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COYOTE CONTROL BY POISONS*

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Probably no subject in the wildlife field today can provoke more discussion than that of coyotes, coyote control, and especially coyote control by poisons. There may be other reasons, but in the background is the fact that the coyote means different things to different people: he may be a ruthless destroyer of livestock and poultry, or a killer of harmful rodents; he may be looked upon as a wilderness figure inseparably associated with the Old West, or be valued for his fur or the bounty his scalp will bring at the County Clerk's office; he may be the predator that is killing too many deer and antelope, or the one that is needed to help hold down the numbers of these game animals. He is literally the Dr. Jekyll and Mr. Hyde of the wildlife world, and I think an appropriate tribute was paid him by his mortal enemies, the Idaho sheepmen, who, at their recent Boise meeting, passed around word that if the Russians had been really smart and had sent up a coyote in place of a dog in Sputnik II, they'd have gotten it back . . . and maybe with a litter of pups!

And the methods used to control coyotes, especially poisons, come in for their share of discussion. Most people would prefer to see control accomplished by some means other than by poison, and that includes those who work with such chemicals. There is no way to glamorize the use of poison in any field. Nevertheless, it must be pointed out that its wise use may be one key to our very existence. All of us use it at one time or another to protect our belongings or even our lives from rats, mice, insects, germs, and other organisms. It may be called a rodenticide, a fungicide, an insecticide, or a germicide, but it's still a poison. What is needed is a similar term to apply to the chemicals used to give protection from the depredations of coyotes.

You can get yourself an argument when you discuss either coyotes or poisons; and when you mix the two, as I am doing today, you come up with a subject on which, to put it this way, there is not always 100 percent unanimity of opinion.

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Poisons, particularly strychnine, have been used for centuries to control the numbers of unwanted animals. Predator poisoning in the West perhaps reached a peak 70 or 80 years ago when professional wolfers "salted" carcasses with strychnine as a means of taking wolves. Later, when cattle and sheep were moved in, there was an unwritten law of the range that a rider would not knowingly pass by a carcass without loading it with strychnine. During this era the wolf was reduced in numbers on the western stock ranges and was later finished off with traps, but the more versatile coyote still thrived.

When the Government entered the predator control field in 1915, the Bureau of Biological Survey--a predecessor agency of the present Bureau of Sport Fisheries and Wildlife--assumed direction of most of the predator poisoning. Drop baits containing strychnine largely replaced carcass poisoning; these small baits, made of lard or fat, would melt down and decompose in warm weather and were not dangerous for long periods as were the poisoned carcasses. This was a step forward, but poison still was too widely used. Through its "farmer-hunter" system, the Survey issued strychnine to stockmen and others to use against predators, but had too little control over how it was employed.

Early reports of the Biological Survey emphasized the success of this new approach and hailed it as the solution to the coyote problem. Later, however, much of this confidence faded, and the records indicated a gradual increase in coyote numbers. These predators had learned to detect and avoid strychnine, and the build-up in their populations reached a peak, at least for recent times, during the early 1940's.

When Poland was invaded by Germany to touch off World War II, two Polish scientists escaped to England and carried with them the secret of a new poison, chemically known as sodium fluoracetate. From there, with utmost wartime secrecy, the information was conveyed to this country. At that time the United States was largely cut off from foreign sources of economic poisons, and the Committee of Medical Research for the Office of Scientific Research and Development was directing a crash program to find substitute poisons with which to combat rats and other rodent pests. The Fish and Wildlife Service was participating in the search, and when the new compound reached our research personnel it was assigned the code number 1,080--or "ten-eighty" as it is known today. Because of the circumstances under which it was developed, a vast amount of research--probably more than for any other economic poison up to that time--centered around 1080. As a result of this research, the potentialities and hazards of the poison are well-known to the agencies using it.

Compound 1080 is extremely poisonous--let there be no mistake about that--and in discussing its use in coyote control, I do not wish to imply that the chemical is not dangerous. It is dangerous, as are most other poisons, but it can be handled safely through using prescribed precautions. Furthermore, 1080 has characteristics which make it the most effective known poison for the control of coyotes; and at the same time, it is one of the most selective with respect to not killing other wildlife.

The chemical is poisonous to all forms of mammal and bird life, but is more toxic to members of the dog family than most other creatures. Pharmacologists measure the toxicity of a poison in terms of milligrams of the chemical to kilograms of the body weight of the possible victim, and their description of the toxicity of 1080 to coyotes as members of the dog family is .1 mg/kg. At the same time, the toxicity ranges up to 10 mg/kg. for most hawks and owls, through 17 mg/kg. for chickens, to 50 mg/kg. for black vultures. In more simple terms, if one unit of 1080 is needed to kill a given weight of coyote, then the number of units needed to kill equal weights of other mammals and birds likely to be endangered by coyote baits would be: magpies, 6; bobcats, 6; martens and badgers, 10; raccoons, above 20; golden eagles, 50; most hawks and owls, 100; and oppossums, 600.

Advantage is taken of this characteristic of 1080 in using it for coyote control. Since the coyote is one of the most susceptible creatures, very small amounts of the poison are used in the preparation of baits--actually the figure is 1.6 grams of 1080 per 100 pounds of meat. At this rate, one pound of the chemical will treat more than 28,000 pounds of coyote bait, which is divided into 50-to-200-pound pieces to form a "station." One to two ounces of the meat is enough to kill a coyote, but much larger amounts would be needed to fatally poison the more resistant creatures. For example, 7 coyotes were killed by eating 2 ounces each of regular station meat, yet only 1 of 3 wild martens was fatally poisoned when similar bait was left overnight in their cages. The animals had been fed clean meat of that type for several days, but their tolerance for 1080--about 10 times that of coyotes--and a distaste for, or some physiological reaction from, the poison was such that they fed lightly and 2 of the 3 animals survived.

In other cage tests, 2 badgers and 1 raccoon, after being fasted for 48 hours, voluntarily at 11, 7, and 6 ounces, respectively, of 1080 station meat. Only one badger died, but the other two animals were left with nervous disorders which probably would have prevented their survival under natural conditions. These animals, however, were hungry and had they eaten less--as they may have done in their natural environment where they would have had a choice of foods--the aftereffects among the survivors could have been less severe.

Predatory birds, being generally more resistant than the mamamls, are affected less by the coyote bait. The data indicate that an eagle may have to eat as much as a pound to be killed. To find out what would happen if they did eat large amounts, four golden eagles were force-fed 10, 13, 16 and 22 ounces, respectively, of 1080 coyote bait, and only one of the birds died. In another series of experiments which may be more indicative of conditions in the field, four hawks of different species were fed horse meat for 2 weeks to condition them to this food, then were fasted 48 hours and given 1080 coyote bait in a free-feeding test. Each ate only small amounts of the poisoned meat and survived with no adverse effects.

Treating coyote bait with small amounts of 1080 limits, but by no means precludes, poisoning of the more resistant mammals and birds that feed on the station. A further and more distinct advantage, however, would be in limiting the so-called secondary poisonings. A badger, for example,

needing to eat nearly a half-pound of coyote bait to be killed, could get that amount easily at the station but with greater difficulty from secondary sources. An eagle, with its requirement of nearly a pound, would have even less chance of being poisoned at locations away from the station. A coyote or a dog, needing only 1 or 2 ounces to be killed, would be in greater danger from poisoning in this manner.

Perhaps the greatest weakness of the 1080 station is the vomitus problem. Compound 1080 exerts an emetic action on its victims, particularly the canines, which results in excess lethal materials in their stomachs being deposited at various points around the station. Even though this material may be partially digested, diluted, and represent only a portion of the poison taken by the original feeder, it may still be dangerous. Dogs have been killed by eating this regurgitated meat, but the danger would be much less to those creatures having the greater tolerances.

I might mention here that our Laboratory currently is exploring the possibility of adding a drug--possibly one of the tranquilizers--to 1080 to counteract its emetic action, but for the time being, extra precautions should be taken to locate stations at points well-removed from ranches and other human habitations.

The possibility of lethal amounts of 1080 being passed from one animal to another might be compared to the danger of killing several animals with one bullet. It could happen, but the dangers are apt to be exaggerated. If the powder charge and the bullet are heavy enough, one shot might kill a second or a third or a fourth victim--if they were lined up at the right times and the right places. Conceivably this could occur, but it would be a very "iffy" situation. The force of the bullet would be reduced with each victim, and the chances of the next one being hit before the bullet lost its killing power would become successively more remote.

The same principle would apply to poisons. If killing amounts of poison could be transmitted from one animal to another, the chain might go on endlessly--if the victims were lined up one after the other. However, as with the bullet, the poison would lose much of its force with each animal, and the chances of still another animal finding and eating lethal residues would greatly diminish with each victim. When the initial poison charge is light--as is the case with 1080 in coyote control--its force would be largely expended on the first victim; and if the second animal is harder to kill than the first--as likely would be the case--the progression would be halted in a hurry. Because of their extreme susceptibility to 1080, the killing of dogs through so-called secondary poisonings is not uncommon and must be guarded against. I know of no instance of a third poisoning in this manner, but that doesn't mean that it hasn't occurred. If it did happen very often, however, it likely would involve dogs and we would hear about it.

In addition to using such small amounts of 1080 that the more resistant creatures are afforded some degree of protection, other precautions are taken in placing coyote stations. The baits are located

only in spots where dangers to valuable fur bearers are at a minimum, are used primarily during the winter when many creatures are in hibernation, and are placed in such locations and at such widely-scattered intervals that few of the smaller mammals would ever locate them. Being larger and ranging farther, relatively more coyotes than other meat eaters find the stations. It is intended that each of these precautions limits the dangers to other wildlife, and in combination they give such protection to other wild, meat-eating mammals and birds that the 1080 station, in its place, is one of the most selective methods of coyote control.

As an example of what I mean, a few years ago we carried on a study to determine how predators and fur bearers had fared in areas where 1080 stations had been used. Previously, in 1940 and 1941, in studying the relative merits of traps and coyote-getters, the catches with coyote traps were recorded in detail for several localities in Wyoming, Colorado, and New Mexico. Thus, it was known how many coyotes and bobcats could be trapped in these areas in a given number of trap days before 1080 stations were used, and the same information was available for the other wild mammals most likely to be poisoned: the skunks, badgers, and raccoons. By repeating these trapping studies after 1080 stations had been used, the population trends of the predators as well as the fur bearers could be determined.

The studies were repeated in seven localities in 1951, and results are summarized in Slide 1. The data, compiled scientifically, show that where 1080 stations had been widely used for the control of coyotes, these predators were about one-fourth as numerous as before. At the same time, the other meat-eating wild animals most likely to be poisoned--the bobcats, skunks, badgers, and raccoons--had almost doubled in numbers or become even more plentiful. Some had been poisoned, of course, but in such small numbers compared to the kill of coyotes that their populations were well able to withstand the losses and even to increase.

Slide 1

Relative Numbers of Predators and Fur Bearers Before and After Employment of 1080 Stations

	1940-41	1951	Index 1940-41	Index 1951
Trap-set days	16,250	16,291		
Animals trapped				
Predators				
Coyotes	77	18	100	23
Bobcats	11	22	100	200
Fur Bearers				
Skunks	30	48	100	160
Badgers	26	51	100	196
Raccoons	2	18	100	900
Kit fox	1	0	-	-

Although these studies were conducted in other states, the results should apply to similar habitats in Idaho. One need only to look at the booming populations of badgers, skunks, and bobcats in areas where 1080 has been used to realize that coyotes can be selectively controlled through the proper use of poisons.

The upswing in the numbers of the other carnivores could logically be explained by a drop in the prices of long-haired furs and the use of more selective methods of coyote control, but still a third factor might have played a part. It will be noted that the collective weights of the various carnivores before and after the use of 1080 may not be greatly different, and the decrease in coyote numbers seems somehow to have been balanced by an increase in the numbers of the other carnivores. Biologically this would not be unexpected as the basic food supply would support a given weight of flesh eaters, though of different species; and if predators of one kind become scarce for any reason, the others would have less competition for food and would tend to increase. Although the subject of predator-prey relationships is beyond the scope of this discussion, it may be well to point out that the competing predators that likely would be benefitted by coyote control could more easily fill in for the coyote in preying on the smaller prey such as rodents, than on the larger prey such as sheep, deer, and antelope.

Man's susceptibility to 1080 is estimated to be 2 mg/kg., making him 20 times as resistant as the coyote. These figures mean that if a 150-pound man picked up coyote bait on the open range and used it for food, he probably would have to eat about 8 pounds to be killed. This, of course, seems unlikely to occur.

If some of the 1080 used in coyote control were to get into a stream, the dangers to people drinking the water are illustrated by calculations by our pharmacologists at the Laboratory. They have computed that if all the 1080 used in coyote control in Idaho during 1 year (nearly 8 pounds) were dissovled in a tank of water 10 by 10 by 10 feet, the water would be lethal only if a man drank a full 8-ounce glass of it. The amount of water so poisoned is a drop in the bucket compared to that in even one small mountain stream; and when we consider that only a minute fraction of the 1080 used in coyote control could ever get into streams under any conditions, we can see how remote is the possibility of people being endangered through contamination of water supplies by 1080 control methods.

The dangers to people would occur primarily when 1080 is in a powder or concentrated form, and then mostly to our field men who handle the chemical. To avoid any possibility of accidents involving humans, we have continually stressed the hazards of the materials. Perhaps this has been over done and has led to unfounded fears, and a closer look might be in order. If so, we could compare the toxicity of 1080 with that of a more commonly known poison, strychnine. In the predator field, strychnine has been the stand-by poison for a hundred years, and the oldtimers had little fear of it. Actually, however, the lethal dose of strychnine to humans may be as low as 1 mg/kg. compared to 2 mg/kg. for 1080, which, by weight, would make strychnine twice as poisonous to humans.

Before anyone jumps to the conclusion that 1080 is not dangerous, I would hasten to add that strychnine's bitter taste would be much more of a deterrent to accidental poisonings than 1080's less objectionable cream-of-tartar taste. Furthermore, if lethal amounts of 1080 were not removed from the system in a matter of minutes, it would be too late to do much about it. It's these characteristics, among others, that make 1080 an effective coyote poison.

When 1080 was first used operationally in coyote control 12 years ago, the initial results were remarkable. Sheepmen in our study areas who were losing 2 to 3 percent, or even more, of their lambs to coyotes during lambing season alone had their losses cut nearly 90 percent. Similar or even more spectacular results were obtained all over the West.

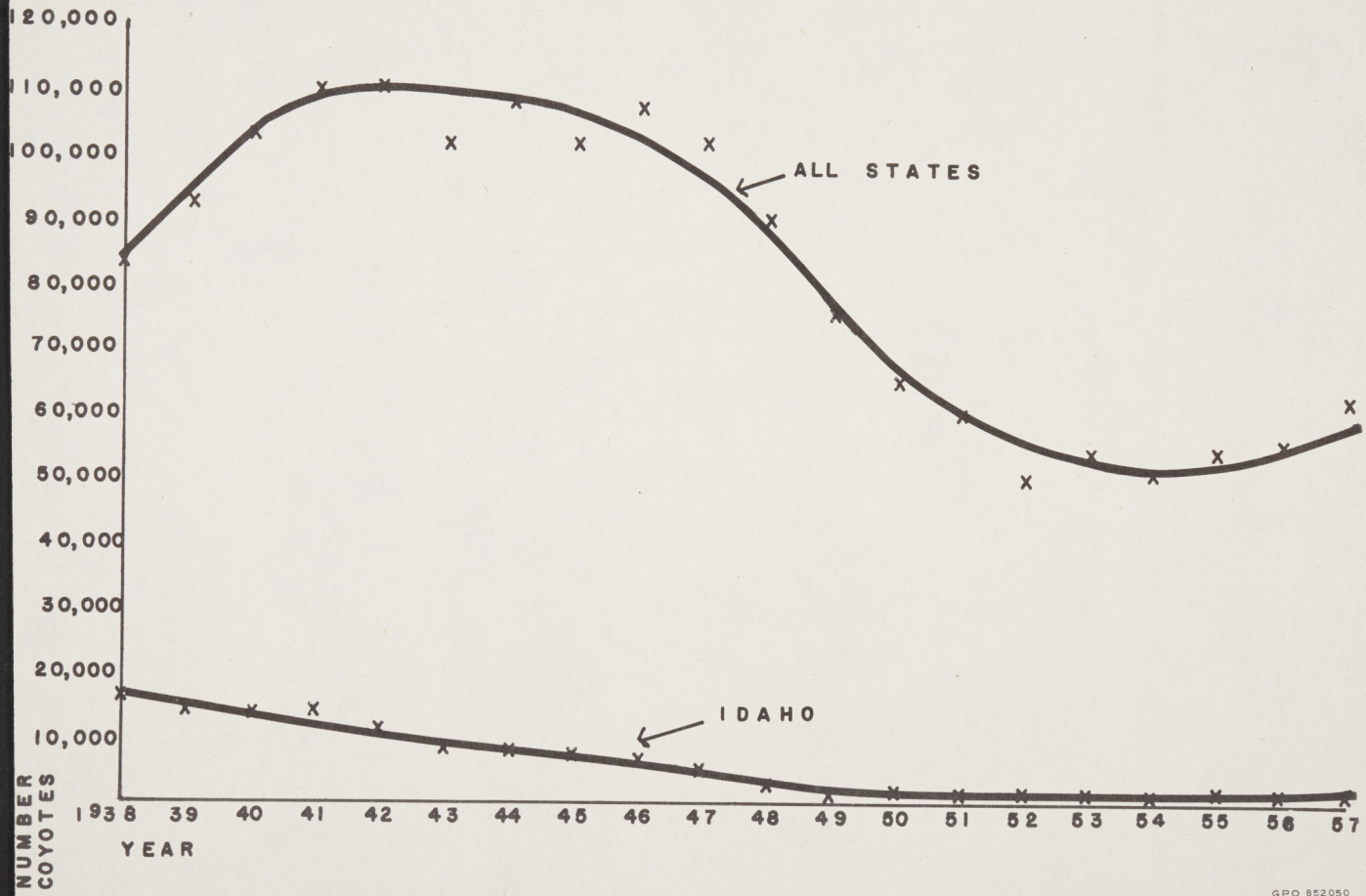
But, like most control methods, the best results were experienced the first years. Later it became a matter of trying to hold the ground that had been gained, and more recently, the trend has been for an increase in coyote numbers. Although control procedures still are efficient compared to pre-1080 days, populations of resident animals that have learned to avoid present methods are building up. At the same time, many sheepmen are practicing more open herding, which is good for the range but gives coyotes greater opportunities to kill. The result is a general worsening of the predator problem.

The coyote control picture is well illustrated, I believe, by the accredited catch records of the Bureau for the past 20 years. These are shown in Slide 2 for the entire West and for Idaho alone. In Fiscal Year 1938, the Bureau took some 84,000 coyotes in its cooperative program in all of the Western States. Other coyotes were killed, of course, but these were the ones whose scalps or skins were counted. The catch rose to a peak of 111,076 in 1942 and held at a high level, above 100,000, through 1947. By then the effects of two new control methods--coyote getters and 1080 stations--were being felt, and the catch declined sharply to a low of 50,661 in 1952. It varied upward to 55,000 during the next 4 years, then rose to 62,585 last year.

The fluctuations in the catch doubtlessly were due more to changes in coyote numbers than to changes in the numbers of predatory animal hunters. The drop in the recorded catch from slightly more than one hundred thousand to fifty thousand over a 5-year period was due chiefly to 1080. The decline, of course, was greater in some areas and less in others, but this was the average.

The picture in Idaho differed slightly at the beginning and the end of the 20-year period. The highest catch of 15,839 coyotes was recorded in 1938, and the trend thereafter was downward. The drop was sharpest--from 6,921 to 2,475--between 1947 and 1952 when 1080 stations were getting in their licks. Since then the catch has continued downward more than the national average, reaching a minimum of 1,722 in 1956. This continual downward trend doubtless was due to the excellent cooperation of the livestock and wildlife interests in the State of Idaho, plus an effective aerial shooting program. The increase to 1,828 last year may have

SLIDE 2 — COYOTES TAKEN BY BUREAU IN COOPERATIVE PROGRAM



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been the result of more federal funds which permitted the hiring of a few additional hunters; if, however, it is part of the national trend, we may have seen the low point in coyote numbers in Idaho for some time to come.

Those of us who are connected with control work are just as interested in not exterminating coyotes as others who may defend the animal more vigorously. But, having first-hand experience in just what it would take to kill off all the coyotes, we are not worried about that happening. The past decade of intensive control with some mighty effective weapons cut the recorded catch of coyotes only about in half, and a further reduction would be much more difficult. Even though the total catch has remained quite high, there are vast areas, including southern Idaho, where coyotes are generally scarce; in many of these areas--and I am referring specifically to the sheep ranges--it would be desirable that coyotes be reduced even more if that were possible. However, in view of the fact that even our most effective control measures leave some coyotes, we are not apprehensive about the future of the species. Furthermore, there are many areas where control is carried on less vigorously or not at all.

What we must recognize, I believe, is that there are some locations where coyote control is not necessary, others where only nominal control is needed, and still others--particularly the domestic sheep ranges--where only a few coyotes cannot be tolerated. To properly handle the predator problem, we must be able to exert control where and when the need arises, and our ability to do that seems to be slipping.

We are greatly in need of more research in the predator field, not only to improve methods of control but to learn more about other aspects of the problem. In the control field we need to develop better techniques, poisons, and baiting procedures; we need to improve the coyote-getter to reduce the hazards to the public and make the device more effective for coyotes; and we need better ways of controlling the growing numbers of bobcats. In related fields, we need to know more about the effects of predator control on prey species, particularly harmful rodents. I am thinking especially of the adjustments that may take place among competing carnivores when coyotes are controlled. There is much evidence that other predators and natural forces may become more effective in regulating rodent numbers in the absence of coyotes, but we need to know more about how these factors operate and the effect of other influences, such as vegetative changes, on rodent populations.

Until something better comes along, we must continue to use poisons in controlling coyotes. Of this, however, you can be sure: before any new control method involving lethal agents is approved for operational use, it will be thoroughly studied and safe procedures developed. Our goal is to get maximum benefits from a minimum use of poison, and in this connection the accomplishments with 1080 are noteworthy. Although employed over vast areas, far less poison is exposed, fewer stations are involved, and the program is more carefully supervised than in the days when strychnine was the dominant lethal agent. This is another step forward in the use of poisons.