

THE HABITS AND ECONOMIC IMPORTANCE OF WOLVES IN CANADA.

By Norman Criddle.



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(SPECIAL BULLETIN)

CONTENTS

	PAGE
Introduction..	3
Historical..	3
The Grey Wolves:	
The Habits of Grey Wolves..	4
The Food of Grey Wolves..	6
Economic Status of Wolves..	7
The Arctic Wolf..	7
Coyotes:	
The Habits of Coyotes..	8
The Food of Coyotes..	13
The Economic Importance of Coyotes..	14
The Value of Coyotes..	15
Wolf and Coyote Control..	
Miscellaneous methods of control..	19
Hunting with Dogs..	19
Protection of flocks and herds from Coyotes	19
Instructions for trapping and poisoning Wolves..	20
Instructions to trappers..	20
Seasonal trapping..	22
Poisoning..	23
Preparation of poison baits..	24
Other good baits.	24
Preparing poison for use.	24
Instructions for preparing skins.	24

ILLUSTRATIONS

Grey or Timber Wolves..	5
A Coyote den..	10
Young Coyotes removed from den..	10
Young Coyotes feeding..	11

The Habits and Economic Importance of Wolves in Canada

By NORMAN CRIDDLE, *Entomological Branch*

INTRODUCTION

The wolves of North America are separable into several distinct races, of which no less than seven occur in Canada. These races in turn may be readily divided into two groups, namely, the large grey wolves and the smaller prairie wolves, the latter being commonly called coyotes. As the habits of these two groups of wolves differ in various particulars, they will be discussed separately in this bulletin.

In dealing with animals that have a range in Canada extending from the Atlantic to the Pacific and from the international boundary northward to the Arctic Circle, it has been necessary to rely very much upon the writings of others, as well as upon the kindness of various correspondents who have generously responded to my appeal for assistance. Among the former, most of the standard works have been consulted and I have drawn freely upon the publications of the United States Biological Survey, to the officers of which, under Dr. E. W. Nelson, I am deeply indebted. I am also under obligation to Dr. R. M. Anderson, Victoria Memorial Museum, Ottawa; Major Allan Brooks, Okanagan Landing, B.C.; F. Bradshaw, Chief Game Guardian, Saskatchewan; E. R. Buckell, Entomological Branch, Vernon, B.C.; J. P. Coulter, Piapot, Sask.; J. H. Evans, Deputy Minister of Agriculture, Manitoba; C. de B. Green, Marron Lake, B.C.; Arthur Gibson, Dominion Entomologist, Ottawa; Ben Lawton, Game Commissioner, Alberta; J. B. Harkin, Commissioner. Parks Branch, Ottawa; Hoyes Lloyd, Secretary, Advisory Board on Wild Life; and numerous others.

The article relating to the prairie coyote is drawn, largely, from a paper published in the *Canadian Field-Naturalist* and written in co-operation with my brothers, Messrs. E. and S. Criddle, with whom the animals have been studied in Manitoba for nearly forty years, and to whose help I owe much in the preparation of this bulletin.

HISTORICAL

In former times wolves were almost as widely distributed as man himself. They have figured in history almost since its dawn, and as they were so constantly before the people of ancient times they naturally formed a prominent part in the folklore and supersitions of early periods. The story of the supposed founders of Rome is an example familiar to every one. Canadian Indians have innumerable stories connected with wolves, and it is interesting to note that some tribes still show a superstitious reluctance to kill the animals.

History teaches us that wolves have been a menace to farmers' flocks from earliest recorded times. England fought the animals for hundreds of years, and they continued to take toll of her herds until the sixteenth century; in Scotland they remained until 1743; France harbours them still, and Russia continues to record numerous human deaths due to their attack.

While wolves have been man's foes from time immemorial, it is interesting to know that he has brought some of them under domestication, and that several, if not all of our breeds of dogs, are descendants of members of the wolf family.

The attempted control of wolves had a very early beginning. We do not know how early, but history records that King Edgar of Saxon, England, levied a tribute of 300 wolf skins annually from the Welsh in the tenth century, and that Henry III granted lands on condition that the wolves upon them be destroyed.

In North America, we find that wolves roamed the continent long before man made his appearance on it. In early times, they lived by preying upon herbivorous animals, such as rabbits, deer, buffalo, etc., and it is probable that they then performed a useful work in keeping down rodent pests as well as in devouring the sickly or unfit game animals generally. Nor were these habits affected to any marked degree by the arrival of the Indians who were, themselves, chiefly hunters. With the advent of settlers from Europe, however, conditions changed. The new people were largely agricultural and brought with them cattle, horses, and poultry. They began to clear the land, to plant crops, and to kill the wild animals by means of firearms. Several new factors were thus brought into play. The natural food of carnivorous animals was either destroyed or much reduced in quantity, and a new source of food supply provided by the introduction of domestic live stock. As the game became reduced in numbers the wolves speedily learned to attack the farmer's flocks and herds, in this way acquiring a habit which they have persisted in ever since. It was thus that the problem of wolf control became of importance to the community and has remained so to this day.

THE GREY WOLVES

At least four distinct races of large wolves occur in Canada. These are the Eastern Wolf, *Canis lycaon* Seh., found in Quebec and adjacent parts of Ontario; the Buffalo Wolf, *C. nubilus* Say, formerly abundant over the buffalo-inhabited ranges of the prairies and adjacent woodlands, but now restricted to a much smaller territory; the Timber Wolf, *C. occidentalis* Rich., inhabiting our northwest forests; and the Arctic Wolf, *C. tundrae* Mil., met with on the barren grounds of the semi-arctic regions.

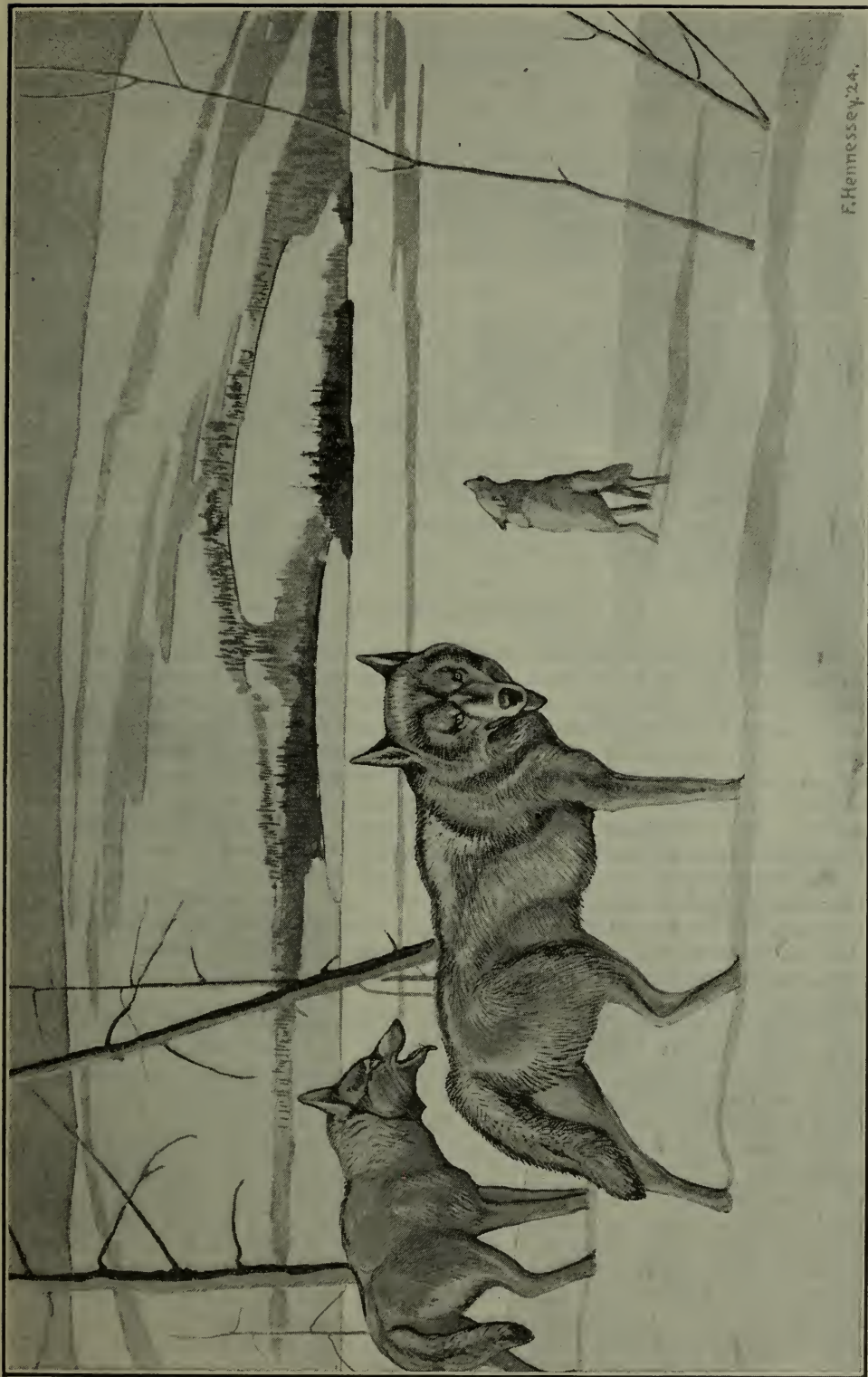
The ranges of these various wolves are still conjectural, but as their habits appear to be much alike they will be treated here under one heading.

The Buffalo Wolf, once a persistent follower of the animal whose name it bears, has given way before civilization, until to-day it is rapidly following the buffalo into retirement. The survivors, however, are probably still the most important stock-destroyers of the larger wolves, and as far as we know, it is this wolf which stockmen have chiefly to contend with in western Canada. The Buffalo Wolf, however, is no longer a serious menace in southern Canada, and its extermination over all the cultivated areas is only a matter of a comparatively short time.

THE HABITS OF GREY WOLVES

The grey wolves, as we know them to-day, are inhabitants of woodlands, but in former times they roamed over most of the prairie country. They are not so adaptable as the coyote to the ways of man, and for that reason they have gradually given way before agricultural development. They are timid, suspicious animals, despite stories to the contrary, and preferably avoid human habitations rather than risk meeting the occupants at close range. Individuals will, however, readily attack farmers' herds and having once acquired the habit they may persist until eventually destroyed.

In their home life, wolves make excellent parents. They are said by some authorities to mate for life, but the evidence on this point is conflicting. They have been known to fight fiercely during the mating season, and on this account it might be expected that the victor in battle would acquire the female of his choice for the season rather than for life. Having once become mated the pair



F. Hennessey, 24.

Grey or timber wolves.

remain in company throughout most of the year, and it is believed that both parents take an active part in providing for the young.

The dens consist of holes dug in hillsides, or of small rocky caverns where such are available. They have also been found in hollow logs or beneath fallen trees.

The young are born in April and May. They vary in number up to fourteen, six being a normal litter. The pups, like dogs, are born blind and remain so for about nine days. During this period they show very little intelligence. They seem to have an instinctive knowledge in obtaining food from their mother, but they readily attempt to suck any object within reach when removed from the den.

With the opening of the eyes and the developing of the other sense organs the pups undergo a rapid change and speedily become wolf-like, with all the natural alertness for which the adults are famous. The young are said to be suckled for about two months and after that time to feed upon half digested meat disgorged by the mother. It requires from two to three years for a cub to become fully grown, at the end of which period the wolf weighs from 90 to 125 pounds.

Parent wolves live in pairs during the summer months, but as the young develop they form with them small bands, which meeting with other families in their wanderings, acquire the proportions of packs. These packs break up again in February and as the breeding season approaches the animals once more become semi-solitary.

THE FOOD OF WOLVES

The food of wolves is exceedingly variable. Under normal conditions they live largely upon rodents, such as bush rabbits (*Lepus americana* Erxl.), gophers, mice, etc. They are said to kill and eat foxes, and it is probable that coyotes might be taken when their range overlaps that of the wolves. Young moose, or deer, fall speedy victims to the wolf's cunning, and in times of hunger large animals are readily brought down and devoured. Wolves are specially destructive to deer in winter time during periods of deep snow. Under these conditions deer congregate into what are termed yards and being unable to move away from such places without being quickly exhausted in the snow, they are slaughtered by wolves night after night until none remain. It may be but a single wolf that accomplishes this feat, but, as a rule, several are involved, and generally many more deer are killed than are necessary to furnish immediate food requirements. At other times, wolves hunt singly, either surprising a young animal as it strays from its companions or more commonly slowly overtaking their prey by persistent pursuit.

Writing in response to a request for information Mr. J. P. Coulter, of Piapot, Sask., states: "When making a kill wolves do not rush right in on the animal and take it down. I have seen them keep jumping past the animal and slashing at the hind quarters, tearing pieces off as the victim got weaker, till finally, when it fell from loss of blood, they made a meal of it."

The loud deep howls to which wolves give voice may be uttered as the animals congregate into packs or they may indicate a chase after game. That these howls strike terror into the uninitiated is not surprising. The hunter, however, knows that there is little real danger and at the worst he has only to light a fire to keep his prowling enemies at bay until daylight scatters them to seek more profitable hunting. As a matter of fact, we have little to warrant the belief that hunters are molested by wolves, and the few occasions when trappers have been found partly eaten by these animals doubtless occurred after the former had died from exhaustion or from some other cause, rather than to their having been attacked by wolves. We have only to recall the extreme difficulty in trapping wolves, or the rare opportunities of getting within

range of them, to discount the numerous stories which periodically find their way into the press, or the fakes in photography which occasionally accompany them.

THE ECONOMIC STATUS OF WOLVES

It has already been pointed out that wolves destroy large numbers of deer and allied animals, these creatures being in reality part of their natural food. The rapid settling of the country has, however, provided other prey which wolves frequently take advantage of. Sheep probably suffer most, but young horses and other live stock are often destroyed by them. Writing on this point Mr. Coulter says: "They kill yearling colts in preference to cattle, but will kill any kind of stock when hungry."

One has only to read the annual reports of the Chief of the United States Biological Survey to see how great have been the losses inflicted by wolves to the south of us, single animals, at times, accounting for thousands of dollars worth of live stock. Strange as it may seem, our losses in Canada appear to be less acute and while the depredations of wolves are serious enough in northern districts, the southern portions of Canada, at least, are comparatively free and such losses as occur are nearly always traceable to coyotes rather than to grey wolves.

The value of wolves lies chiefly in their pelts from which a considerable revenue is derived, and for which there is a good demand in the fur market. In addition to their value as fur producers wolves are also beneficial as destroyers of noxious rodents, particularly bush rabbits, which destroy countless numbers of young trees. They also play a useful part in eliminating sickly game animals due to the fact that the weakly are more apt to fall a prey to them than are healthy individuals. This is a provision of nature of which the average sportsman takes little account, yet it is important in preserving the health of game animals and serves as useful a purpose as the destruction of sickly animals in the flocks of the stockmen.

Weighing the evidence for and against the wolf it would appear that the animal is far too dangerous a neighbour to harbour in our midst on account of its destruction to live stock. It must, therefore, be eliminated from all our settled districts. Nor can we tolerate it in our game preserves. Whether it may be permitted to remain in the more uninhabitable regions of the north is a problem that must be left to posterity, as there is little chance of our being able to destroy it there at present.

THE ARCTIC WOLF

The Arctic Wolf, *Canis tendarum* Mil., is a variably coloured animal usually of a dull white with black along the back and tail. It may vary from this colour to grey, or even black in occasional individuals. It is closely related to the Buffalo Wolf and its general habits are very similar. The Arctic Wolf inhabits the barren grounds of the north where during the summer, it preys chiefly upon arctic hares, gophers, lemmings and young water fowl. In winter, caribou, musk ox and arctic sheep are devoured, and it is largely due to its winter habits that this wolf is condemned by game conservationists and the inhabitants of northern Canada.

The Arctic Wolf seems to be less afraid of man than its southern neighbours, and Dr. R. M. Anderson showed me, as evidence of this, the skin of a large female that had actually mixed with the sled dogs around his tent, and which bit Mr. D. Jenness, one of his party, on the arm. On other occasions they have been known to steal provisions from the sleds or tents. It seems, however, that the animals indulging in these habits are usually females which have been attracted to the vicinity by the sled dogs to which they are in reality closely related.

The Arctic Wolf is of importance in reducing northern game animals upon which the natives of those regions largely depend and it should, therefore, be reduced in numbers as much as possible.

COYOTES

The coyotes, or prairie wolves, are separated into numerous races of which at least three inhabit Canada. These animals are practically confined to the Prairie Provinces and British Columbia where their range is restricted to the open or semi-wooded country, and where they only occasionally enter the heavily mixed-timber forests. The destruction of such timbered areas by fire and the gradual clearing of the land for agricultural purposes has, however, made other territory available to the coyote, and in consequence, the range has been extended both easterly and northerly. The exact distribution of the three races is still doubtful, but it is generally supposed that the Common Coyote, *Canis latrans* Say, which is the largest of the three, inhabits all the lightly-wooded country east of the Rocky Mountains to the western borders of Ontario; that the Prairie Coyote, *C. nebrascensis* Merriam, a smaller animal, ranges over the more open country of the south, and that the Mountain Coyote, *C. listes* Merriam, is confined to British Columbia. A possible fourth coyote termed the Brush Coyote, supposedly of large size, has been reported by hunters and others as inhabiting the heavier timbered regions, but we have been unable to secure specimens to verify these claims. It seems probable, however, that this animal is really the Common Coyote, *C. latrans* Say, which occasionally exceeds forty pounds in weight.

THE HABITS OF COYOTES

When we speak of the coyote, it is well to remember that the three kinds involved are, in some respects, different in their habits and choice of food. It should be understood, also, that the native food is not always alike over the coyote's range and on this account the economic status of these wolves may differ in various parts of the country. Since, however, the habits are similar, it has been thought wise to include them in a general statement, the variations being considered later, in the chapter on food habits.

The coyote may be met with in any section of the country outlined above, but it prefers those districts which are undulating in formation and which provide a semi-wooded landscape. River flats and adjacent banks have a special attraction for the coyote, doubtless because such situations provide a maximum amount of shelter together with food and excellent breeding places. The so-called sand hill ranges are also favourite retreats and prove very suitable as breeding grounds. From these general haunts this wolf wanders far afield in search of food and therefore, there is really very little of the country which is not more or less overrun at one time or another.

Coyotes are timid, suspicious animals, and usually avoid close association with man during the day-time unless they can find convenient concealment such as provided by trees or shrubs. At night, however, they become more fearless and prowl even to the door-steps of human habitations in search of food. As far as we are concerned there are few animals to be less feared than the coyotes and the old stories of their attacking children have never been substantiated by trustworthy evidence. Nevertheless, these wolves were much bolder in early days and it was not unusual to be able to get within a few yards of them. Indeed, once, as a boy, I assisted in a chase after one of these animals which moved off in a very leisurely manner and in the afternoon returned sufficiently near to narrowly escape a hammer which was thrown at it. Modern firearms and the more thickly settled conditions have taught the coyote to keep at a safe distance, and consequently, while the animals are ever ready to take advantage of the new means of procuring food which man has provided, they show no desire to meet him face to face. It is for this reason that the coyote is now more often heard than seen, and it is only by hearing

them that we can form a reasonable estimate of the number present in a district.

The weird howls to which coyotes give utterance, more frequently during the darker hours, and in autumn, show much variation and without doubt convey numerous meanings, several of which are not hard to interpret. To one not accustomed to them, the united cries of half a dozen animals will be mistaken readily for a pack of twenty or more and perhaps occasion no small alarm. To those who have lived in a coyote-infested territory there is something particularly fascinating in their cries the absence of which would be much felt.

Usually a coyote-serenade is begun by a single animal uttering a bark and a shrill howl. This is answered by another some distance away, then the chorus is taken up by others at every point of the compass and in a moment the woods and hills echo and re-echo with music perhaps as weird as any that nature can provide on this continent. These vocal demonstrations may terminate as quickly as they begin or they may continue intermittently for hours and include the voices of animals as far apart as the ear can detect them. These utterances include a bark not unlike that of a fox, location cries, hunting cries, danger signals and perhaps challenges as well. It is doubtful, in fact, if there is another animal on the continent with a larger number of signals or one that can make them known to its fellows at a greater distance, or to better advantage.

There is reason to suspect that the female coyote retains possession of the area in which her dens are situated for a number of years, perhaps throughout her life, but that the males, though remaining faithful to their mates for the breeding season are obliged to change their habitats due to the law of battles which assigns the prize to the victor. In other words, the original pair will remain together only as long as the male retains his supremacy over his rivals.

Both parents take an active share in attending to their families and there is no doubt that the male provides food for the female in the early stages of motherhood. The young are reared in dens which frequently are formed from enlarged badger holes. Very little effort is made to provide a bed and the only indication of one consists of a few dead leaves; what bed there is, however, is always dry due largely to the warmth of the female's body.

For some time before the young are born, and occasionally afterwards, the female coyote spends much time in digging out various old holes or in enlarging those of other animals. Dens are occupied for many years and probably throughout the entire life of the female. Generally, however, the same pair possess two or more prominent holes, perhaps several miles apart, which are occupied alternately or for several years in succession, depending upon circumstances relating to the previous year. Besides their main burrows many other holes are enlarged from year to year. Thus the presence of breeding coyotes in a locality is often indicated by the hole-enlarging habit alone. Frequently these minor residences may be occupied by the young after leaving the original burrow, while at other times they provide emergency homes when danger threatens the chief one.

The burrows of coyotes may be found in a great variety of situations. Hillsides covered by brush are most frequently selected but nearly every imaginable place may harbour them, from situations in dense woods to bare hillsides or open prairies. The dens vary much in depth and length, their depth being largely influenced by the situation or condition of the soil. Thus, in a flat country, the holes slant downward but a few feet before turning in a horizontal direction; whereas on hillsides they may penetrate directly inwards, although usually with a curve. In length the newer burrows seldom exceed five feet, while old ones have been known to extend for more than twenty feet. There is usually only one entrance, but there may be several when a deserted fox den is occupied.



Upper figure, showing entrance to a coyote den, a cross indicating position in hole where young were situated;
 lower figure, showing young coyotes before their eyes were open, sleeping in a heap after having been removed
 from the burrow. (Original)

The young are born in late April or early May and the litters range in numbers of pups from one to fourteen, six being the average of over twenty families of which records were kept. It is probable that the smaller litters were reduced at an early stage of growth or at birth, while the larger ones may have constituted the offspring of more than one mother. Indeed we have evidence of this; in one instance when a den was found to contain seven young, three of which were fully two weeks younger than the other four; how these got together or why, is unknown.

The pups are born blind and remain so for about nine days, though some individuals reared by an assistant, Mr. R. M. White, did not all open their eyes for several days longer. The young show very little intelligence at first and when taken from the den remain in a heap or go to sleep as readily in the hands of their enemy—man—as they do amid the fur of their mothers. They know how to obtain food, but have no fear. With the opening of their eyes there is a marked change. The ears, too, become erect at this time and, therefore, with sight, apparently comes hearing. Soon the broadened nose narrows and the pups become like their parents—active and suspicious, running for shelter or crouching at the least alarm. They make interesting pets if reared from infancy, readily learning to take food from a bottle and



Young coyotes feeding from bottles. Photo by R. M. White. (Original)

showing in their playfulness all the little actions familiar to the breeder of domestic dogs. They also become extremely affectionate when treated kindly.

The young coyotes generally remain close to their original home until late June when they begin to follow their parents and wander from one hole to another. It is at this time that the value of the supplementary burrow is demonstrated. The pups may scatter over a considerable area at this period of the year and when danger threatens, the numerous holes become exceedingly valuable as hiding places.

The pups remain with their parents for nearly two months longer, after which they begin to depend upon their own exertions for obtaining food although they remain together more or less well into the winter.

The parents attend to the young with great care, and exercise considerable cunning in attracting the human enemy away from them. A characteristic bark and short howl uttered when man is near is often the means of locating a den, just as a crow by its notes unintentionally calls attention to the whereabouts of its nest. There are times, however, when the most experienced hunter is deceived, the den being either effectively concealed or at a much greater distance away than the wolf's attention would indicate. When a den

is located the parents keep watch from a convenient elevation and try by their cries to attract the enemy to themselves. Though these animals are very solicitous for the safety of their families, they make no effort to defend them from peril when man is involved and a coat thrown over the occupied den is quite sufficient to keep the parents away over night. While, however, they remain at a safe distance under such circumstances, they show much cleverness in luring dogs from their dens and at times attack them with great boldness.

Coyotes are expert hunters and they adopt various stratagems for the purpose of securing food. Their diversity in hunting methods has been interpreted, indeed, as almost human in their knowledge of the animals they are hunting, and while this is probably stretching the facts, there is no doubt that coyotes do show much cleverness in the way they go about the chase, particularly when more than one wolf is taking part in it. Hunting more by sight than their relations the grey wolves, they are often able to take short cuts to head off an animal while a companion is following the quarry. Acute hearing also enables them to adopt the same practice but that they actually know, as some authorities claim, that deer run in circles and station themselves at vantage points accordingly, seems very doubtful, particularly as the circle, when taken, is exceedingly indefinite in length or width. One method of hunting very often resorted to is that of lying in wait until the unsuspecting victim comes sufficiently near, then a rapid dash ends in a capture. This is what is termed the surprise method. A variation of this is for the coyote to saunter casually within reach of the game, well aware of its presence, and, leisurely awaiting an opportunity, to suddenly dart in before its victim has time to escape. These are the means usually resorted to in stealing poultry from the barn-yard or in hunting game birds. Jack rabbits are nearly always taken by surprise, being too fast to overtake in chase. Bush rabbits, on the other hand, may be either surprised or overtaken. In the latter case the coyote follows more by scent than sight and the chase is often a long one. No sound is uttered by the pursuer while thus employed.

Apart from the general methods of hunting depicted above, there are the more accidental means of procuring food, such as the discovery of nestlings or eggs, the disturbed mouse and the newly born rabbit which are picked up as the coyote wanders over the country.

The farmers' flocks have provided a new source of food supply for the coyote which often enables it to survive when the native food falls short. Hunger will make any animal bold, but the coyote is by no means unmindful of the danger involved in visiting farmers' habitations, and all its cleverness is brought into play for the purpose of outwitting man. That it succeeds is amply demonstrated by the devastation wrought among both sheep and poultry during years of rabbit scarcity. Yet the sheep killing habit is by no means a usual one, being more often the work of one or two old wolves, whose cunning learned by experience, enables them to escape the usual devices prepared for their destruction. It is probable, too, that most of the damage is done by the larger Common Coyote east of the Rocky Mountains, and by the almost equally large Mountain Coyote, west of them.

Coyotes frequently wander far in search of food and often their favourite hunting grounds are a dozen miles or more away from their dens. In winter they have no fixed abode but may be met with during the day resting upon a sunny bank or upon a strawpile from which points of vantage they can view the surrounding country. The condition of the snow greatly influences their presence in a given locality. When this is soft and deep or semi-frozen hunting except by surprise, becomes impossible and the wolves are obliged, therefore, to seek more profitable surroundings. Often the only means of subsistence at such times consist of a dead horse or cow dragged away from the barn by a farmer, but for which the wolf might well perish of starvation. Like many

carnivorous animals, the coyote kills more if possible than is required for immediate use, the remainder, when not too large, being buried in the same way as a dog hides a bone.

THE FOOD OF COYOTES

The coyote lives chiefly upon rodents of which bush rabbits constitute by far the largest item. When rabbits become scarce through disease this wolf readily turns to other creatures to make up for the deficiency, and when sheep and poultry are convenient it has no hesitation in adding them to its bill of fare.

It is in this way that the coyote fluctuates in importance with the relative prevalence of its wild food supply. Not only has this native food an important bearing upon the economic habits of the wolf, but it is also a factor which largely governs the survival of the pups, a fact which close observation has fully demonstrated during the last fifteen years. It was found that when rabbits were abundant the coyotes' litters were larger and the pups survived without difficulty. Centering around 1918, however, the rabbit population was much reduced by disease east of the Rocky Mountains with the result that nearly all the coyote litters were small and but few of the pups reached maturity. It is possible that the relative size of the original litters was not as variable as our observations indicate, but that the young died at an early stage of growth. By 1921, the rabbits had once more assumed their normal numbers and the survival of young coyotes was again unrestricted.

The influence of rabbit fluctuation on the economic status of coyotes is of much importance because it is during the years of rabbit scarcity that nearly all the injury is inflicted upon live stock, a fact at once indicated by the large numbers of complaints of wolf depredations received by the Dominion and Provincial Departments of Agriculture around 1918, and by the very few registered from 1921 to 1924. This, however, does not refer to British Columbia where conditions are different and another kind of coyote exists. But even there the rabbit prevalence has a marked influence on the coyotes' activities amid the farmers' flocks.

Poultry are more apt to suffer from coyotes at any time than are larger animals because they approximate the size of this wolf's normal food, but the losses are far less where rabbits are plentiful than where they are scarce.

The following is quoted from a letter received from Mr. F. Bradshaw, Provincial Game Guardian, Saskatchewan: "With regard to the coyote, I find upon enquiry that there have been fewer complaints of destruction by these animals during the past three years. Only the other day I was speaking to a sheep herder along these lines and he informed me that he had not lost a single sheep during the past three years although the coyotes are seen and heard in the vicinity of the sheep ranch. It is also significant that the sheep breeders when in conference usually make this subject a very live topic, but of recent years it has not received nearly so much prominence. Nevertheless, I do not think there has been any appreciable decrease in the numbers of coyotes."

Referring to 12,000 coyote skins sold in the Province during 1922, Mr. Bradshaw goes on to say: "This does not take into consideration the pelts upon which bounties were paid and the large number of coyotes that must have been killed when the fur was of no commercial value. Under the circumstances one would seem justified in concluding that the coyotes have been living mainly upon wild life and it is noteworthy that game birds and rabbits, especially the jack rabbit, have been very plentiful during this three year period (1920-23). In some districts the jack rabbits have been a veritable pest, so much so that a bounty is paid by some municipalities for their destruction and recommendations have been made that coyotes be protected in order to control the pest."

Apart from its preference for rabbits, the coyote is almost omniverous in its choice of food. All the smaller forms of wild life are eaten: gophers, mice, game birds, small birds, frogs, probably snakes, grasshoppers, beetles, etc. The coyote has also a liking for fruit and when other food is scarce it makes a practice of frequenting choke cherry bushes, the fruit of which form quite an important item of diet. In addition to this, it has been known to eat apples, watermelons, haws and rose hips, as well as grain. Finally, there is the well-known habit of devouring dead animals, the latter forming an item of diet which is often of the utmost importance to the coyote in times of deep soft snow when ordinary hunting is of little avail.

The Mountain Coyote of British Columbia has habits very similar to its relations of the plains, with the exception that it shows a greater liking for sheep and apparently deer. I have not had a personal opportunity of studying this animal but shepherds and sportsmen are so unanimous in their condemnation of it that its sheep and game destroying proclivities can hardly be questioned. I have before me letters from the well-known naturalist, Major Allan Brooks, from Mr. C. de B. Green and others, all condemning the coyote. An article in the *Agricultural Journal of British Columbia* for July, entitled "Coyote Control," by Mr. T. P. MacKenzie, Commissioner of Grazing, is equally severe against the animal. Indeed, the general testimony is so unfavourable to the coyote as to leave little doubt of the wisdom in attempting to reduce its numbers in every possible way.

THE ECONOMIC IMPORTANCE OF COYOTES

The greatest losses inflicted by coyotes are to the live stock industry, the stock affected being mainly sheep and poultry. During times of rabbit scarcity these losses become very severe and many thousands of dollars worth of damage is done annually by prairie wolves, to say little of the general discouragement which this loss gives to sheep-farmers. As a rule, these depredations continue to be severe for about three years, or until the rabbits attain their normal numbers again, when coyotes once more turn their attention chiefly to the natural food supply, the losses to sheep then becoming practically negligible. Poultry, however, continue to suffer from coyote activities though much less frequently.

Thus it is that the economic status of the prairie coyotes is largely governed by the numbers of rabbits and other rodents upon which they normally subsist, and the losses inflicted by them are, therefore, fluctuating in character rather than continuous from year to year. There is no question, however, but that the sheep industry suffers severely during times of rabbit scarcity, and that its encouragement would be enhanced were the coyote menace removed.

Apart from attacking sheep and poultry, coyotes occasionally kill young calves or pigs, but this is only a casual habit and is usually traceable to a single old wolf.

Next to the losses inflicted upon domestic animals come those upon game or other useful creatures. Grouse are frequently destroyed while young, as also are ducks, smaller birds and their eggs. Deer are reported to have been killed on various occasions, especially during severe winters when the snow was deep and firm enough to support the coyotes but not the deer. Other useful animals, such as weasels, skunks, shrewmice, etc., also suffer from coyotes, and there is reason to believe that even foxes are not immune from their attack.

Before concluding the evidence against coyotes, it is necessary to state that they are capable of contracting rabies, which they readily spread to domestic animals such as cattle, horses and dogs. We have no authentic records of this having occurred in Canada, but in the United States a very severe outbreak of rabies took place among predatory animals and considerable losses were inflicted, and much money spent, before it could be brought under control.

Another disease spread by wolves is that known as gid in sheep. This fatal affection is due to bladder-like cysts formed on the brain. It is in reality caused by the immature stage of a tapeworm found in dogs, coyotes, etc., and so far as is known it has no other means of spreading than through these animals. The chief method of distribution is brought about by carnivorous animals devouring carcasses of sheep which have died of the disease. Dr. Seymour Hadwen, formerly Chief Veterinary Pathologist of the Dominion Department of Agriculture, who furnished this information, states that gid in sheep is not uncommon in Montana and that it has been found in Saskatchewan. Should this disease ever become prevalent in Canada, the problem of coyote elimination would doubtless assume a more serious aspect. Prompt destruction of carcasses affected by gid should, however, do much to overcome the menace.

Another tapeworm in which coyotes act as one of the hosts is that in which the bladder stage occurs in rabbits, both the bush and the jack rabbits being affected. This parasite becomes extremely common in times of rabbit abundance and undoubtedly has a marked influence in reducing their numbers. An interesting feature in the life of this tapeworm is that the bladder or cyst stage so weakens the rabbits that they fall easy victims to coyotes, and in this way the parasites are perpetuated much more readily than would otherwise be possible. The rabbit-coyote tapeworm is, of course, dependent upon both animals for its existence and the destruction of either would practically eliminate it; a fact well worthy of consideration when we realize that to destroy the coyote might materially improve the health of the rabbits.

THE VALUE OF COYOTES

The value of coyotes is divisible into two sections, namely, their usefulness as destroyers of noxious animals and their importance as fur producers.

Attention should be drawn, first of all, to the fact that bush rabbits are at times serious pests which destroy millions of young trees both in forests and in areas under cultivation. Jack rabbits also do much mischief and are yearly becoming more important as pests on the prairies. Since the normal food of coyotes consists of these animals, their value in maintaining a natural balance is unquestionable. The coyote also kills innumerable gophers, mice and voles, all of which take heavy toll of the farmers' crops. The destruction of these smaller rodents is particularly marked in years of rabbit scarcity, when coyotes have to make up the deficiency in rabbits by obtaining other food.

Among the minor uses of the coyote, may be included its habit of devouring insects. This perhaps, is not of great economic importance, but it is interesting to note that these animals have been known to follow the plough, at a safe distance, and pick up white grubs (*Phyllophaga* spp.). They also feed extensively at times upon grasshoppers.

That the coyote performs a useful purpose in devouring carrion is probable. It may also be of use in checking such fatal diseases as Rocky Mountain spotted fever brought about by the bite of a tick and spread by rodents, including bush and jack rabbits.

Such, in brief is a summary of the food habits of the Prairie and Common Coyotes. In arriving at these facts data have been obtained from as many sources as possible including the examination of dung which has provided many interesting details.

An account of the economic standing of coyotes would, however, be far from complete without reference being made to their value for fur-producing purposes. The demand for pelts has increased enormously within recent years, and as our northern animals are among the best fur producers, their importance as a source of revenue cannot be overlooked. As an illustration of this, it may be noted that according to Mr. Bradshaw more than twelve thousand coyote pelts were purchased by fur dealers in 1922 from Saskatchewan hunters,

which, at a normal price of ten dollars each, would mean a revenue of \$120,000, the total for the three prairie provinces probably exceeding \$300,000 in one year.

The facts presented above will indicate how difficult it is to arrive at an accurate conclusion as to the coyote's economic standing; at one time it does immeasurable harm, at another it is an ally whose good deeds, combined with the value of its fur probably outweigh the harm it does.

The most important evidence against the coyote undoubtedly relates to its sheep-destroying habits rather than to the losses inflicted upon poultrymen because, apart from the fact that poultry can be protected by fencing, there seems little doubt that the revenue derived from the sale of coyote pelts more than balances the poultry losses. There are, however, sure to be years of rabbit scarcity when serious harm will be done to livestock on the prairies. It is believed, however, that by studying the prevalence of the wild rabbits an accurate forecast of impending coyote activities among the farmers' flocks might be made and in this way steps could be taken to guard against them.

Judging from most of the testimony available, it appears that the Mountain Coyote of British Columbia has less to make its perpetuation desirable and the losses, as well as the discouragement, which it causes sheep-breeders, make its destruction necessary if sheep production is to become a permanent success.

WOLF AND COYOTE CONTROL

The problem of controlling noxious animals is one which has engaged the attention of governments and individuals from early times. Rewards for the animals destroyed, usually in the form of bounties, has been the most popular method of attempted control as yet, but in spite of its popularity, it would seem very doubtful whether any permanent reduction in the numbers of the animals has been accomplished by this system.

Agricultural development, increased population, and firearms have probably done more to reduce noxious animals than the millions of dollars spent in bounties, while the demand for fur, and the up-to-date methods of procuring it, have aided much in bringing about this end.

The evidence against bounties as a means of controlling wolves is now so overwhelming as to scarcely require repetition. In practically every case investigated the objective aimed at has not been reached despite the enormous sums of money expended. Probably one of the chief objections to bounties is that they provide a reward for animals killed irrespective of other considerations. In other words, fully half the wolves destroyed are taken casually and not because there is a bounty offered for them. Of late years the value of pelts has been ample enough to induce coyote hunting whenever opportunity offered. Farmers do not, however, hunt these animals in a busy season for the sake of a two dollar bounty when they can get ten dollars for prime skins during a slack season later on. Nor is the search for dens and young pups particularly remunerative, and it often happens that bounty is paid for pups, many of which would have died in the course of being reared.

Another objection to bounties is that they lead to innumerable frauds which only an expert can detect and no amount of legislation can guard against.

All the wolf-infested provinces of Canada have spent large sums of money on bounties during the last quarter of a century, which have failed to attain the object aimed at. Coyotes, it is true, have fluctuated in numbers from time to time, due chiefly to natural causes, but judging from the majority of reports available they are as numerous to-day as they ever were. It would appear, therefore, that the bounty system is not a practical one for controlling predatory animals.

Bounties are not recommended in this publication, but should they be adopted as a measure for wolf control, some plan of uniformity is essential

whereby states and provinces agree to a consistent method of action in order to guard against such practices as requiring a leg as evidence of killing in one place and ears in another. The bounty should be confined to animals destroyed during the summer months and perhaps to pups alone.

The most effective method of controlling predatory animals on a large scale is that inaugurated by the United States Bureau of Biological Survey, which has allotted definite territories to divisional inspectors with some 300 expert hunters under them directed by an administrative head at Washington, D.C. The scheme is worked under a co-operative system whereby states, counties, associations and individuals, unite with the federal government in providing funds and carrying on the necessary work. In addition, the federal department has engaged experts who have greatly improved methods of destroying the animals and overcoming the many difficulties that are encountered in work of this kind. Hunters are despatched, on request, to localities where depredations are most acute or to where some particularly cunning animal is doing great damage and yet avoiding the contrivances prepared for its destruction. In this way enormous savings are frequently made at a relatively small cost.

Referring to the Report of the Chief of the United States Bureau of Biological Survey for the year ending June 30, 1922, we find that continued operations in that year accounted for approximately 80,000 predatory animals which, it is claimed, represents a saving of about \$4,000,000. Moreover, the skins, which become the property of the government employing the hunters, produced a revenue of \$34,000, making a total since 1915, in excess of \$283,000.

These operations consist of trapping, seeking dens from which the young are taken and destroyed, and in wholesale poisoning. The last-named practice is by far the most extensive, and we quote from the report referred to above in order to show how great and satisfactory this practice is:—

"The chief poisoning operations are conducted in winter, but very effective work has been done in summer in desert country, particularly around watering places. The small fat baits distributed about a poison station are especially suited to operations over plains and deserts where the climate is at least moderately warm and natural food for predatory animals is abundant. Carcass poisoning is successful on the high summer ranges, where the weather in winter is colder and the natural food supply of predatory animals is scarce. The value of this method lies in its permanency, as the poison continues effective until spring or until no part of the animal remains; and it makes possible the destruction of predatory animals over vast timber and mountainous areas where no camp accommodations are available during the winter months and travel is impossible except on snowshoes. The poison-studded stations are established after the sheep and cattle have been removed to lower ranges and when the weather is sufficiently cold, the hunters work down the mountains behind the retreating herds. As the stock is again moved up to the summer ranges in spring the hunters go in advance to destroy all the stations that were established, in order to prevent accidental poisoning of dogs or other animals and to trap predatory animals which have escaped the poison. Similar systematic work on winter ranges and lambing grounds has practically ended livestock losses over great areas and has much reduced them at other places.

"In a period of five weeks two Utah hunters put out a poison line approximately 300 miles long in a great loop and around the first two stations on their return found 40 dead coyotes. A stockman wrote that these two men did good work for, as he put it, they left a string of dead coyotes wherever they went."

The chief points of advantage in the above system are in being able to concentrate upon any given point—the central organization, and the thorough co-operation possible throughout the infested territory. The last consideration is particularly important in the case of countries where predatory animals occur on both sides of the boundary, as the operations on one side would be more or less abortive unless accompanied by similar efforts on the other.

The system in any case, is much more effective than that of offering bounties. It is also more economical because the money utilized does not, in any way, remunerate the individual who destroys wolves casually, or for their fur, in the way that bounties do. The appropriations made are for direct results and the value of skins of animals killed goes toward lessening the cost of operation.

While state control may be the most efficient means of protecting farmers from noxious animals, it is believed that such means should only be adopted when the farmer is unable to do the work himself. Government experts similar to those available for investigations or for giving advice and supervising the control of insect pests, might be employed to advantage, and a few expert hunters would doubtless accomplish much in exterminating particularly noxious individuals, or in concentrating upon districts where severe depredations were taking place.

In a great many instances, however, the farmer should be able to protect his own flocks and the following points are given to assist him in doing so.

Many of the losses to live stock or poultry are caused by a single wolf, more often an old one, the killing of which brings the depredations to an end. In hunting down these single wolves several precautions are essential to success. First, it must be understood that wolves have a wonderful power of scent and hearing. Secondly, they usually adopt certain times of the day to make their raids, and in approaching they take advantage of any cover available, coming up from behind bushes or along a gulley. They make a careful inspection as they approach and have been seen to actually stand upon their hind legs in order to get a better view of their surroundings. The hunter who watches for a coyote must, therefore, take into consideration the direction of the wind and be sure that it is not blowing from him towards the coyote's usual road of advance. Next, he must keep still and conceal himself as much as possible. Patience is essential and a few days of time lost from other work must not be considered. It is better, also, to wait for a comparatively sure shot than to be hasty and miss, for a wolf once frightened is an extremely difficult animal to destroy (see instructions for trapping).

Coyotes frequenting a certain district in springtime are almost sure to have a den in the vicinity. If near a sheep or poultry run it should be sought out and destroyed, if possible after taking advantage of its presence to kill the parents.

Dens are not always easy to locate, but they may be often traced by the newly dug out holes referred to under the chapter on "The Habits of Coyotes;" by the earth scratching habits of the male, and by taking note of the direction in which the animals howl. Careful noting of tracks, and the fact that they lead to and from a certain point, is also an aid to locating the den. Parent coyotes will always seek an elevated situation when they discover man in the vicinity of their young and it is not unusual for them to utter quick barks with a short howl at the end, a signal that nearly always indicates a den within a mile or two. The pups can be often traced in July when their shriller notes are readily distinguished from those of the parents. The animals, however, are not easily found at this time. An inhabited den is recognized by the worn appearance of the opening and by the indistinct pathways leading to it. It is also possible as a rule, to hear the young within. Coyotes, however, enter many holes and the fact that there is hair sticking to the sides does not necessarily indicate that there is a family in residence.

MISCELLANEOUS METHODS OF CONTROL

When farms and flocks are large enough the employment of a regular shepherd would seem to be economical. There is no reason why, however, the herder should not be one of sufficient experience to know how to protect the flocks from predatory animals. Major Allan Brooks, indeed, suggests that the problem of controlling these animals lies in the engagement of men with duties similar to those of British game-keepers. Such men would know how to shoot and trap and would be familiar with the habits of the creatures they were protecting, as well as with those they wished to destroy. The system is successful in the land of its origin. Its success in Western Canada, however, depends upon the cost of operation of which no figures are available. It seems to be well worthy of a trial. Mr. C. de B. Green of Marron Lake, B.C., writes:—

“There is only one sure method of destroying coyotes and that is from May 15 to June 15 in this district. Two expert rifle shots accompanied by trained dogs trace a coyote to its den. The coyote follows the dogs back from the den till they meet the men who shoot them and then destroy the den. To trust a single rifleman is not enough since it often leads to one wolf being missed which cannot be got afterwards.”

HUNTING WITH DOGS

Many men have made a success of hunting coyotes with dogs, and there is reason to believe that this method of destroying the animal might prove very successful on the more open country where the coyote would not be able to escape among the trees. The dogs used are usually a cross between greyhounds and Russian wolfhounds, the pure greyhound failing as a rule to pull the coyote down. A man on horseback is a necessity in such hunting, but the chase presents a good deal of attraction and might well be developed into a sport that would combine pleasure with profit and usefulness. Some hunters are said to make more than two thousand dollars a year by hunting coyotes with dogs.

Foxhounds have been used successfully to run down coyotes that have obtained entrance into coyote proof pastures, but we have no records of their being profitably utilized for coyote hunting generally.

PROTECTION OF FLOCKS AND HERDS FROM COYOTES

One of the most important methods of overcoming the depredations of prairie wolves is to erect fences which they cannot get through or over. The initial cost of such fencing is high, but the saving, in the long run, usually more than compensates for the money spent. The object of fencing is to keep the coyotes out, but there are also some advantages in having the livestock safely corralled which should not be overlooked in estimating the practical value of coyote-proof fencing. The method has this additional advantage that it protects the flock and at the same time preserves the coyote for the trapper to make a living by. It, moreover, keeps out dogs which are frequently more destructive to sheep than coyotes are.

Fencing against noxious animals has been in operation for many years in Australia and South Africa, in the former country against rabbits and dingoes, and in the latter as a protection from jackals. It is becoming more common in North America and wherever the fences have been built correctly the results have been highly satisfactory. To fence mountain ranges is doubtless impracticable but even there moderately sized pastures might be enclosed for night protection or for convenience at other times. For persons rearing poultry on a large scale, fencing seems to be a necessity, and its economy can hardly be questioned.

From the evidence available it is believed that a triangular-wave wire-fence with a mesh of not more than five inches, three feet high and containing two strands of barbed wire above, would be sufficient to keep out coyotes under all ordinary circumstances, but in order to make sure of success, a four foot fence is recommended. The wire should rest upon the ground so that wolves cannot crawl beneath it, because, as a rule, a coyote is much more apt to force its way through or under an obstacle rather than to attempt to jump over it. Some authorities, indeed, recommend barbed wire sunk four inches into the ground as an additional protection, but this, under ordinary conditions, seems an unnecessary addition to the cost of construction. It is naturally important that such fences be kept in good repair, and that badger holes dug beneath the wire be promptly filled in to prevent coyotes using them as an entrance into the pasture.

Sheep bells and scare-crows have their limited uses and they may often be profitably employed to keep predatory animals away. Coyotes, however, get used to them in time and then an alteration becomes necessary. Any object that has been handled will keep wolves away temporarily.

INSTRUCTIONS FOR TRAPPING AND POISONING WOLVES

The instructions given below are copied largely from printed matter supplied to hunters by the United States Bureau of Biological Survey, which the Chief of the Bureau has very kindly permitted us to use. They have been modified in places to suit our conditions or when our experience seems to warrant alterations.

INSTRUCTIONS TO TRAPPERS

Trapping Equipment.

One pair of clean cotton gloves, for trap setting.

One canvas, three feet square, used to kneel on and to put dirt on when setting a trap; it should be rubbed over the body of a coyote to get the right scent.

One hatchet or prospector's pick.

One pair of lineman's wire cutters and several feet of bailing wire.

One bottle of scent, with cork and screw cap.

One sharp-pointed No. 9 wire, five inches long, for killing coyotes.

One small sack for coyotes' droppings.

Rifle and cartridges.

Traps for summer should be No. 3 size, and in winter No. 4. Clamps for setting traps are desirable.

Placing Traps.

Find places most frequented by coyotes as indicated by tracks. These are usually along the bottoms of gullies, at creek crossings, trails or on hills used for lookout places. Young coyotes, in particular, are very fond of playing on sandy blowouts.

Trail Setting.

Trail settings are most successful in rough country where the animals are forced to go through canyons or passes. Traps are concealed in the centre of the trail and no scent or bait of any kind is used. The narrowest point in a gully where trails run together or the lowest place in a pass are the best locations for trail setting. Such traps will catch wolves or coyotes that would not go near scent settings.

When trail settings are interfered with by stock, advantage should be taken of vacant pastures. In making settings never follow along the path but approach from the side so that human tracks may not be noticed.

Two or more traps may be used in a setting, placing them lengthwise on the trail and the pans 18 inches apart. A stake or drag should be used for each trap and the chains should be pulled out full length in opposite directions. After making a trail setting, the ground should be smoothed over and made to look as much as possible as it did before it was disturbed. (See seasonal trapping).

Pork Crackling Set.

Select a site on a high place away from the bush, from 5 to 100 feet to the side of a trail, taking advantage of the prevailing wind so that the wolf can smell the bait from the trail. Set two traps about 18 inches apart. Scatter a handful of pork cracklings over the trap setting and within a radius of three feet, with some in between the traps. A little grease left between the two traps helps to keep the coyote around if it does not happen to get into the trap while picking up the crackling. Pork cracklings should be chopped up fine then scorched a little in a hot oven. Bacon rinds, when prepared in this way, make excellent baits. When either of these two baits is used some of the grease should be smeared over the traps. Horse meat, raw and chopped up fine, is also good when used in the above manner.

Natural Setting.

Advantage should be taken of places where coyotes urinate, or where their droppings are found. A carefully prepared blind set, without bait or scent is best here.

Cut-bank Setting.

Whenever possible, a scent set should be made near the edge of a cut-bank so that when the animal gets into the trap it will fall over the edge of the bank and so in a short time be hanged. It is very rarely that a coyote caught in such a place can get away by twisting loose. If possible, the hunters should stand in the gulch under the bank while the setting is being made.

Open Water Sets.

In making water-sets for wise animals the hunter should wade up or down stream for several yards until he strikes a narrow piece of land protruding into the water. Place the trap near the edge of the water and cover with moss so that the water barely trickles over the top of the moss. A piece of fish or meat placed under a rock about eight inches from the trap and out towards the centre of the stream will attract the coyote.

Barn-yard Settings.

Where coyotes are stealing poultry they always approach from the side that provides the most cover, such as from behind bushes and banks. A few good trial sets will soon catch the coyotes.

Badger Set.

When a badger, skunk or similar sized animal has been killed it should be put down in a place where a trap is to be set and where there are no weeds and grass so that the sun may burn the grease into the earth. After three or four weeks remove the animal and place two traps in the scented earth. When a coyote has been caught here, reset the traps but do not use any scent or bait.

Badger-hole Setting.

After setting traps on a badger mound brush them with a freshly killed rabbit from which the entrails have been drawn, throwing the latter down the hole. No other bait or scent should be used.

Gang Sets.

Gang sets are most effective in the fall before the pups have become trap-wise. Watch the tracks closely and find where the bunch of pups are making

their headquarters. Place about twelve traps within a radius of one hundred yards, using fetid scent. If one pup is caught, it is almost certain that some other pups will get into the trap.

SEASONAL TRAPPING

Winter.

Traps at this time should be placed level with the ground and the pan should be covered with paper. Let the falling snow cover the trap providing it does not crust over. When the snow drifts, hunters should place their traps on ridges where the wind will keep the traps barely covered. Fine sheets of hard snow are excellent for covering the traps, but it is desirable to place some paper or wood shavings beneath the pan to prevent clogging by snow. Skis may be used to advantage in travelling over the snow as they retain very little human odour. Heavy drags are better than stakes for fastening the traps to. They are easily traced in the snow and the coyote is less likely to pull free from the trap than with a solid support.

Spring.

Hunters should keep all their traps busy during the denning season. Trail settings should be made for the adults and the pups be taken afterwards. Keep well away from the dens in trapping, otherwise the parents will remove the pups.

Summer.

July 15 to August 31. This is when the young have left the dens and begin to travel in families though not for any great distance. Their presence is indicated by their cries towards night and by the playgrounds. Gang sets are probably of most value at this time but a series of traps about a quarter of a mile apart will usually secure the inexperienced young.

Autumn.

This is when the pups are hunting for themselves and they are often very hungry. The gang set is most effective at this period of the year.

SCENT PREPARATIONS FOR WOLVES AND COYOTES

Various scent preparations are attractive to wolves and coyotes. The following scents may be easily prepared:

Fetid scent.

Oil from decayed beaver, mice, muskrats, calves and colts, putrid blood, juices from unborn coyotes or rotted suckers, with an ounce of zinc valerate, or an ounce of ground-up mush from beaver or muskrat mixed with every gallon makes an excellent fetid scent. Hunters should always keep a good supply of this on hand. The older the scent, the more attractive it is to the coyote.

Passion Scent.

Take wolf or coyote urine, the gall, and the anal glands, which are situated under the skin on either side of the vent resembling small pieces of bluish fat; or if these cannot be obtained, the whole anal parts may be used. In preparing four ounces of the mixture, use one ounce of glycerine to give it body and to prevent too rapid evaporation, and one grain of corrosive sublimate to keep it from spoiling. Let the mixture stand several days, shake well, and scatter a few drops on weeds or on the ground six or eight inches away from the place selected for the trap. The farther from the trail the trap is set the greater will be the quantity of scent required. A little of the scent should be rubbed on gloves and shoes to conceal the human odour. Three or four coyote droppings placed about eight inches back from the trap pan with passion scent placed on them make a good attraction.

The footpad from wolf or coyote ground up fine, or from which the oil has been rendered and mixed with the above scent, together with a few drop-pings, give the mixture body and strength. The urine may be obtained from a coyote that has been trapped or from a domestic dog.

POISONING

Necessary Equipment.

In order to put out a satisfactory poison line in the quickest way the following outfit is recommended.

Team, sled or wagon, an axe, butcher-knife and bailing wire to fasten parts of carcass to stakes.

Poison Lines and Stations.

In establishing poison lines, stations should be strung out in the same manner as a trap line, except that plans should be made to cover four times the territory.

Best Station Material.

(a) Horse or cattle carcass. Cut animal into eleven pieces; namely, head, neck, two shoulders, two ribs, two hind legs, rump and two pieces of entrails, the belly fat and fat from entrails to be saved.

(b) Recently stripped carcass that coyotes have been feeding upon.

(c) Entrails of butchered animals.

(d) Dead chickens, badgers, rabbits, etc. These buried with a tail or leg sticking out make excellent poison stations.

When materials are ready load them into the conveyance and following the line mapped out, leave the first portion at station one and scatter about fifteen dummy baits, the size of a silver dollar, within a radius of 40 feet of each station. Fasten a ten-pound meat drag behind the conveyance which will assist to bring coyotes into the station.

Travel on for a mile and leave another portion of the carcass, fixing same with the wire to a convenient support. Repeat until the entire load has been disposed of. Locate stations carefully on natural travel ways of coyotes. Use dummy baits at each station when putting out first line.

Don't put out any poison until after the stations have been visited by coyotes.

In districts where there is danger of killing dogs, poison notices should be posted in conspicuous places and all herders and residents informed as to the exact location of the poison stations.

After several lines have been established a beginning can be made in placing poison baits along the first line, putting from five to ten dummy baits at each station within a distance of from 15 to 30 feet of the large bait. Hide some of them under chips or bits of snow so that they may escape discovery by magpies, etc.

When coyotes have not visited the station no baits should be put out. Don't put out dummy baits when poison baits are exposed.

When the ground is bare of snow, and there is no danger of killing sheep dogs, place baits from 50 to 100 feet away from the stations, otherwise keep within 30 feet of them.

General Hints.

Don't poison carcasses.

Don't use salt pork for baits.

Don't place poison near main roads.

Don't leave poison baits lying around; burn them when they are no longer of use.

Don't put out poison in meat; it endangers dogs.

Don't fail to gather up all poison when the work is done.

Don't fail to obtain permission before putting out poison baits on private land.

When coyotes get poison-wise pick up all poison baits and feed dummy baits until they have cleaned them up twice, then give poison baits again.

There are laws governing the use of poisons. Learn what they are before starting a poisoning campaign.

PREPARATION OF POISON BAITS

(1) Fresh clean fat (not rendered) from horse, beef, cattle, hogs or sheep should be used in preparing poison baits.

(2) Hands should be cleaned and thoroughly greased before starting to make baits, to avoid imparting the human scent.

(3) All baits should be cut before the poison is placed in them.

(4) A dose of poison consists of 4 grains by weight of the granular form of strychnine.

(5) Make baits about one and a quarter inches square by about one-eighth of an inch thick, placing the poison in the side without splitting the bait, and taking care to avoid spilling any on the outside.

(6) Place poison baits in cans with an air hole and a tightly fitting top to guard against dogs or cats getting access to it.

(7) Poison baits should be prepared the night before they are to be put out, and they should be kept in a cool place.

OTHER GOOD BAITS

Lard-honey Bait.

Warm some lard and strained honey by placing them in a warm pan, but not over a fire. Mix three parts of the lard to one part of honey, mould into pellets about the size of a walnut, adding to each a dose of poison. This bait is successful in cold weather and is placed around poison stations in the usual manner. Put the lard-honey mixture in a quart can and take two teaspoons along to make these baits in the field.

Ground Suet

Fresh beef suet or fat put through a meat grinder and moulded by hand into balls with poison in the centre makes a good coyote bait.

PREPARING POISON FOR USE

Measure out on a piece of glass or a saucer the quantity of strychnine necessary to prepare the number of baits required. Add sufficient cold water to make a paste thin enough to spread rapidly, but not thin enough to run. Make a small hole in the side of the bait and place the paste within so that none is left on the outside. Fill the hole with some small bits of fat. Do not add oils of any kind to the poison.

A small gelatine capsule to place the poison in is preferred by some hunters.

INSTRUCTIONS FOR PREPARING SKINS

Open the legs on the inside and pull the skin free. Draw out the tail and then pull the skin off towards the head using the knife as little as possible. Place the skin on a stretching board with the flesh side out and pull off any surplus meat remaining on it. Split the tail on the inside and apply a little salt; also salt the ears, lips, and any other portion of the skin where drying may be slow. Leave on the board until dry. Do not place the skins in the sun or dry artificially.

PUBLICATIONS ON INSECTS

The following publications of the Department of Agriculture relating to Insects are available on application to the Publications Branch, Department of Agriculture, Ottawa:—

Pea Weevil, The	C.P.L. No. 9
Lime, Arsenate of	C.P.L. No. 10
Corn Borer, The Control of European.....	C.P.L. No. 16
Tent Caterpillars	Circular No. 1
Flea Beetles and Their Control	Circular No. 2
Chinch Bug in Ontario, The	Circular No. 3
Insects and Their Control, Common Garden	Circular No. 9
Tussock Moth, The Habits and Control of the White-marked	Circular No. 11
Boring Caterpillars which are Liable to be Mistaken for the European Corn Borer	Circular No. 14
The Control of Black-beetle Outbreaks in British Columbia	Circular No. 15
Army Worm, The	Bulletin No. 9
Pear Thrips, The	Bulletin No. 15
Apple Bud-Moths and Their Control in Nova Scotia	Bulletin No. 16
Fruit Worms of the Apple in Nova Scotia, The	Bulletin No. 17
Cleorini (Geometridæ) Studies in North America	Bulletin No. 18

NEW SERIES

Crop Rotation to Offset the Injury of Field Crop Insects.....	Circular No. 2
The Date on Which it is Safe to Reseed Fields after they have been Devastated by the Pale Western Cutworm.....	Circular No. 4
The Fruit Tree Leaf-roller and its Control in British Columbia.....	Circular No. 10
How to Foretell Outbreaks of the Pale Western Cutworm in the Prairie Provinces	Circular No. 12
The Beet Webworm.....	Circular No. 14
The Control of Forest Tent Caterpillars in the Prairie Provinces.....	Circular No. 19
The Walnut Caterpillar and its Control.....	Circular No. 21
Two Insects Affecting Cane Fruits in British Columbia.....	Circular No. 22
The Lesser Oak Carpenter Worm and its Control.....	Circular No. 23
The European Earwig.....	Circular No. 24
The Grasshoppers of British Columbia.....	Circular No. 25
The Plum Curculio and its Control in Quebec.....	Circular No. 27
The Apple Maggot and its Control in Quebec.....	Circular No. 28
The Strawberry Root Weevil, with Notes on Other Insects Affecting Straw- berries	Pamphlet No. 5
The Western Wheat-stem Sawfly and its Control.....	Pamphlet No. 6
Directions for Collecting and Preserving Insects.....	Pamphlet No. 14
The Hessian Fly in the Prairie Provinces.....	Pamphlet No. 30
Aphids or Plant Lice.....	Pamphlet No. 31
Root Maggots and their Control.....	Pamphlet No. 32
Wireworm Control.....	Pamphlet No. 33
Control of the European Apple Sucker in Nova Scotia.....	Pamphlet No. 45
Injurious Shade Tree Insects of the Canadian Prairies.....	Pamphlet No. 47
The Control of the Destructive Spruce Bark Beetle in Eastern Canada...	Pamphlet No. 48
The Satin Moth in British Columbia.....	Pamphlet No. 50
Insects Affecting Greenhouse Plants.....	Bulletin No. 7
Insects Affecting Live Stock.....	Bulletin No. 29
Grasshoppers of British Columbia.....	Bulletin No. 39

