to avoid lamb meat tainted with lithium
and, after a period, live lambs.

One of the drawbacks of aversive agents, such as lithium, will
probably be that coyotes will have to be reconditioned periodically
(test coyotes eventually started to eat the type of meat that had
originally made them sick).

Other aversive agents have been experimented with in recent
years including bad smells such as skunk odor or mountain lion urine,
and devices such as electric collars.

Penned tests have been completed using two candidate aversive
agents, DRC-6081 (a bitter compound) and DRC-5593 (a compound causing
an intense burning sensation). Other emetus or nausea producing
compounds are also being tested (USDI, 1974).

Attractants

The role of pheromones as a possible attractant for coyotes is
being investigated. Tests on trap lines in Wyoming have raised some
interesting questions about coyote responses to a group of five fatty
acids that make up a pheromone complex in a number of mammals. A
recent field test with pheromones revealed that old "snaggle-toothed"
coyotes were being taken rather than young inexperienced animals.
Apparently these older animals had been avoiding local control efforts
for years (Reed, 1973).

**Tranquilizers**

The need for capturing adult coyotes in good condition for experimental use led to the development of a tranquilizer trap-tab to eliminate or reduce injuries incurred in steel trapping. Other types of tranquilizers are being studied at present.

In one study, the drug "diazepam" has shown utility in reducing injuries to carnivores caught in steel traps and in preventing their escape (Balser, 1965). In this instance, the drug was enclosed in a chewable cloth capsule and wired to the trap jaw. The dose for coyotes was 1 gram of "diazepam" per capsule. Following capture, it was found that most coyotes chewed the cloth capsule and ingested enough of the drug to produce the symptoms of ataxia, salivation, lack of attention, drowsiness, and reduction or absence of biting. Seventeen coyotes were captured and only one failed to ingest the tab in field tests. This study showed that tabs also were effective, in some degree in tranquilizing various numbers of foxes, badgers, skunks, and bobcats.

Advantages of using tranquilizers in conjunction with steel traps or other programs are, (1) taking animals unharmed for various purposes, (2) enabling easy release of recalcitrant animals and reducing foot damage, and (3) helping prevent the escapement of trapped animals and making the steel trap more humane.

Direct application of tranquilizers in the form of injected drop baits are of interest. Coyotes tranquilized in this manner
would be more unwary and would be easier to take by other control methods.

**Mechanical Devices**

Ongoing experiments using mechanical control devices include various forms of "coyote-proof" fencing and electric fencing. Contractual studies are underway at Colorado State University to determine which of the highly developed senses of the coyote are most subject to chemical or mechanical means of inducing prey avoidance.
CHAPTER VI

THE SHEEP INDUSTRY

In order to more fully understand the controversy over animal damage control it is necessary to gain insight into the sheep raising industry, their operations, and their problems.

Sheep raising has long been an important part of the nation's livestock industry. Its advance into the western part of the country coincided with expansion of the frontier.

Sheep thrive under a wide variety of physical and biological conditions. They graze well on terrain too rough, high, and arid to be habitable by other domesticated animals, and can make use of plant species which might be too sparse or unpalatable to other species of livestock. Sheep are among the most efficient domesticated ruminant animals in the conversion of roughages, and they blend well either as a supplementary farm enterprise or a highly specialized enterprise (Goodsell and Belfield, 1972).

Types of Operations

Sheep-producing units can be classed into three major types of operations; farm flocks, stock farms, or sheep ranches.

Farm flocks are extremely varied as to size, but generally average about 40 head per unit. The farm flock is basically a
supplementary type of enterprise used in conjunction with agriculture or other stock raising. Farm flocks make up nearly 95 percent of all U. S. producing units, but produce less than a third of the lambs and wool.

Stock farms generally average around 500 sheep per unit, few exceeding 1000 head. This group produces about one-fifth of U. S. sheep.

Sheep ranches are found mainly in the Western and Southwestern United States. They vary in size, and may range from 1,500 to 10,000 head per ranch. This type of operation produces more than half the lambs and wool in the U. S.

Decline of the Sheep Industry

From 1890 to 1940 sheep numbers in the U. S. fluctuated between 40 and 50 million head. A big crash in sheep numbers occurred between the years 1940 and 1945 when the sheep population declined from 40 million to approximately 26 million. The decline in numbers of sheep has continued to the present time, and it is estimated that there are now only 16,500,000 head in the U. S., concentrated mainly in the West (Appendix 4).

Reasons for the Decline

The sheep industry's decline can be attributed to a variety of factors, including (1) labor shortages, (2) low prices for lamb and wool, (3) predation, and (4) competition from foreign markets. All of the above factors have played a part in the decline of the sheep
industry, however, the biggest single contributing factor was labor shortages (Wilson, 1973) (Cain et al, 1971) (Evanson, 1967).

The labor shortages which had to be faced by the sheep industry came as a result of the manpower requirements of World War II. The shortages were a crucial blow because they were mainly in the form of trained herders. The importance of these herders to range sheep operations cannot be overestimated.

Sheep have been called the most dependent, defenseless, and instinctively deficient of all domestic animals. Thousands of years of inbreeding to obtain high quality meat and wool has made the sheep relatively helpless, requiring human assistance throughout their lives.

At lambing time the ewe has an absolute need for human assistance. Losses on ewe flocks average five percent, most deaths resulting from lambing complications (Evanson, 1967). Numerous lamb losses also occur at this time from such causes as inclement weather, predation, disease, abandonment, and malnutrition.

On the range, adult sheep are subject to the above causes of mortality and many more. Drownings, over-exposure to the sun, parasites, improper diet, and poisonous plants are all responsible for numerous deaths each year.

Much sheep mortality on the open range is preventable providing the animals have adequate human supervision. It was only natural that sheep numbers declined, and losses from all causes increased, following the herder shortages.

The sheep industry never fully recovered following the labor shortages and drop in stock numbers. Additionally, further economic
woes beset the wool growers in the form of increasing losses to coyotes, low wool and lamb prices, reduction in grazing quotas on Federal lands, increased operational costs, and competition from foreign markets. All of these factors were responsible for driving a considerable number of marginally successful sheep operators out of the business.

At approximately the same time as the initial decline in sheep numbers occurred (mid 1940s) coyote populations were low throughout much of the West. These low numbers were attributed, mainly, to the initial success of the chemical control programs which had started in the early 1940s. However, the coyote populations may have been at cyclic lows during this period.

Either because of normal population fluctuations, or reduced effectiveness of control programs, coyote numbers increased during the late 1940s and throughout the 1950s (this is based purely on observations by field agents and ranchers--there being no way to assign an absolute number to coyotes at that time). At this same time complaints of increased losses of sheep to coyote predation began to be heard. These complaints have persisted to this day, and now most sheepmen claim that the coyote is the single most detrimental factor to the industry. A frequently quoted figure from the wool growers is that the coyotes cost them $20,000,000 a year. Whether this figure is inflated or not, the coyote is a considerable financial burden to the industry which operates on a narrow profit margin. The narrow profit instability of the wool producing industry led to government assistance in the farm subsidies.
Subsidies to the Sheep Industry

The Federal Government subsidizes the sheep industry in three ways; (1) wool tariffs, (2) wool incentive payments, and (3) predator control.

Wool Tariffs

American sheep raisers do not produce enough wool to satisfy domestic needs. In an attempt to reduce the dependence of American consumers upon imported wool, protective tariffs have been enacted. The tariff on woven woolen fabrics valued at over $2.00 per pound is 37.5 cents per pound plus 38 percent ad valorem. This adds $1.135 to the price of each pound of this fabric. According to Evanson (1967), the tariff has not been successful because wool production declined in spite of the higher prices received by wool growers, while imports of raw wool and woolen fabrics continued to rise.

Wool Incentive Payments

Price supports (called wool incentive payments), tied to the current market prices, are authorized by the National Wool Act of 1954, which declares that, "it is the policy of Congress, as a measure of national security and in promotion of the general economic welfare, to encourage the annual domestic production of 300 million pounds of shorn wool." When wool prices are low as in 1971, 19.4 cents per pound, incentive payments are high. For instance, in 1971 subsidies of 271.1 percent were paid to bring the price of wool up to the 72 cents per pound level set by the Wool Act.
Funds for incentive payments are derived from tariffs on wool. Up to 70 percent of the accumulated total of funds from wool tariffs may be used for incentive payments.

Predator Control

Predator control activities are carried out mainly to protect the western sheep industry. A good part of the funding for the program is derived from public monies by Congressional appropriations. In 1971, for example, the Federal Government spent $1,700,000 for coyote control in the western United States. The 1973 and 1974 budgets are approximately 4 million dollars.

Montana’s Sheep Industry

Montana’s sheep industry is similar to the western sheep industry in general. It is comprised largely of range sheep operations east of the Continental Divide with farm flocks located mainly west of the Divide.

The sheep industry in Montana has followed the same pattern of decline as the industry as a whole. A 1973 survey, carried out by the Montana State Livestock Department, showed that the number of sheep in 19 of Montana’s largest sheep producing counties (representing 70 percent of the sheep population) during the past 12 years has steadily declined (Sayler, 1973). Montana Crop and Livestock Reporting Service figures show that sheep and lambs on Montana farms and ranches January 1, 1974 totalled 794,000 head—a decline of 17 percent from last year. The inventory of total sheep and lambs on a national basis
on January 1, 1974 was 16,500,000 head—a decline of 7 percent from 1973. Wool production figures for Montana and the United States as a whole have also declined from earlier levels. Montana wool growers sheared a total of 7.7 million pounds of wool, grease basis, in 1973—down 10 percent from a year earlier. Nationally, the 1973 production of wool was 153.9 million pounds, grease basis—down 8 percent from 1972.

A survey carried out in December of 1973 by the Montana Wool Growers Association, which represents 90 percent of the State's 2,700 sheep men, showed a 58.5 percent increase in predator losses from 1972 to 1973, and estimated that many ranchers have lost from 20 to 40 percent of their total lamb crop. Predation is the number one problem to Montana sheep producers according to this survey (Montana Wool Growers, 1973).

The frequency of predation problems seems to fall within three general categories in Montana. First, chronic problems occur from year to year in certain areas during April through October with high lamb losses. Calf losses occur from March through May. Secondly, seasonal problems occur each year with sporadic predation at times reaching chronic proportions. However, the total amount and duration of intensity fluctuate greatly from month to month and year to year. Thirdly, irregular predation problems exist when livestock producers have little or no consistent annual predation problems. Then livestock producers may experience losses of chronic proportions (Montana Department of Livestock, 1974).

It is uncertain what the future holds for the sheep raising industry in Montana or the United States. Whether it will continue to
follow the pattern of decline which has already been set or whether it will regain some of the earlier prominence it once enjoyed is not known. Whichever course the sheep ranching business takes will depend upon the economic factors influencing any business, use of proper operational techniques, and the effectiveness of coyote management programs.
CHAPTER VII

DISCUSSION

The predator control controversy has raised issues that demand resolution and which reflect the public's growing environmental awareness and the need for sound planning in wildlife management programs.

Predator control activities were started when the concept of "environmental impact" was still in the future. As time passed, the public's attitudes changed and mass reduction of predator populations, by whatever means, became less and less popular. Even so, the country's livestock producers still had to make a living and to them predator control was a necessity. The Wyoming eagle poisoning incident focused public attention on the government's control activities and increased the outcry at animal damage control. The ban on toxicants which followed had the same effect on the nation's stockmen who began to claim increased losses and call for more effective control efforts. This is a large part of the predator control controversy; one of the hottest issues to come along in years.

Solutions to the conflict will not come easily and time will be required before research can provide information to fill the gaps in knowledge which now exist. It was one of the shortcomings of the government's control program that little attempt was made to accurate-
ly assess either the public's attitude on control or the effectiveness of the program itself. As a result, the Federal Government is now involved in a crash research program which will eventually produce solutions to the conflicts. These solutions will lie somewhere between the extreme viewpoints of no predator control and vastly increased control programs using all available weapons.

Most conservationists agree with the livestock producers that some control is needed in the West; however, the questions of supervision, cost, and methods still have to be settled. The major issues involved in the present controversy were outlined in Chapter Two. Recent research has provided insight into some of the problems brought out in Chapter Two and I believe that some of the points in contention can be resolved at this time.

Administration of Control Programs

Legislation currently before Congress, if passed, will shift the burden of predator control to the States. Whether the States can accomplish any more than the Federal Government accomplished is not known at this time; however, a large degree of the success will depend upon which State agency will have control responsibility. There has been heated debate in Congress over this very point. H. R. 38 specifically designates the State agency for wildlife management to administer the State's Federally funded predator control program. H. R. 4759 leaves the question of administration up to the State, requiring only that such a program be "reviewed" by the wildlife agency. H. R. 11266 provides for the program to be jointly approved
by the appointed State agency and the agency for wildlife management, if the latter is not the one designated to administer the program.

I believe that the responsibility for a predator control program should fall to the State agency for wildlife management. In Montana, this would be the State Fish and Game Department. This agency is in the best position to oversee control activities to prevent damage to the numerous animal communities connected with control of predators. While the Department of Livestock has been responsible for carrying out Montana's coyote control program in the past, it is my opinion that this agency may be too closely associated with the State's livestock interests.

A close association of this type could lead to conflicts in control program administration. Conflicts must be avoided in predator control programs wherever possible because the programs have such far-reaching consequences. For this reason, I feel that the State Department of Fish and Game should administer animal damage control programs with direct input by, and in coordination with, the Livestock Department.

**Toxicant Use in Predator Control**

The issue of toxicant use in predator control has received more attention than it deserves from both stockmen and environmental groups alike. Ranchers have tended to look upon poisons as the main line of defense against the coyote, while environmental groups have rallied to the theory that the only good poison is a banned poison. I feel that the available evidence suggests that neither of the above positions is correct.
In my opinion, the ban on toxicant use was enacted rather
hastily with little thought to its impact on the livestock industry
or Federal control programs. It is interesting to note that the
Leopold Committee found nothing wrong with careful use of Compound
1080, while the Cain Committee, made up of many of the same people,
recommended that 1080 be banned along with other poisons. Certainly
there were dangers associated with poison use. Threats to nontarget
species of animals, and especially rare animals, should have been
avoided at all costs but were not because of careless administration
of toxicant programs. In addition, there was a lack of evaluation
of either the effectiveness or the impact of toxicants. Wholesale
1080 programs and broadcast programs using strychnine baits should
never have been allowed. Toxicant use should have been thoroughly
planned, supervised, and used only in critical situations.

Even though ranchers have come to look upon poisons as the best
means of controlling coyotes, evidence supporting this belief is lack­
ing. At this time it is impossible to separate the effectiveness of
toxicants from that of other controls. Toxicants have played a role
in preventing or reducing livestock losses but it is difficult to
determine how great the role was. In addition, no generalizations
can be made at this time about coyote numbers and sheep losses in
relation to the ban on toxicants other than that we have probably
suffered a considerable net reduction in control efficiency by
removing toxicants. Efficiency was lost because more costly
mechanical methods had to be substituted for poisons.

Further research is needed concerning the effects of poisons
but I feel that we will find that limited use of selective toxicants
may be necessary to achieve control in some situations. Even so, use of toxicants should be prohibited in most situations where adequate control can be provided through mechanical means. If a situation warrants use of poisons, the M-44 device should be used. This device provides some selectivity, eliminates the danger of secondary poisoning, and is relatively humane because of its quick action.

The Economics of Predator Control

Economic considerations as related to the interactions between livestock, coyotes, and predator control are complex. As in other areas of the predator control controversy, the scarcity of accurate data has contributed to the overall confusion.

The major point which has to be resolved regarding economics of control is how much damage is inflicted upon the livestock industry by predators. The sheepmen are hardest hit and claims frequently approach $20,000,000 per year. Evanson (1967), using a method he developed, has estimated that $4-10 million would be more realistic. Whichever is the case, there is no doubt that coyotes and other predators inflict a heavy financial burden on the sheepmen each year. How great the losses actually are is not known but they must be determined through more accurate means of damage assessment. It will be some time before current studies will be able to provide accurate insight into the sheep loss situation. Investigations will probably show that loss figures are inflated considerably in some areas and that control expenditures are not always justified in terms of the value of the resource being protected.
There is not enough information available at this time to draw any final conclusions about the coyote effect on the economy of the sheep industry, although a tentative conclusion might be that predation has been responsible for a further decline in an already declining industry.

**Effectiveness of Control Programs**

Information needed to evaluate the effectiveness of control efforts is limited. Control effectiveness is gauged primarily by the reduction or prevention of livestock losses and by reduction of coyote numbers. In the first case, livestock producers are firmly convinced that control programs have had little effect on losses and even less effect since the toxicant ban. The plain fact is that there are no means presently available to determine the overall effects of control measures on livestock losses. All control methods have probably helped to prevent and reduce losses to an extent but just how great the extent has been has not been determined. Current studies are attempting to find some of the answers but evidence is oftentimes conflicting. For instance, in the University of Montana study near Florence, Montana, losses on a herd of sheep have not significantly increased from 1973 even though control was in effect in 1973 and is not in 1974. Since losses in both years are approximately equal, it can be argued that controls have had no effect in this case. In a companion study, being carried out in New Mexico, a herd of sheep is being monitored in an area with no control in effect. Losses have not been as heavy as in Montana and a tentative conclusion
is that controls in the surrounding areas have helped reduce losses on the study herd.

Available statistics show a gradual increase in losses from predation over the past 20 years. The statistics do not show how these losses are distributed, however. There is evidence that only a relatively small number of ranchers are suffering losses which can be considered heavy while the majority is suffering light to moderate losses. A loss pattern such as this suggests that, in some areas, control has been effective while in others it has not. The reasons for the differences in effectiveness must be determined through research. Since the types of controls used have been essentially the same in all areas, outside factors obviously play a much greater part in control effectiveness than has been suspected. Current beliefs are that coyote density, livestock density, and the natural food supply all are directly related to predation on livestock.

The other means for evaluating the effectiveness of coyote control programs is determining whether they have reduced coyote numbers. Here the picture is clearer. Disregarding normal cyclic fluctuations, it appears that coyote populations have remained relatively constant throughout the past 20 years. In other words, coyote controls have not been responsible for any longterm population reductions. It is probable that coyote populations have not been successfully regulated because they have made compensatory adjustments in both reproductive success and in survival of the young. For this reason, a different approach to coyote control is indicated. Future control programs and research should concentrate largely on nonlethal means for regulating predator populations.
Following review of the literature on predator control, I am of the opinion that a high degree of effectiveness could be achieved through directing controls at the specific animal causing damage to livestock. Extension programs have been successful in the East and have concentrated on the predator killing stock. It is possible that similar systems would be of benefit in the West. The success of such systems would depend largely on the training given the ranchers.

In conclusion, definite changes are called for in the present animal damage control program. Past controls have not been effective in reducing coyote numbers and have been wasteful in terms of animals taken and in funds which have been expended. Improved control effectiveness will come through selective measures used in programs planned for specific areas, seasons, and range conditions. This type of planning has not taken place in the past.

PRIVATE INTERESTS VERSUS PUBLIC INTERESTS

IN COYOTE CONTROL

In addition to questions of a scientific nature, the predator control controversy has raised certain moral issues. These issues involve both funding of predator control programs and management of public lands.

Predator control programs are partially funded with public monies derived from Federal and State appropriations. This practice is objectionable to many people, myself included. The public should not be required to fund programs for the benefit of a private industry. While a stable livestock industry is probably in the best
interests of the national economy, I believe that the coyote should be considered a risk of livestock production and, therefore, all control programs should be funded by the user interest. The livestock industry should be assisted through Federal and State research and technical skills only.

The other moral issue which has been raised concerns the management of the public's wildlife (predators) on public lands. A great many people find the coyote and other large predators to be of aesthetic value and object to the killing of these predators on public lands. It is my opinion that while the public should not have to fund predator control operations, it does have other obligations towards the livestock industry. There is a definite need for predator control activities at this time; therefore, control programs on public lands should be accepted as one of the trade-offs which have to be made. The general public should be made aware that management of coyote populations through control activities has not affected the coyote's abilities to maintain adequate population levels.

The above questions are complex and not easily answered. Like most moral issues, they will probably never be settled to everyone's satisfaction.
CHAPTER VIII

SUMMARY

The controversy surrounding control of larger carnivores, and particularly the coyote, presents one of the most difficult problems in the field of wildlife management.

Predation by larger carnivores has concerned man for a long time; however, no predator control problem has stirred up more controversy than the one involving predators that prey on domestic livestock.

For the past thirty years an emotional confrontation developed between livestock producers and segments of the general public who might be collectively labeled conservationists, environmentalists, or preservationists. The major points in contention are (1) administration of control programs, (2) use of toxicants for predator control, (3) the effectiveness of control programs, (4) the economics involved in predator control, and (5) public interests versus private interests in coyote control. Resolution of these areas of conflict will be difficult, but a necessary task for researchers. To date, efforts have been handicapped by the scarcity of field data and by the emotional quality of the debate.

The Federal Government entered into control activities in 1915 when Congress authorized $125,000 for the Bureau of Biological Survey to conduct animal damage control programs. Then in 1931, Congress
passed the Animal Damage Control Act which directs the Secretary of the Interior to conduct campaigns for the control of animals injurious to agriculture, livestock, or people. The present Federal predator control program is carried out pursuant to this Act. The program is conducted in cooperation with the States and local cooperators, and is funded through Congressional appropriations and contributions from the State and local cooperators.

The Federal predator control program is aimed primarily at protecting western range sheep from attacks by coyotes, although nonpredatory bird and mammal controls are also practiced.

In the 1940s and 1950s, public attitudes changed concerning predator control programs. Most urban people found that coyotes and other large predators have aesthetic value and they objected to the killing of the predators for the benefit of the private livestock industry. One particular incident served to focus more public attention on predator control activities than any other. It was discovered that 22 bald and golden eagles had accidentally been poisoned from consuming baits meant for coyotes. Further investigation showed that nontarget birds and mammals were quite often the victims of coyote control programs and public protests reached their peak at this time. As a result, an advisory board was formed to evaluate the Federal control program and present its findings to the Secretary of the Interior. Their report, commonly referred to as the Leopold Report, was published in 1964. Among other things, the report stated that the present controls considerably exceeded the amount needed and did not take into account the full spectrum of human needs and values.

Few changes came about as a result of the Leopold Report.
Because of continued public dissatisfaction, another committee was formed in 1971 to reevaluate control programs. The final report, called the Cain Report, was published in 1971. It found numerous failures in predator control activities and made 15 recommendations for needed changes. In response to one of the recommendations, President Nixon issued Executive Order 11643 which banned the use of all toxicants for predator control on Federal lands. This order was immediately followed by Pesticides Notice 72-2 from the Environmental Protection Agency. The notice removed the registration of all toxicants used for predator control and prohibited their interstate commerce.

The ban on toxicants brought loud protests from the livestock industry, who looked upon poisons as the main defense against predators. Following the ban in 1972, livestock producers complained of greatly increased losses to predators and waged a battle for the reinstatement of poisons. Their arguments were countered by various environmental groups who stated that livestock losses had not increased and that effective control could be achieved without the use of poisons.

If efforts to evaluate the effects of the toxicant ban, the Department of the Interior initiated a program of intensified predator control. This program incorporated only mechanical controls, relying mainly on trapping and shooting predators from aircraft. It was concluded that adequate control could be achieved without poisons, but this would be more expensive. Stockmen have vigorously disagreed with this conclusion.

At the present time, the Federal Government is involved in
research that concentrates on nonlethal control methods, damage assessment techniques, and predator ecology and biology. Large gaps of information exist in these areas. It will probably be some time before current field studies will be able to provide answers to the existing questions; however, progress is being made.

In response to public protests concerning the past inadequacies of predator control programs, legislation is currently before Congress. Briefly, this legislation, if passed, would transfer the responsibility for control programs to the States, make Executive Order 11643 into law, repeal the Animal Damage Control Act of 1931, and authorize the Secretary of the Interior to assist the States in control activities.

While the new legislation may help to resolve some of the existing problems connected with predator control programs, some of the issues will never be totally settled. However, with continued research and public education the opposing sides in the controversy can be brought closer together. Any final solutions will have to be compromises between the extreme viewpoints of vastly increased control programs, using all available methods and no predator control at all.
APPENDIX 1

OFFICE OF THE WHITE HOUSE PRESS SECRETARY

THE WHITE HOUSE

EXECUTIVE ORDER

ENVIRONMENTAL SAFEGUARDS ON ACTIVITIES FOR ANIMAL DAMAGE CONTROL ON FEDERAL LANDS

By virtue of the authority vested in me as President of the United States and in furtherance of the purposes and policies of the National Environmental Policy Act of 1969 (42 USC 4321 et seq.) and the Endangered Species Conservation Act of 1969 (16 USC 668aa), it is ordered as follows:

Section 1. Policy. It is the policy of the Federal government to (1) restrict the use on Federal lands of chemical toxicants for the purpose of killing predatory mammals or birds; (2) restrict the use on such lands of chemical toxicants which cause any secondary poisoning effects for the purpose of killing other mammals, birds, or reptiles; (3) restrict the use of both such types of toxicants in any Federal programs of mammal or bird damage control that may be authorized by law. All such mammal or bird damage control programs shall be conducted in a manner which contributes to the maintenance of environmental quality, and to the conservation and protection, to the greatest degree possible, of the Nation's wildlife resources, including predatory animals.

Section 2. Definitions. As used in the order, the term: (a) "Federal lands" means all real property owned by or leased to the Federal Government, excluding (1) lands administered by the Secretary of the Interior pursuant to his trust responsibilities for Indian affairs, and (2) real property located in metropolitan areas.

(b) "Agencies" means the departments, agencies, and establishments of the executive branch of the Federal Government.

(c) "Chemical toxicant" means any chemical substance which, when ingested, inhaled, or absorbed, or when applied to or injected into the body, in relatively small amounts, by its chemical action may cause significant bodily malfunction, injury, illness, or death, to animals or man.

(d) "Predatory mammal or bird" means any mammal or bird which habitually preys upon other animals or birds.
(e) "Secondary poisoning effects" means the result attributable to a chemical toxicant which, after being ingested, inhaled, or absorbed, or then applied to or ingested into a mammal, bird, or reptile, is retained in its tissue or otherwise retained in such a manner and quantity that the tissue itself or retaining part if thereafter ingested by man, mammal, bird, or reptile, produces the effects set forth in paragraph (c) of this section.

(f) "Field use" means use on lands not in, or immediately adjacent to, occupied buildings.

Section 3. Restrictions on Use of Chemical Toxicants.

(a) Heads of agencies shall take such action as is necessary to prevent on any Federal lands under their jurisdiction, or in any Federal program of mammal or bird damage control under their jurisdiction:

(1) the field use of any chemical toxicant for the purpose of killing a predatory mammal or bird; or

(2) the field use of any chemical toxicant which causes any secondary poisoning effect for the purpose of killing mammals, birds, or reptiles.

(b) Notwithstanding the provisions of subsection (a) of this section, the head of any agency may authorize the emergency use on Federal lands under his jurisdiction of a chemical toxicant for the purpose of killing predatory mammals or birds, or of a chemical toxicant which causes a secondary poisoning effect for the purpose of killing other mammals, birds, or reptiles, but only if in each specific case he makes a written finding, following consultation with the Secretaries of the Interior, Agriculture, and Health, Education and Welfare, and the Administrator of the Environmental Protection Agency, that any emergency exists that cannot be dealt with by means which do not involve use of chemical toxicants, and that such use is essential:

(1) to the protection of the health or safety of human life;

(2) to the preservation of one or more wildlife species threatened with extinction, or likely within the foreseeable future to become so threatened; or

(3) to the prevention of substantial irretrievable damage to nationally significant natural resources.

Section 4. Rules for Implementation of Order. Heads of agencies shall issue such rules or regulations as may be necessary and appropriate to carry out the provisions and policy of this order.

Richard Nixon

THE WHITE HOUSE
February 8, 1972
APPENDIX 2

ENVIRONMENTAL PROTECTION AGENCY
PESTICIDES OFFICE
WASHINGTON, D. C. 20250

March 9, 1972
PR Notice 72-2

PESTICIDES REGULATION DIVISION

NOTICE TO MANUFACTURERS, FORMULATORS, DISTRIBUTORS
AND REGISTRANTS OF ECONOMIC POISONS

Attention: Person Responsible for Federal Registration of
Economic Poisons

Suspension of Registration for Certain Products
Containing Sodium Fluoroacetate (1080),
Strychnine and Sodium Cyanide

I.

Last spring, this Agency made a public commitment to review
the status of registrations for strychnine, cyanide, and sodium
fluoroacetate (1080), for use in prairie and rangeland areas for
the purpose of predator and rodent control. This commitment grew
out of grave concern surfaced by the reported deaths of some 20
eagles killed by the misuse of thallium sulfate.¹

This same concern caused the Secretary of the Interior to
initiate a through review of the government's federal predator
control program. An advisory committee was appointed under the
chairmanship of Dr. Stanley Cain, Director, Institute for
Environmental Quality and Professor of Botany and Conservation

¹This concern predates last summer. In 1963 the Secretary of
Interior appointed an Advisory Board on Wildlife and Game Management
chaired by Dr. Leopold of the University of California.
at the University of Michigan. The report of that advisory committee was released earlier this month.

Aside from this Agency's review and the Gain findings, a detailed petition has been submitted to this Agency by several distinguished conservation groups urging that the registrations of these compounds be cancelled and suspended immediately. That petition invoked the Federal Insecticide, Fungicide and Rodenticide Act, 7 U.S.C. § 135, Section 2z(2)9c) which requires that an economic poison contain "directions for use which are necessary and if complied with, adequate to prevent injury to living man and other vertebrate animals...", and Section 4c which allows the Administrator to initiate cancellation proceedings by ordering immediate suspension "when he finds that such action is necessary to prevent an imminent hazard to the public."²

Based on this Agency's review of the registrations of sodium cyanide, strychnine, and 1080 in light of available evidence, I am persuaded that their registrations for predator uses should be suspended and cancelled.

II.

The Cain group has dealt at length with the effects of the use of strychnine, cyanide, and 1080 for predator control. The report points out the extreme toxicity of these compounds, their non-selectivity, and their potential impact on the environment which "is increased by secondary hazard, accumulation in the animal, and combined characteristics of chemical stability and solubility in water." This report reconfirms the findings of the Leopold Report (see\textsuperscript{1}, \textit{supra}) that the predator control program took a heavy environmental toll.

Cyanide, strychnine, and 1080 are among the most toxic chemicals known to man. They act quickly, spreading through an entire animal crippling the central nervous system. These poisons are toxic not only to their targets but other animals and wildlife. All of these poisons have a similar pattern of use as unattended baits and are spread over vast areas of open prairie.

In the case of strychnine use against badgers, coyotes, and foxes, a tablet containing the poison is placed inside a one-inch ball or cube of bait material such as meat, lard or tallow. These baits are left along animal trails or near non-game carcasses. While instructions caution the user to cover the baits over with chips or brush to avoid ingestion by non-target animals, the Cain
Report has suggested the inadequacy of such directions.\(^3\)

The pattern for cyanide use differs little in pertinent respects. An explosive gun, a "coyote-getter," charged with cyanide is baited and driven into the ground. The gun is left unattended along the trail or range and is triggered when an animal pulls at the bait. In the case of 1080, carcasses of dead animals are laced with the substance and strewn to attract the predator.

Indiscriminate baiting over wide unpoliced areas poses two obvious and recognized threats to non-target animals that share the ranges as a natural habitat. The unsupervised bait is itself a potential killer of non-target range species. The threat, however, is compounded by the extremely high toxicity of these poisons, which can transform the predator carcass into a potential lethal killer of prairie animal life.

While the effects of prairie baiting are, for the most part, not documented, the Cain group has suggested the present evidence may well understate the true damage. It is appropriate to take

\(^3\)According to the Cain Committee, if toxicants were consistently applied under field conditions with meticulous care, it is possible undesirable side-effects might be avoided. Draft at 131. However, the Committee concludes, "It appears that the necessary high standards are not likely to be attained." (Draft at 115) The Committee found no reliably precise data is available showing the degree of predator control achieved or the possible loss that might ensue without any program.
administrative notice of the fact that isolated accidents involving wildlife are not apt to be reported. Isolated, even if routine and numerous, instances of secondary animal poisoning would not have the visibility of a wildlife "kill," nor is there apt to be an observer present as in the case of human mishap. The administrative process need not be blind to these realities. This Agency's Pesticides Registration Division has, moreover, reports of cases of alleged secondary and accidental poisoning, and recently range-use of 1080 has been suspected of killing birds, including some of our rare species.

Measured against these obvious threats to wildlife are only ill-defined and speculative benefits. The Cain Committee has noted the absence of any meaningful information on the efficacy of poison baiting, especially in relation to the economic loss caused by predators to the sheep industry. At least one state, Nevada, has estimated that the cost of predator control was ten times the value of livestock and poultry lost to predators.

This absence of any meaningful data of benefits derived from the use of these highly dangerous poisons which pose a marked potential threat to the environment renders these registrations suspect. It is now settled that the burden of proof rests on the poison. The report, moreover, specifically cites the greater selectivity of ground shooting, denning, and trapping, and the Department of the Interior is embarking on a study to determine other methods of control. Here, where it is known that alternative
methods of control exist, the registrations must be seriously questioned.

III.

In deciding whether or not these considerations justify suspension, it must be recognized that the concept of suspension is one that must evolve, and existing verbal tests are not readily translated into a decisive cue for action. The Federal Insecticide, Fungicide and Rodenticide Act, and the judicial and administrative constructions of it to date set forth only word formulas that establish a general attitude on suspension questions. Each situation must be scrutinized not only for what is involved, but also for what is not involved.

Turning to the verbal tests by which we must measure the use of these poisons, FIFRA provides that the Administrator of EPA "may, when he finds that such action is necessary to prevent an imminent hazard to the public, by order, suspend the registration of an economic poison immediately." "Public" is not to be viewed restrictively, and includes fish and wildlife, as has recently and forcefully been noted in an opinion of federal court. See EDF v. Ruckelshaus, 439 F. 2d 584, at 597. Nor does "imminent" mean that we are on the "brink" and that the harm
will occur tomorrow or has been documented. It is sufficient that reasonable men can conclude that action taken today will with reasonable certainty lead to a loss in the future and that loss will be irremediable and uncorrectable by subsequent action, and that the apparent benefits from using a chemical, pending the complete statutory review process, are outweighed by the possible harm of use during the period. Or, as the matter was put in the Agency's DDT policy statement of March 18, 1971, the type, extent probability and duration of such injury will be measured in light of the positive benefits accruing from use of the economic poison, for example, in human or animal disease control or food production.

Bearing these principles in mind, I am persuaded that a definite hazard exists. While the mere toxicity of poisons does not, under FIFRA, render them a hazard, their degree of toxicity

4 An 'imminent hazard' may be declared at any point in a chain of events which may ultimately result in harm to the public. It is not necessary that the final anticipated injury actually have occurred prior to the determination that an 'imminent hazard' exists." Reasons Underlying the Registration Decisions Concerning Products Containing DDT, 2,4,5-Te, Aldrin and Dieldrin, at 6.

5 The cancellation proceeding involving the possibility of both a scientific advisory committee and public hearing consumes at least one year. In actual fact, these proceedings have generally taken considerably more than a year.
and pattern of use may well do so. The unattended and unsupervised use of poisons over large areas of land, by definition, poses a hazard to non-target species. The fact that label instructions contain directions for placing the baits at times and in areas least likely to be populated by non-target species and for policing them, affords slight, if any comfort. This Agency has on prior occasions taken into account a "commonly recognized practice" of use (see In Re Hari Kari Lindane, I.F. & R. (Docket #6), and has noted that the likelihood of directions being followed may affect their adequacy (see In Re King Paint, 2 ERC 1819 (1970)); In Re Stearns, 2 ERC 1364 (1970).

The hazards from the pattern of use for these chemicals is not remote or off in the distant future. The prairies and ranges are populated by numerous animals, some of which are becoming rare. At jeopardy are potentially endangered species. Each death to that population is an irremediable loss and renders such species closer to extinction.

No apparent circumstances exist to counterbalance this distinct hazard and suggest that the possibility of irremediable loss is outweighed by the harm that might occur from their nonavailability during a period of suspension. The situation might well be different were the removal of these poisons from the
market likely to affect human health or the supply of a staple foodstuff; or were there no apparent alternatives available, the balance might be differently struck. This, however, is not true.

I am hereby affixing findings of fact and an order suspending and cancelling these chemicals for use in predator control.

Mar. 9 1972

William D. Ruckelshaus
Administrator
FINDINGS OF FACT

Cyanide

1. Two products in the form of shells containing sodium cyanide are currently registered for explosive devices designed to kill coyotes that may prey on sheep. The device is simply a cyanide charge placed in a baited cylinder and driven into the ground. When the animal pulls at the bait the charge explodes into its mouth. Only one of the shell products is registered for use by the general public. The Division of Wildlife Services of the Department of the Interior has probably been the largest user of such devices.

2. Sodium cyanide is a water-soluble white-solid which reacts with acids to form hydrogen cyanide gas. This chemical is among the most toxic and rapidly acting of all known poisons.

3. Persons overcome by gas either die very rapidly from respiratory failure or recover completely within a relatively short time.

4. Ingestion or inhalation of a very low dose (as little as 300 micrograms per litre of air) may rapidly result in death.

5. There is no true effective antidote.

6. Recent data show four incidents involving cyanide compounds in fiscal year 1970 in three of which human beings were injured by the discharge of cyanide guns placed in fields. Only quick thinking on the part of all three victims in seeking immediate medical aid prevented any loss of life.

7. There is evidence that dogs have been subjected to
poisoning by cyanide (used as outlined above) which is highly toxic to all wildlife and domestic animals.

Strychnine

8. Currently at least six products containing strychnine in tablet and technical powder form are registered for use in baits against coyotes and wolves.

9. The technical powder form is for reformulation and repackaging, and is for use only by professional pest control operators and government agencies.

10. The tablets are available on the open market.

11. Strychnine is an extremely bitter-tasting white crystal.

12. It is a complex, naturally occurring, organic compound which would probably bind to soil readily and decompose over a period of time, although information on the persistence of strychnine and its effect on the environment is somewhat limited.

13. Strychnine is highly toxic to humans and animals, with 30 mg. considered as a threat to the life of an adult man. Death has, however, been reported with as little as 5 to 10 mgs., and animal life may be acutely poisoned by ingestion of small amounts.

14. Strychnine acts by interfering with normal neural processes, causing exaggerated muscle contraction and violent convulsion. Death in a rather gruesome form due to respiratory failure soon follows unless the seizures are controlled.

15. There is no true effective antidote.
1080 (Sodium Fluoracetate)

16. Four products containing 1080 are currently registered for use as mammalian predacides.

17. Use is restricted to areas west of the 100th meridian, and then only by Division of Wildlife Services personnel, or under their direct supervision.

18. 1080 is a white powder, soluble in water, very stable, and thus very persistent in ground water.

19. 1080 is highly toxic to all species. The dangerous dose for man is 0.5 - 2 mg/kg. The chemical acts rapidly upon the central nervous and cardiovascular systems with cardiac effects. Effect is usually too quick to permit treatment, and antidotes are relatively valueless.

20. According to one authority, prior to 1963 there were 13 proven fatal cases, five suspected deaths, and six non-fatal cases of 1080 poisoning in man, although it is not clear to what extent predator control materials were implicated.

21. There is evidence that a certain number of non-target animals are being adversely affected by 1080 products, particularly, in the case of carrion eating birds and mammals, by secondary poisoning. It is not clear, however, how various animal populations are being affected, although 1080 is thought to have contributed to the death of at least one California condor, an endangered species.

Benefits

22. There is no reliable data as to the amount of predator control achieved by the use of these poisons.

23. There is no reliable data as to the loss of sheep that
might occur without a predator control program using these poisons, or of the real effect of such losses on the general economic health of the sheep industry. Certain data that are presently available indicate predator losses may in fact be of such a low magnitude as to be a minor part of total losses. The Cain Report suggests that among other reasons for the decline of the sheep industry may be competition from synthetic fibers and from lot-fed livestock.

24. For the maintenance of predator control programs, especially in the sheep industry, effective non-chemical alternatives exist, including denning, shooting and trapping, methods that have long been available and effective, though more costly than poisons.

25. The Federal Government has committed itself to a research program for methods of controlling predators other than poisons.
The predator use of the foregoing chemicals presents an imminent hazard such as to warrant their suspension pursuant to § 4(c) of the Federal Insecticide, Fungicide and Rodenticide Act.
ORDER

In accordance with the attached opinion and findings, it is hereby ordered that the registration for all products containing sodium fluoroacetate (1080), sodium dyanide or strychnine for use against mammalian predators be cancelled and suspended immediately.

Registrations for those products bearing directions as listed above are hereby suspended and the products may not be legally shipped in interstate commerce until labeled to block out instructions for predator use.

Mar 9 1972

William D. Ruckelshaus
Administrator
APPENDIX 3

MONTANA ANIMAL DAMAGE CONTROL BUDGET
Fiscal Year 1974
July 1, 1973 -- June 30, 1974

Supervisory and Clerical Expenditures

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary State Supervisor, 2 District Supervisors 2 clerks</td>
<td>$76,592</td>
</tr>
<tr>
<td>Hazardous Pay</td>
<td>1,000</td>
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<tr>
<td>Retirement, Insurance Premium, and Health Plan</td>
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</tr>
<tr>
<td>Per Diem and Travel</td>
<td>6,200</td>
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<tr>
<td>CSA Rental Vehicles</td>
<td>3,800</td>
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<tr>
<td>Gas and Oil for Government Vehicles (Service-owned)</td>
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<tr>
<td>Repairs for Government Vehicles &amp; Equipment (Service-Owned)</td>
<td>800</td>
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<tr>
<td>Federal Cost Reimbursable Accounts 2%</td>
<td>4,500</td>
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<tr>
<td>Telephone</td>
<td>1,600</td>
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<tr>
<td>Express</td>
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<tr>
<td>Utilities</td>
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<tr>
<td>Postage</td>
<td>1,400</td>
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<tr>
<td>Supplies</td>
<td>3,000</td>
</tr>
<tr>
<td>Major Equipment (2 new trucks—including trade-in)</td>
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<tr>
<td>Administration Expense, Department of Livestock</td>
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Funds Available

<table>
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<tr>
<th>Source</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Montana Department of Livestock</td>
<td>$165,821</td>
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<tr>
<td>Montana Fish &amp; Game Department</td>
<td>40,000</td>
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<tr>
<td>Bureau of Sport Fisheries &amp; Wildlife</td>
<td>157,250</td>
</tr>
<tr>
<td>Counties</td>
<td>88,000</td>
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</tbody>
</table>

$451,071
District Field Assistant Expenditures

Salary for 8 man-years @ $7,200 $57,600
Salary for 10 man-years @ $7,500 75,000
Salary for 1 man-year @ $7,800 7,800
Salary for temporary 9/12 man-years @ $7,200 (Inc. Soc. Sec.) 5,715
Retirement, Insurance Premium, and Health Plan 12,500
Mileage and Per Diem (306,000 miles) 40,920
Horse Allowance 690
Snow Traveler Allowance 200
GSA Rental, Pickup 1,800
Gas and Oil for Government Vehicles used by DFA's 7,500
Repairs for Government Vehicles used by DFA's 2,800
Telephone 2,000
Express 300
Warehouse 816
Supplies 4,500
Airplane, 2,600 hours @ $16, $20, and $23 per hour 57,200
Contingency 3,280

$280,621
Shaded areas cover over 75% of the sheep in the West. Based on stock sheep, summer distribution not shown.

Source:
REFERENCES CITED


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Robinson, W. B. 1943. The "humane coyote-getter" versus the steel trap in control of predatory animals. J. Wildl. Mgme. 7(2): 179-189.


