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RABIES VECTOR CONTROL IN ALBERTA

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ABSTRACT: Following the last serious outbreak of rabies in 1952-57, the province of Alberta remained virtually free of the disease for 13 years. In 1970 a sudden increase occurred with 16 cases in various species. The Alberta Central Rabies Control Committee was reactivated to cope with the situation. Pre-immunization of high risk personnel and domestic pets was initiated along with supportive research to monitor infection rates in various species. Vector control programs were established to stop the spread of rabies by known wildlife vectors, particularly skunks (Mephitis mephitis) which had brought rabies across the great plains to the Alberta-Saskatchewan border by 1970. By the use of a buffer zone and radial depopulation, the spread of rabies westward into Alberta has been essentially prevented over the last three years.

BACKGROUND

The province of Alberta, Canada, has experienced sporadic outbreaks of rabies and over the last 20 years has tried various means to reduce and eradicate the disease. This outline will deal mainly with rabies in Alberta since 1970 and the program to control it.

Geographically Alberta is a landlocked province extending approximately 750 miles from Montana in the south to the North West Territories on the north, and between 200 and 400 miles from British Columbia on the west to Saskatchewan on the east. About half of Alberta's 255,285 square miles is unsettled and forested, mostly to the north and west. More than half of the human population of 1.6 million is located in urban areas, mainly in the cities of Edmonton and Calgary.

The last serious outbreak of rabies in Alberta occurred during 1952-57 and spread from the northern Arctic region southward across the province (Ballantyne, 1958). The main vectors were canines and other large carnivores. An active program of vector depopulation helped to protect humans and domestic animals. The disease was progressively eliminated from south to north, although there is some controversy even today about the need for vector control. However that is another story. The province remained free of rabies for 13 years from 1957 to 1970 with the exception of one case of a dog in 1965.

The situation across the great plains and in Saskatchewan however was quite different. Between 1962 and 1970 rabies moved progressively northwestward across Saskatchewan (Fig. 1)*. Most of the cases involved skunks (Mephitis mephitis) (Hayles and Dryden, 1970) which appeared to be the main vector in the U. S. and Canadian prairie region. By 1970 rabies in skunks had spread westward to various points near the Alberta-Saskatchewan border.

During November-December, 1970 Alberta experienced a sudden increase of rabies (Table 1) mostly in dogs and coyotes (Canis latrans). Most of the positive cases were in the central part of the province and no skunks were involved. However the threat of rabies in skunks on the east border was real. The province had maintained a watching brief for years. In December of 1970 the provincial Central Rabies Control Committee (C.R.C.C.) of the 1950's was reactivated to cope with the situation.

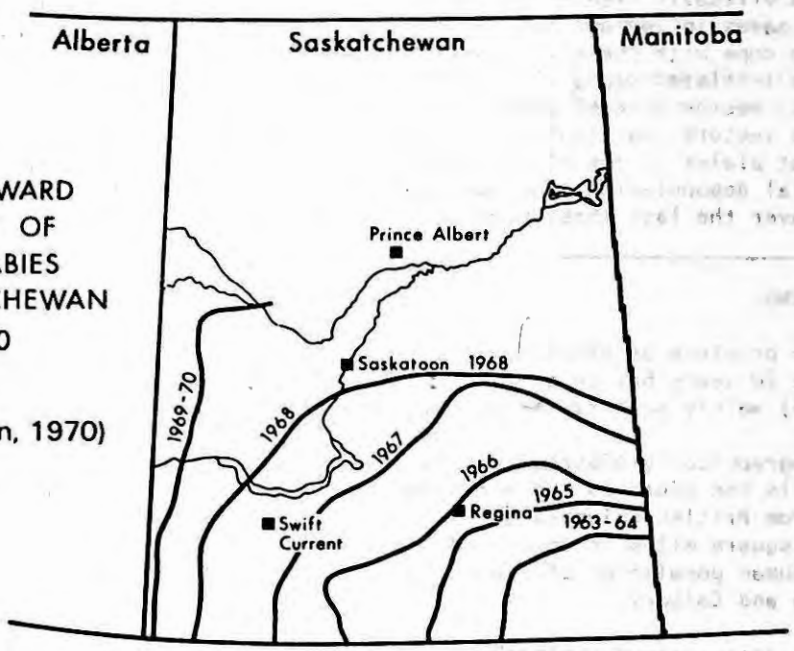
THE ALBERTA RABIES CONTROL PROGRAM

In Canada, rabies is a named disease under the federal Animal Contagious Diseases Act, and as such is the responsibility of the Health of Animals Branch, Agriculture Canada, to whom all suspect cases must be reported. The Alberta C.R.C.C. is a provincial coordinating, advisory and operational group with representatives from the federal Health of Animals Branch, the Alberta Departments of Agriculture, Health, Municipal Affairs, and Lands and Forests, the R.C.M. Police, and the Alberta Veterinary Medical Association.

In January 1971 the Central Rabies Control Committee was provided with emergency funds and it recommended several courses of action to protect human and animal health:

*Some figures used in this paper have previously appeared in the Alberta Department of Agriculture publication "The control of rabies vectors in Alberta" by Dale E. Alsager, 1973.

1. Pre-exposure immunization of high risk personnel such as veterinarians, pest control and wildlife officers, technicians, etc.
2. Pre-exposure immunization of domestic pets.
3. Vector control programs designed to stop the spread of rabies by known wildlife vectors.
4. Supportive research to monitor infection rates in various species and to increase effectiveness of vector control programs.



NORTH WESTWARD BOUNDARIES OF REPORTED RABIES CASES, SASKATCHEWAN 1963 - 1970

(Hayles & Dryden, 1970)

FIGURE 1

Table 1. Summary of Alberta positive rabies cases*

Year	Total Positives	Domestic Animals	Wildlife Animals			Total Specimens Submitted for Analysis
			Skunks	Coyotes	Bats	
1970	16	11	-	5	-	274
1971	21	9	2	7	3	1179
1972	12	1	3	-	8	767
1973	31	3	7	3	18	1180
TOTAL	80	24	12**	15	29	3400

*Analysis done by Health of Animals Diagnostic Laboratory, Lethbridge, Alberta.
**All but three located within depopulation buffer zone.

The Department of Health arranged for the immunization of high risk personnel at public health clinics across the province and followed up any human involvement with rabid animals. The Alberta Veterinary Medical Association organized numerous pet immunization clinics throughout the province through its member veterinarians at nominal cost. Alberta Agriculture and other provincial departments provided extensive information on the situation to field staff and the general public via all media. Agriculture Canada through its Health of Animals Branch assumed responsibility for the collection of specimens and laboratory analysis, investigation of cases and establishment of specimen container depots. Alberta Agriculture and Lands and Forests shared responsibility for the control of wildlife vectors and supportive research.

WILDLIFE VECTOR CONTROL PROGRAMS

General Control Plan

The Alberta C.R.C.C. agreed that all possible action should be taken to prevent and reduce rabies as a threat to humans, domestic animals and wildlife. The interim objective was to limit and contain rabies, with a final objective of disease elimination as experienced following the 1952-57 outbreak.

The responsibility for control of wildlife vectors was assumed by Alberta Agriculture, Crop Protection and Pest Control Branch and Alberta Lands and Forests, Fish and Wildlife Division. It was agreed that depopulation of proven wildlife vectors, as experienced during the 1952-57 Alberta outbreak and more recently in Montana, was a worthwhile mechanism in rabies control. A Joint Program of Rabies Control of Vector Wildlife Species was drawn up and agreed to by both Departments and the C.R.C.C. in January 1971 (Gurba and Kerr, 1970).

The Joint Program for Vector Control provided for the following:

1. To make use of existing systems of policies, programs, staff and expertise wherever possible, augmented as necessary by special staff, materials, equipment, etc.
2. Agriculture will be generally responsible for vector control in agricultural regions with District Agriculturists providing coordination, planning and organization, and information.
3. Lands and Forests will be generally responsible for the forest or unsettled regions, and in settled areas will be directly responsible for vector control, particularly skunks, in provincial parks, camp sites, summer cottage and other recreational and public areas, as well as in urban areas (towns and cities).
4. Municipalities will be requested to provide the services of Pest Control Officers, Municipal Police and other available trained staff. Training will be provided for staff designated by urban municipalities, particularly in skunk depopulation.
5. At the provinical level, vector control will be coordinated by joint action and decision of the Chief Wildlife Biologist and the Pest Control Branch Head. Program coordinators were appointed: Assistant Administrator, Fish and Wildlife Division and the Supervisor, Animal Pest Control.
6. The general plan, program outline, responsibilities, information and instructions will be supplied by each Department to Regional and District staffs, to all municipalities and other agencies concerned.
7. Regional staffs of both Departments will coordinate regional activities and assist with regional and local planning and programs. It is essential that District Agriculturists, District Fish and Wildlife Officers, and municipal Pest Control Officers maintain close liaison at the local level.
8. Trained provincial field staff will train and assist regional and local staff. Printed instructions on vector control, supplies of approved poisons, warning posters, regulations and necessary forms would be provided.
9. Evaluation of vector population levels and changes, effectiveness of control measures and necessary supportive research shall be carried out on a continuous basis and reported to the C.R.C.C.
10. Special costs shall be paid out of a central rabies control fund.

Early in 1971, skunks were proven vectors on Alberta's east border but the situation for other wildlife species was uncertain. It was decided that an interim program should proceed with changes made as necessary upon further developments in the rabies outbreak.

Coyote Control

There were five positive cases of coyotes in 1970. Early in 1971 it was recommended that the general reduction of coyotes should be encouraged in the agricultural region wherever numbers were high or where rabies was determined. To cover the five positive cases in central Alberta, depopulation was encouraged within a 50 mile radius by hunting and the supervised use of approved poisons by landowners. The level of control was determined by landowners and by local municipalities.

During 1971-73 the coyote has not been established as a vector and only 15 positive cases have occurred in 1970-73 (Table 1). The coyote population is at a high level in the agricultural region. Hunting and pelting are popular due to the high price of long-haired fur.

Skunk Control

In view of the threat from Saskatchewan via infected skunks and the high skunk population in Alberta, landowners were encouraged to reduce numbers on their property. Two main programs were undertaken using the knowledge and recent experience of the U. S. Fish and Wildlife Service in adjoining Montana:

1. Skunk Control Buffer Zone (Fig. 2)
   Early in 1971 a "buffer zone" was established along the Saskatchewan border, 18 miles (3 ranges) wide and extending 380 miles from the Montana border to Cold Lake in the north. This same buffer has successfully kept Norway rats (Rattus norvegicus) from invading Alberta from Saskatchewan for 23 years. The seven district Rat Control Officers became the pivot men in encouraging skunk depopulation to prevent westward spread of rabies through intra species contact.
2. Radial Depopulation of Skunks
   Where positive skunks were confirmed within the interior of the province, a three mile radial depopulation of skunks has been carried out.
   These two concepts and control programs have been the basis of successful rabies vector control in Alberta. During 1970-73, twelve positive skunk cases have occurred with only three beyond the buffer zone. The mechanics of the two programs are further detailed.

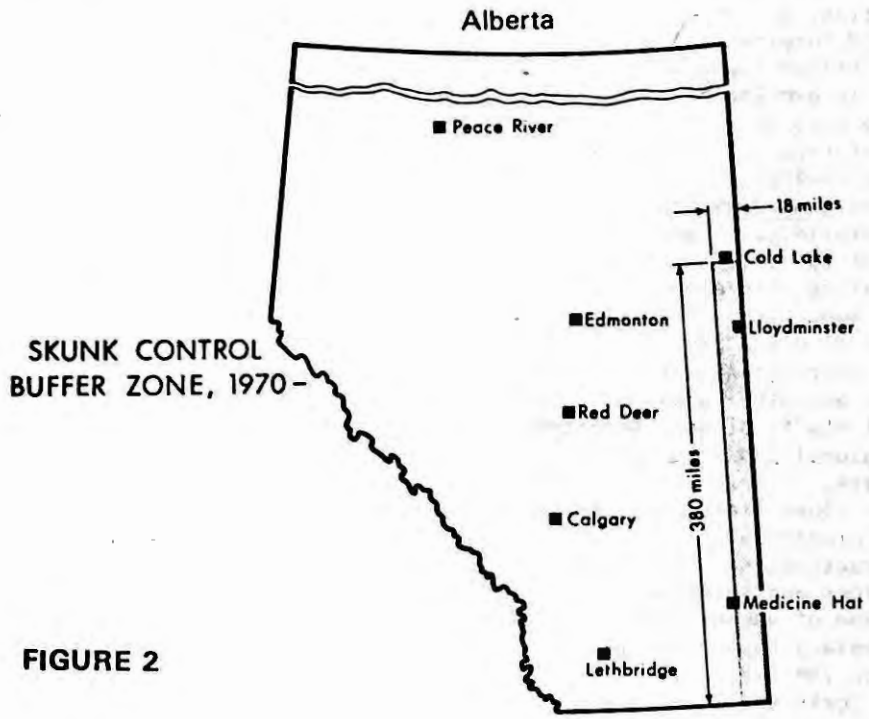


FIGURE 2

Buffer Zone

The buffer zone program since its initiation in 1971 has operated as a joint project between provincial and municipal governments. Coordination, general supervision, training and materials are provided by Alberta Agriculture. Local skunk control is encouraged and supervised by municipal Rat Control Officers and district Fish and Wildlife Officers in the eight Counties or municipal units along the Saskatchewan border. Extensive training was provided to local officials through meetings, on-the-job training, publications and instruction. An annual seminar on Animal Pest Control Methods and Techniques has provided comprehensive training and updating. We have appreciated training assistance from American specialists, Simon Fraser University and other agencies.

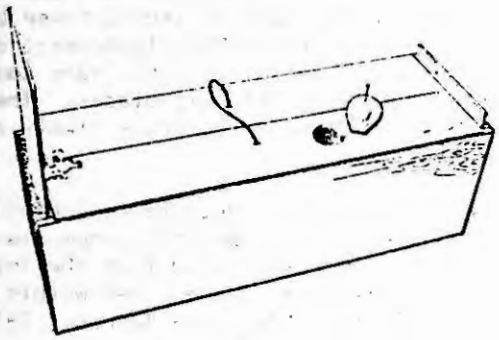
Most landowners in the buffer zone have reduced skunks by shooting, gassing and trapping. Live traps have been supplied to residents by Pest Control and Fish and Wildlife Officers. The most common traps in use were wooden box traps (Fig. 3a) and the Horpestad metal box traps (Fig. 3b). The most successful traps were the Rudolph Skunker (Fig. 3c), the Horpestad, and the National Live Trap (Fig. 3d).

Trapping success has been limited by:

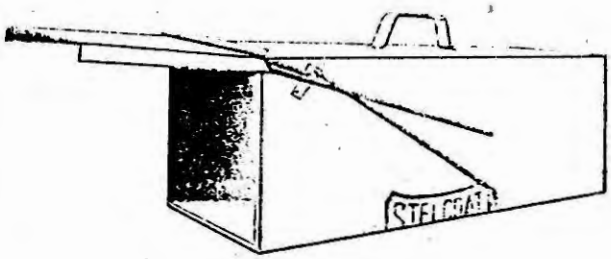
1. The amount of time and man-hours required to set and maintain them.
2. The time of year - only effective when skunks forage outside dens and return the same day i.e., in the fall.

Trapping is used primarily in urban and other areas where poisons cannot be used with relative safety.

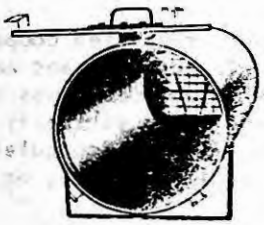
The most successful control agent in Alberta is the specially prepared, perishable "skunk pellet" (Fig. 3e), patterned after similar baits used in Montana (Miner, 1970). These poison baits contain 0.5 grains of strychnine in a mixture of beef fat designed to break down after 3 - 4 days exposure under average Alberta climatic conditions. The pellets are coated with granular tankage material to increase palatability to skunks and less tempting to nontarget species such as weasels, badgers and other fresh meat-eating carnivores.



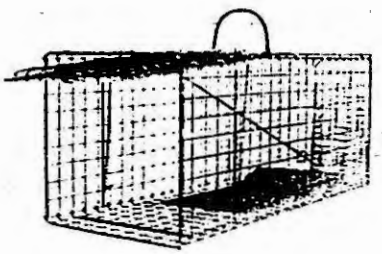
(a) Wooden Box Trap



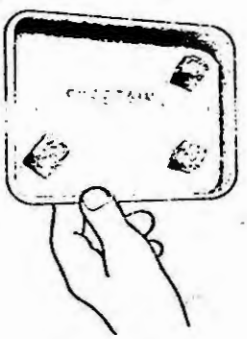
(b) Horpestad Metal Box Trap



(c) Rudolf Skunk Trap



(d) National Live Trap



(e) Skunk Pellets

Figure 3. Skunk control techniques.

The pellet also contains a strong green marker dye which serves as a deterrent to birds as well as an identification marker for safety purposes. The pellets are set by trained officers with the written permission of the landowner and placed only in specific skunk habitat which contains evidence of recent activity. The pellets are used in burrows, under buildings and similar places where they are not readily accessible to children, domestic and wild animals. The sets and number of pellets are recorded and rechecked. Any remaining pellets are recovered for use elsewhere.

Buffer Zone Results

Since the buffer zone was established in early 1971, an estimated 4371 skunks (Table 2) have been removed from the area which contains about 3500 farms. This reduction by Pest Control and Fish and Wildlife Officers has varied with area and time of year (Alsager, Bourne 1971, 1972) with the overall average estimated at 40% for all areas of the buffer zone during 1971-73 (Table 2). A total of 4624 pellets have been used during 1971-73 along with about 60 live traps.

Table 2. Summary of skunk control activities in buffer zone 1971-73.

Year	Estimated Total Skunks Taken	Estimated Percent Control (average)		Materials Used
1971	1190	Range 10 -	80%	993 pellets
		Average	30%	53 traps
1972	1621	Range 5 -	95%	1231 pellets
		Average	41%	35 traps
1973 - (interim)	1560	Range 30 -	90%	2400 pellets
		Average	50%	65 traps
TOTALS	4371	Averages	40%	4624 pellets

Landowners in the buffer zone have generally been concerned, cooperative and active in skunk control by shooting and trapping. We have no reliable estimate of skunks taken by landowners, dogs and other predators. One skunk taken by each of the 3500 landowners each year would total more skunks than those removed by officers. Control officers have concentrated on abandoned farms, roadside culverts, out-of-the-way and difficult places. The combined effort of residents and public officers has over the last three years likely reduced the skunk population in the buffer zone over 80%.

It has been noted that ingress of skunks into depopulated areas occurred quickly. Continued vigilance and maintenance of control activity is necessary, especially when skunks are active during spring and fall. Survey samples taken in 1972 indicated that the infection rate in skunks was 36.8% on the Saskatchewan side of the buffer zone, 3.4% within the depopulation zone, and less than 1% on the Alberta side of the buffer zone (Gunson, 1972). Only three positive cases have occurred during 1971-73 beyond the buffer zone.

Radial Depopulation Procedure

Three positive skunks were confirmed by laboratory analysis as established west of the buffer zone: Borradaile, March, 1971; Skiff, February, 1972; Grassy Lake, November, 1973 (Fig. 4a). Action was taken within a few days for intensive depopulation of the area within three miles of each positive case. Each radial depopulation was conducted by a specially trained crew of Pest Control and Fish and Wildlife Officers and completed within four days.

Local agriculturists and municipal agents notified each landowner, requested cooperation and obtained written permission to carry out control measures. Topographic and aerial photo-maps, snowmobiles and 4-wheel drive vehicles, and other necessary equipment was used to rapidly define and cover skunk infestations. Follow-up checks have shown virtually 100% removal of skunks (Alsager and Berdine, 1971 and Alsager and Nimmons, 1972). Repopulation has occurred by natural ingress and no further positive cases have resulted within, or adjacent to, the depopulation area.

Rabies in Bats

In Alberta besides skunks the only other significant vectors are bats. The number of positive cases has increased from 3 in 1971 to 8 in 1972 and 18 in 1973 (Table 1). Most positives have been found to be silver haired (Lasionycteris noctivagans) and little brown bats (Myotis lucifugus). These have turned up during the spring, and particularly the fall migrations (Fig. 5). Most were recovered long distances from known bat colonies and assumed to have dropped out of migration patterns as the disease affected them.

A human exposure in Medicine Hat resulted in the discovery of a large colony of big brown bats (Eptesicus fuscus) in the attic of a nearby public school. Upon consultation with health and school board officials, this particular colony was removed using anticoagulant toxicants applied externally to dispersal bats (Alsager, 1972 - unpublished report). A relatively high infection rate was confirmed by Health of Animals laboratory analysis. Several other school attics in Medicine Hat have since been depopulated and bat-proofed. There seems to be some attraction to attics of brick school houses built about 50-60 years ago.

FIGURE 4(a)

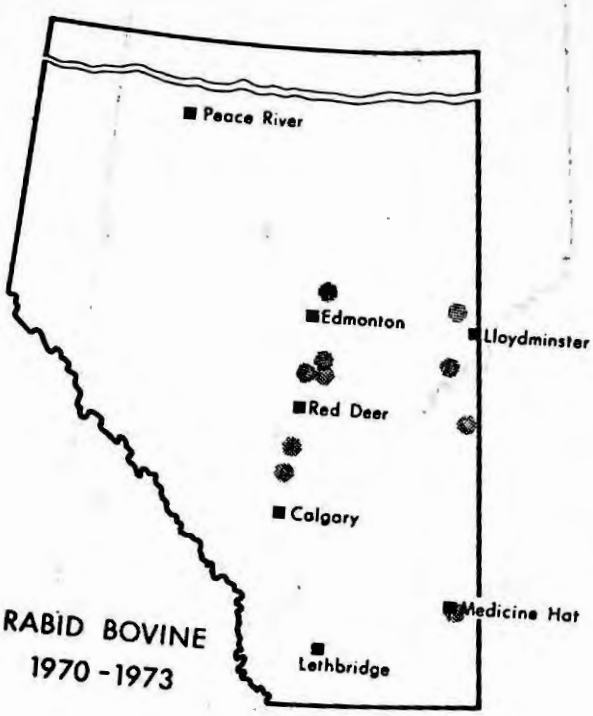


FIGURE 4(b)

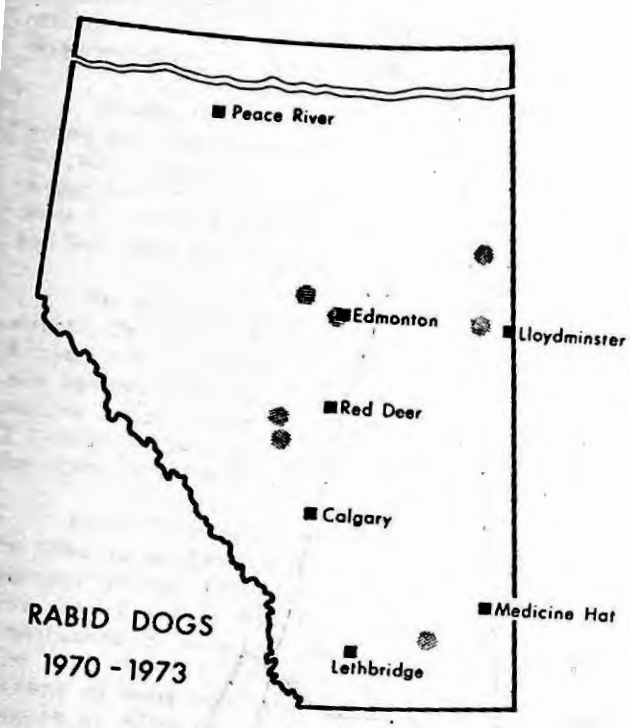


FIGURE 4(c)

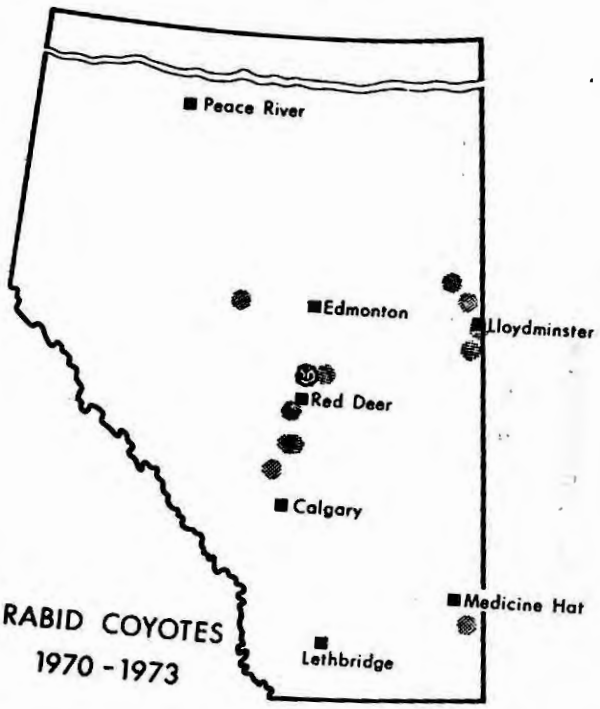


FIGURE 4(d)

igure 4. Designation of geographic locations where rabid animals were found in the Province f Alberta or close to its boundaries. Different groups of animals are represented on maps a) through (e) with all Alberta cases indicated on map (f). Continued on next page.

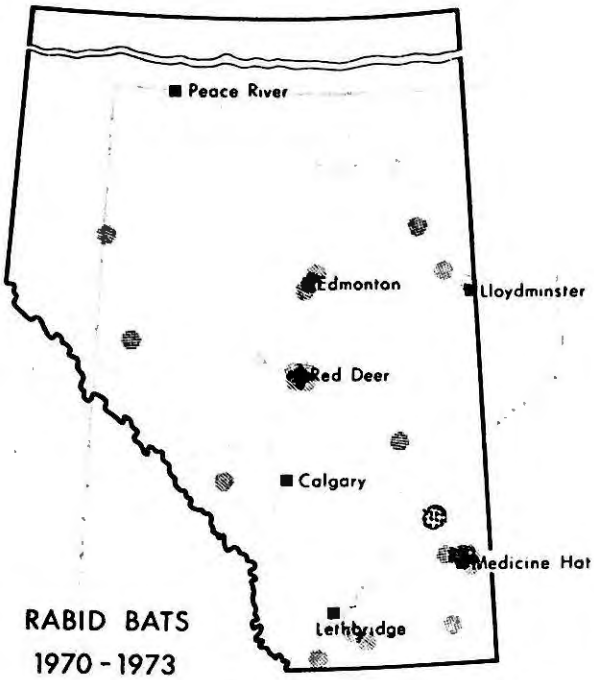


FIGURE 4(e)

FIGURE 4(f)

Figure 4. Continued from previous page.

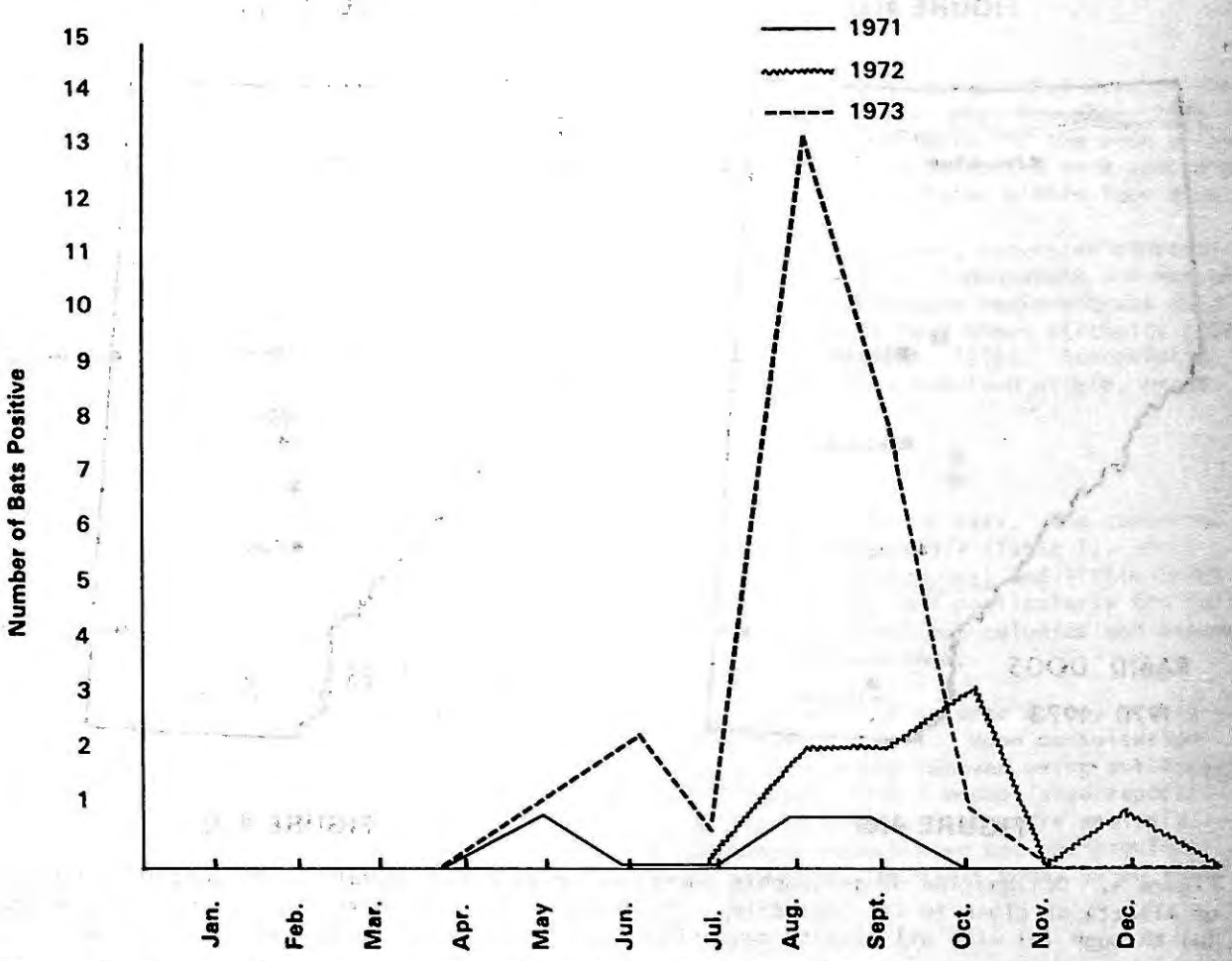


Figure 5. Co-relation of reported positive bats with time of year.

DISCUSSION AND CONCLUSION

Even though rabies disease has been known for centuries and almost 100 years of research in rabies epidemiology has been the subject of many reports, it is apparent that rabies involves many complex factors that are not clearly understood. Science will continue to provide new knowledge but it will likely be many years before it provides clear-cut answers for rabies control. In the meantime public authorities have to make decisions on risks/benefits and what actions should be taken to protect the interests of public health, agriculture and wildlife.

Grimes and Schwichtenberg (1968) have pointed out that rabies disease typically spreads out in a ring-wave direction from the original foci of infection and that natural and man-made barriers can limit spread. Light (1966) and Koroloff (1969) have indicated that locally rabies becomes self-limiting as mortality reduces the vector population. Planned reduction in vector numbers brings about the same results faster and with less loss in numbers of vectors and other susceptible species than if left to nature.

This concept paralleled the experience gained in Alberta during the 1952-57 rabies outbreak when dogs and wild canines were involved. In 1971 the Alberta Central Rabies Committee decided to take positive action even though several vectors were suspected. The first steps were pre-immunization of high-risk personnel and domestic pets plus supportive research to monitor and better define infection in various species.

Coyotes were suspect in 1970-72 and depopulation was encouraged in the area of positive cases. However we are more confident now that the coyote is not a main vector and that rabid cases usually resulted from infected dogs brought in from outside Alberta. Today for coyotes and other potential vectors we handle each case on its own merits.

Bats pose a particular problem since the number of positive cases has increased significantly. However this may be due to a better informed and more concerned public that has resulted in more suspected cases being analyzed. Each positive case is followed up but control action is taken only in schools and similar situations to reduce possibility of accidental exposure of students. There is some hope that bats may not be significant vectors since we did have 13 years of freedom from rabies during 1957-70. Bats were present then, but will bear watching in the future.

Skunks no doubt are significant vectors across the great plains and the main threat along our east border. The extra costs of skunk vector control in Alberta are about $60,000.00 per year. This low figure is possible since we make full use of existing staff, organization and programs. By interesting coincidence, the human population in the buffer zone is about 60,000. Thus protection from rabies costs $1.00 per person per year in the buffer zone and provides a bonus for the rest of the province.

The province pays the full cost of rabies vector control. Besides the $60,000.00 paid out of the special rabies fund, there are other hidden costs of regular staff, special vehicles and equipment, publicity and training courses, etc. However such costs and effort are spread over the various agencies in health, agriculture and wildlife. The incidence of rabies in pets and livestock has declined or remained at a low level (Table 1 and Fig. 4b, c). A number of people involved in positive cases have taken rabies treatment each year but there has been little threat to human health.

There is room for argument about risks/benefits and the merits of rabies vector control. In Alberta we have our differences of opinion between various interests and disciplines. However in our situation with little threat from Montana, B. C. or the North West Territories, the C.R.C.C. has full public support for our vector control programs. We realize the importance of keeping local authorities and local residents informed and actively involved. The rest consists of applying available scientific knowledge, experience and the cooperative effort of many agencies for protection against rabies of domestic and wild animals, and the people of Alberta.

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