

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Proceedings of the 7th Vertebrate Pest Conference
(1976)

Vertebrate Pest Conference Proceedings collection

3-1-1976

THE ROLE OF PRIVATE CONSULTANTS IN VERTEBRATE PEST PROBLEMS IN CANADA

D.E. Alsager

Canadian Bio-Scientific Consultants Limited

Follow this and additional works at: <http://digitalcommons.unl.edu/vpc7>



Part of the [Environmental Health and Protection Commons](#)

Alsager, D.E., "THE ROLE OF PRIVATE CONSULTANTS IN VERTEBRATE PEST PROBLEMS IN CANADA" (1976).

Proceedings of the 7th Vertebrate Pest Conference (1976). Paper 2.

<http://digitalcommons.unl.edu/vpc7/2>

This Article is brought to you for free and open access by the Vertebrate Pest Conference Proceedings collection at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Proceedings of the 7th Vertebrate Pest Conference (1976) by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

THE ROLE OF PRIVATE CONSULTANTS IN VERTEBRATE PEST PROBLEMS IN CANADA

D.E. ALSAGER, President, Canadian Bio-Scientific Consultants Limited, 4815 — 82 Avenue, Edmonton, Alberta, Canada T6B 0E5

ABSTRACT: An in depth look at the principal requirements of an orderly and systematic approach to vertebrate pest problems in Canada is presented (Part I) as a prerequisite to a proposed theoretical model illustrating the involvement of various agencies. A model depicting how these agencies could best utilize their available resources towards the development of improved vertebrate pest control technology is presented in Part II. The involvement of private consultants in vertebrate pestology is relatively new (and perhaps unappreciated), yet offers substantial potential in the development of selected facets of the vertebrate pest field. The proposed roles of other agencies are discussed with respect to advantages of improved co-ordination of effort, and the increased utilization of private consultants. Congruent with revised National Science Policies, predictions are offered regarding the importance of future expansion of industrial involvement (manufacturers, private consultants, private testing and research laboratories and others) in research and development of vertebrate pest control. Although the program requirements and proposed administrative model for a vertebrate pest control program pertain to the situation in Canada, the general principles lend themselves to application elsewhere.

Historically wild animals have been a source of food and pleasure; however, they are also at times a problem for mankind. Birds in orchards, cereal crops, corn fields, and feedlots; rodents in reforestation plantations, orchards, grasslands, and fields; bear damage to apiaries; flooding damage by beavers; carnivorous predators in calving and lambing areas; birds sharing air space with jet airplane traffic; rats in human dwellings and food storage areas; wild animals transmitting diseases to man, his pets, and livestock; are all examples of common, and at times serious, wildlife-human conflicts. To some industries, agriculture and forestry in particular, damage by wildlife may exert a significant influence on production. As the world's human population increases, the number and scope of these problems will likewise intensify as a result of increased competition between man and animals which must compete for a share of the environment.

At present in Canada relatively little applied research has been done on vertebrate pest problems. In many cases we lack not only adequate information concerning the amount and extent of damage caused by vertebrate species, but also lack adequate basic knowledge of the species themselves. Even more critical is the lack of progress in the development of accurate and efficient damage assessment techniques and effective and safe damage control technology. In the absence of concrete and comprehensive reference knowledge, as a basis for an organized approach, vertebrate pest damage control programs are in danger of being developed upon a framework of emotion and public pressure rather than sound planning. In order to provide effective solutions to vertebrate pest problems, a systematic, logical approach must evolve, with organized participation by several agencies.

It is the object of this paper to present some insight into the nature of vertebrate pest problems in Canada and the mechanics of a problem-solving approach (Part I), and secondly, to describe a theoretical model proposing how the resources of several agencies (government and private) could best be integrated and co-ordinated to expedite the provision of solutions to known vertebrate pest problems (Part II). Although the proposed division of labor and organizational format describe a theoretical situation in Canada, the general format of the model lends itself to similar application elsewhere, large or small.

PART I: THE PRINCIPLES OF A LOGICAL, SYSTEMATIC APPROACH TO VERTEBRATE PEST PROBLEMS IN CANADA

There are numerous examples of vertebrate damage control programs that are initiated and undertaken, sometimes at enormous expense and on a large scale, without the benefit of following a logical and systematic approach. For any vertebrate pest problem, regardless of size, the basic steps required for the achievement of sound solutions are as follows:

- (1) identification of the kind and extent of damage caused by vertebrate pests
- (2) an assessment of damage which accounts for positive as well as negative aspects of the vertebrate pest species

- (3) cost-benefit analysis of damage control to determine the economic feasibility of damage control
- (4) selection of amount and type of damage control technology to be used
- (5) implementation of a control program
- (6) efficacy assessment of the control program
- (7) follow up preventative maintenance program and periodic problem re-evaluation.

(1) Identification of Vertebrate Pest Damage in Canada

An inventory of vertebrate pest damage in Canada utilizing scientific methods of damage assessment is badly lacking. The reason for this neglect is probably related to the unfortunate, but historical, unpopularity of vertebrate pest problems with professional biologists in Canada. Vertebrate pest problems tend to be identified as a result of public pressure for solutions after the problem has evolved to the point where it may well be considered out of control as opposed to a systematic effort to identify potential problems in the early stages of development.

Early in 1975, Environment Canada organized meetings with provincial Wildlife and Agricultural agencies, and other interested parties, to discuss various aspects of vertebrate damage to agricultural production and received some indication of the amount and type of damage in each respective province. The resultant report (Solman, et al ., 1975) indicates that -

- (a) vertebrates mainly responsible for losses to agricultural crops are birds (large and small) and mammals (large and small)
- (b) the estimated annual loss of agricultural production due to vertebrates is approximately 51 of total production or about \$240,000,000. (This is about the same order of magnitude as uncontrolled plant disease losses would be and about one third of uncontrolled insect losses.)
- (c) the personal loss to some individual farmers may reach 60% of a crop. High individual damage may force operators out of business even while the average damage in the industry may be within acceptable limits.
- (d) there are wide variations between the amount of vertebrate damage in successive seasons and from province to province
- (e) accurate information on the value of agricultural products damaged by vertebrates is not available. Many kinds of vertebrate damage are undocumented and even unrecognized.
- (f) the loss of organic matter for human or animal food may, in a food-short world, be more important than the dollar loss.
- (g) research in Canada, aimed at reducing crop losses due to vertebrate damage has been negligible in comparison to other crop protection research. This situation relates to a lack of understanding between government agencies of each agency's mission and responsibility, and public opinion which wants food as cheap as possible but not at the expense of destroying wildlife.

Table 1 summarizes an estimate of the types and kinds of vertebrate pest problems in Canada, based on the federal government survey. It must be kept in mind that the estimates provided represent, for the most part, a compilation of "educated guesses" and require confirmation by detailed studies.

(2) The Assessment of Damage

Often amazing is the number of damage control programs that are implemented, some of them existing for many years, without the benefit of even the most rudimentary economic assessment of damage. This is perhaps more common in damage control programs initiated in response to public pressure, rather than by a sequence of comprehensive, long-term planning. Similarly, following their introduction, the maintenance of and expansion of such programs is also often dictated by public pressure.

Vertebrate damage assessment should be an ongoing function and should take place long before the damage reaches a point where corrective actions are necessary. An accurate assessment of damage must balance the positive contributions against the detrimental aspects of the presence of the vertebrate pest species. The assessment of vertebrate damage control in Canada is complicated by the shortage of suitable and proven measurement techniques. It is very encouraging to see the progress of the American Society for Testing and Materials in the development of testing methods for vertebrate pest control technology.

Table 1. Estimated damage by vertebrates to Canadian agriculture by province.

Province	Norway Rats		Field Rodents		Seed Eating Birds		Waterfowl		Predators		Total All Species	
	Total	%*	Total	%*	Total	%*	Total	%*	Total	%*	Total	%*
Newfoundland	21,000				35		163,000					184,000
New Brunswick	109,000	5-10	359,000		1-35		1,001,600			13,400		1,483,900
Nova Scotia	120,000	5-10	484,000		1-35		1,354,700			21,000		1,979,700
Prince Edward Island	90,000	5	130,000		1-35		440,500			15,400		664,500
Quebec	12,000,000		8,713,000		5		23,788,000					44,501,000
Ontario	18,900,000	5-10	10,180,000		1-10		39,561,000			218,000		68,859,000
Manitoba	6,900,000	1-20	13,236,000		3-10		14,974,000	1	6,257,000	28,000		41,395,000
Saskatchewan	15,000,000	5	6,310,000				1,000,000	1	17,800,000	50,000		40,160,000
Alberta	2,200,000	1-10	16,880,000		1-7		1,250,000	1	9,022,000	600,000		29,952,000
British Columbia	3,380,000	5-7	4,250,000		5-40		2,306,000	1	130,000	106,000		10,172,000
TOTALS	58,720,000		60,542,000				85,838,800		33,209,000	1,040,000		239,351,100

*% value represents range of % damage to field crops

An assessment of vertebrate pest damage can take a variety of forms ranging from "an educated guess" by a casual observer, to a detailed comprehensive analysis of damage by vertebrate pests using scientific measuring techniques. Recently two studies under way in Alberta (Alsager, 1974; Alsager, 1975) have undertaken an intensive appraisal of damage caused by (a) pocket gopher damage to rangeland, and (b) bird depredation to field corn, and have resulted in the development of practical damage assessment techniques (Alsager, 1976). Other studies documenting specific damage assessment techniques have been few, but contribute substantially to present knowledge (Radvanyi, 1972). Table 2, using damage to rangeland by field rodents as an example, illustrates the type of balance sheet that should form the basis of any damage assessment. The damage assessment is represented by the net balance between both positive and negative contributions made by the pest species.

Table 2. Mechanics of a vertebrate pest damage assessment.

Components of a Damage Assessment Study**	Factors Attributable to Vertebrate Pest	
	Production Benefits*	Production Costs*
1. Direct Factors		
A. Plant Productivity		
i) soil mixing and moisture penetration	5%	
ii) mounding		25%
iii) consumptive foraging measured		9.8%
B. Mound regrowth	5%	
C. Underground cables, flooding		
2. Indirect Factors		
A. Reduced operating speeds		
B. Machinery maintenance		5%
C. Soil erosion		2%
3. Other Factors (i.e. social, economic, transmission of disease, etc.)		
TOTAL	10%	41.8%

Net Damage Assessment = Total Production Costs - Production Benefits
(expressed as a % effect on production - figures presented are examples only)

*expressed in % forage production lost or gained

**assessment uses as an example Rodent Damage to Hayland by Burrowing Rodents

(3) Cost-Benefit Analysis of Damage Control

The objective of the cost-benefit analysis of damage control is to answer the basic question: "Considering the worth of the crop likely to be saved, what is the optimum or maximum cost of control that can be afforded in order to bring the vertebrate pest damage into tolerable limits?" It is unlikely that any useful benefit would occur if the cost of control procedures exceeded the amount of the net worth of the damage that is being caused by the vertebrate pest.

A cost-benefit analysis also assists in the selection of appropriate control methods and techniques when control is warranted. The economic feasibility of various control methods varies considerably, and is highly dependent on the extent, amount, and location of vertebrate pest damage occurring. In many cases expensive damage control techniques should be eliminated at the "drawing board stage" in favor of more economical methods, if they are not commensurate with the value of crop damage. The significance of a cost-benefit analysis in the early stages of vertebrate damage control programs cannot be over emphasized.

(4) Selection of Damage Control Techniques

The following considerations should be made in the selection of appropriate damage control methods and techniques for a specific vertebrate pest damage problem:

- (a) from available techniques, eliminate those that are not practical on the basis of a cost-benefit analysis
- (b) of the techniques selected, the following consideration should be given:
 - (i) techniques chosen should focus on preventative control if possible
 - (ii) techniques selected should focus on the control of the damage done by the vertebrate pest species as opposed to control of the vertebrate pest
 - (iii) control methods used should be as efficient, safe, humane, economical, and as selective as possible and may involve the integrated use of several techniques to increase efficacy.
 - (iv) lethal types of control should be related to social and economical benefits and the minimum necessary should be used in order to bring damage within tolerable limits.
 - (v) when practical, wildlife control programs should be coupled with scientific utilization programs in order to enhance the quality of control programs and promote better utilization of wildlife resources. The popular notion of utilization of a vertebrate pest species as a "harvestable crop" is often unpractical because the "harvest" is dictated by the worth or abundance of the species and is often not in synchrony with the time of year or location of vertebrate pest damage. This type of control also is non-selective, and frequently avoids the individuals of the species responsible for the damage.
 - (vi) changes in farm management practices and wildlife habitat may influence vertebrate pest damage to some degree, and should be considered where practical.

(5) Implementation of a Control Program

While the mechanics of implementing vertebrate pest control techniques have been outlined by others (Clark, 1975; N.A. of S., 1970), the following are additional considerations which are often overlooked:

- (a) Consideration for public relations, regardless of the size of the control program is imperative. The public needs to be informed of the "hows" and particularly the "whys" of the particular problem and recommended control measures. The "cloak and dagger" approach to vertebrate pest problems - attempting to hide the problems and solutions from public view - is most unprofessional and potentially dangerous not only to the program in question, but also reflects negatively on the vertebrate pest field as a whole, in the eyes of the public.
- (b) The importance of getting results: only control techniques known to be effective in counter-acting damage situations should be used.

(6) Follow-Up Efficacy Assessment

Post-treatment efficacy evaluation should be an integral part of any vertebrate pest program regardless of size. Its value in program modification is essential and helps to monitor the cost-benefit of control programs on an ongoing basis.

(7) Preventative Maintenance Programs

The cost-benefit of preventative maintenance programs on a continuing basis should be considered. In some cases it is much more economical to operate a preventative maintenance program than to contend with a severe vertebrate pest problem at a later date (i.e. Alberta Rat Control Program) (Gurba, et al., 1973).

PART II: A THEORETICAL MODEL OF INTER-AGENCY INVOLVEMENT IN VERTEBRATE PEST PROBLEMS IN CANADA

In Canada one of the reasons vertebrate pest control research has fallen behind is related to the fractionating of responsibilities between various government departments responsible for vertebrate pest control programs (Solman, et al., 1975). There is often lack of co-ordination between the agencies involved. A theoretical, organizational model is proposed (Table 3) outlining a suggestion of how various agencies could best co-ordinate efforts to achieve the following functions:

Table 3. Proposed administrative model for a total vertebrate pest damage control program.

FUNCTION	PRIMARY INVOLVEMENT	SUPPORTIVE INVOLVEMENT
Basic Research _____	.Universities _____ Other formal research institutions	.Federal and Provincial Governments
Applied Research		
(a) Product Development _____	.Industrial manufacturers____ Vertebrate Pest Consultants Private Testing Laboratories	.Provincial Government*
(b) Development of Testing _____ New Control Techniques	.Vertebrate Pest Consultants Private Testing Labora- tories	.Federal and Provincial Governments
(c) Damage Assessments _____	.Vertebrate Pest Consultants	.Provincial Governments
Active Problem Solving and Evaluations _____	.Industrial or domestic _____ producers Vertebrate Pest Consultants	.Extension Service
Regulation and Enforcement _____	.Federal Government _____	.Provincial assistant re inspection and enforce- ment
Extension Service _____	.Federal-Provincial _____ task force Community College	.Vertebrate Pest Consultants
Inter-agency Co-ordination _____	.Federal Government _____	.Provincial Governments

*conditional: limited to financial assistance and grants to firms for development of new products

(a) Basic research Basic research concerning vertebrate pest species should be handled by the agencies in Canada already established, and best qualified to handle it - namely the universities. Basic research is required as a stepping stone for the development of effective technology, however most of this type of research tends to be long-term in nature. The suitability of provincial and federal government departments to undertake this type of research is questionable and their involvement in this area frequently involves a duplication of effort and expenditures. Both provincial and federal government agencies however could provide the necessary supportive involvement for universities on such research endeavors.

(b) Applied Research: This is the area of greatest need at the present time in the vertebrate pest control field. Research on short term applied problems require stimulation by provincial and federal government agencies and it is suggested that these agencies be responsible for the co-ordination and funding of applied research projects, with the actual testing and services handled by private consultants or laboratories under contract. This mechanism would tend to avoid a number of restrictions in government departments at the present time due to control on expansion, and would provide a program which was more compatible with the requirements of active and dynamic applied research on current damage problems.

(c) Active Problem Solving and Evaluation: The technical aspect of vertebrate pest programs and applied research is also best co-ordinated by the provinces or federal government departments. The actual day-to-day control activities and implementation of applied

research should, however, be delegated to independent firms or agencies with the experience in the vertebrate pest field. At the land-owner level, individuals should be encouraged to attempt to handle their own problems, with the assistance of Extension Services provided through government agencies (information leaflets, etc.). Control services of a professional nature should then be available to them through the services of independent vertebrate pest consultants on a contract basis. Similarly, vertebrate pest consultants could be available to manufacturers and developers of vertebrate pest control products for specific product development research and testing.

(d) Regulation and Enforcement: The regulatory function of vertebrate pest control work usually relates to the use or intended use of vertebrate pest control products. For reasons related to present involvement and jurisdiction, the primary involvement in regulation of such products should remain with the federal government authorities. The enforcement of regulations prescribed by the federal authorities is the area where supportive involvement would be warranted by provincial government agencies. The involvement of the various provincial governments superimposing their own regulations concerning vertebrate pest problems may be unnecessary if co-ordination and co-operation between federal and provincial government agencies were improved.

(e) Extension Services: The provision of Extension Services and Information is a function that is vital to the general public. Because of the similarity of problems in certain areas of the country, it is proposed that federal and provincial agencies combine their efforts to avoid possible duplication of information. Community colleges also provide excellent extension and educational services and could contribute a great deal to the vertebrate pest control field. The provision of Extension Services is essential to providing an avenue for individuals to alleviate their own vertebrate pest control problems. Vertebrate pest control consultants can also contribute valuable assistance by contributing to the design and content of the extension materials used.

(f) Inter-Agency Co-ordination: It is suggested that this most vital function be provided by the federal government authorities in view of their present scope of jurisdiction and contact with all agencies. Co-ordination and distribution of information at the regional level can be provided with the assistance of provincial government departments.

THE ROLE OF PRIVATE VERTEBRATE PEST CONSULTANTS

While the proposed model suggests a fairly extensive role by private consultants and laboratories, their involvement in the vertebrate pest field at the present time is relatively new. Consequently the potential value of such a service, and the mechanics of how they would become involved, remains virtually unknown or unappreciated by most agencies at this time. The proposed involvement of private consultants in various phases of the proposed model (Table 3) was suggested for reasons related to one or more of the following advantages or benefits that a private consultant can provide:

- (1) The independent nature of the environment in which a private vertebrate pest consultant works enables him to devote full attention to specific vertebrate pest problems.
- (2) The availability of the private vertebrate pest consultant provides any agency (large or small) with immediate access to a high calibre of expertise and experience in this specialized field. By obtaining the services of an expert in the vertebrate pest control field in the beginning, such agencies avoid the expense of "learning by one's own mistakes" and have the benefit of substantial economic savings, particularly if vertebrate pest damage can be substantially reduced by immediate corrective action provided by the consultant.
- (3) A vertebrate pest consultant is not bound by encumbrances such as restrictive working hours, hiring restrictions or regulations, restrictions on travel, types of expenditures, and other factors which are incompatible with seasonal fluctuations in vertebrate pest damage. Consequently the private consultant can generally offer an unequalled degree of efficiency and versatility in handling of vertebrate pest problems.
- (4) For reasons related to efficiency and promptness of service, the private consultant usually provides vertebrate pest control services at a much lower overall cost compared to other agencies.

- (5) The availability of consultants, hired under contract for specific projects, provide government agencies with an added degree of versatility and efficiency without the encumbrance of having to commit themselves to additional permanent staff.
- (6) The use of consultants and private testing laboratories in the area of vertebrate pest control product testing and evaluation has two fundamental advantages:
 - (a) It automatically provides for a more equitable sharing of the cost of development of these products, with the manufacturer or distributor assuming the responsibility for this aspect. It is further suggested in the model that provision for grants to industry be made available for the purpose of product development - particularly for small manufacturers and distributors with limited in-house research capabilities. Government agencies themselves are generally not equipped or prepared to handle the volume of short term testing required in the dynamic development of new pest control products. Similarly they are unequipped and unable to collect monies for the purpose of defraying costs on specific projects. Consequently the taxpayer, in general, unknowingly accepts financial responsibility for the development of new products. The contracting of consultants on the other hand provides an avenue for more equitable cost sharing involving the industry, suggests a mechanism for financial assistance by government agencies to industry, where appropriate, and also provides a valuable service to the manufacturer.
 - (b) The efficiency of a private consultant or testing laboratory allows for increased flexibility and expedience in the evaluation of specific products. Consequently the consultant provides a very valuable service to a manufacturer in expediting critical development and marketing decisions and projections. Likewise a valuable service can be provided to agencies responsible for regulatory and enforcement functions with respect to the identification and screening of undesirable vertebrate pest control products.

Notwithstanding the fact that both federal and provincial government agencies employ some very highly qualified personnel, increased direct involvement by these agencies in areas of applied research, product testing and development, and vertebrate pest control activities needs to be re-evaluated. At present, Canada ranks as the second lowest of industrialized nations in the world as far as involvement by private industry in research and development (DeRevck et al., 1968). On the other hand, Canada rates as one of the highest in the world when it comes to the extent of government involvement in research and development. Despite our technical capabilities and industrial potential, Canada ranks among the lowest of the industrialized nations in the world in terms of gross expenditures on research as a percentage of gross national product. From this data, it would appear that Canada would be on the wrong track if it maintained the present terms of reference for extent of involvement of various agencies in research and development of the vertebrate pest field. In fact, there are positive indications that an attempt is being made to rectify this situation in the future (Senate Special Committee, 1970, 1972). Therefore it is predicted that the future involvement of industry (manufacturers, private consultants, private testing and research laboratories, and others) in the vertebrate pest field will increase considerably.

CONCLUSION

This report points to the need of increased involvement of private industry, through the use of consultants, private testing laboratories, and others, in the orderly and progressive development of vertebrate pest technology. Despite the high involvement of government agencies in research and development, Canada still ranks as the second lowest of the industrialized nations in the world in terms of gross expenditures on research as a percentage of gross national product, and ranks the lowest in terms of involvement of industry in research and development. Incentives provided by government agencies to stimulate the involvement of private industry in the vertebrate pest control field are required. Also necessary is a clarifying of the responsibilities and inter-relationships of various agencies with respect to vertebrate pest control activities. This paper concludes that private vertebrate pest consultants and private laboratories can offer a substantial and essential function in the area of product development testing, short term dynamic applied research, and the provision of specific vertebrate pest control services. The role of government departments should focus on program funding and co-ordination, supportive services, regulation and control of the use of vertebrate pest control products, and the provision of improved Extension Services. The responsibility for basic research in vertebrate pest control fields should be left with the universities and formal research institutes.

LITERATURE CITED

- ALSAGER, D.E. 1970. A New Way to Control Pocket Gophers, Alberta Department of Agriculture Public Information Booklet Number 686, Edmonton, Alberta, Canada.
- _____. 1974. Pocket Gopher Damage to Southern Alberta Rangeland. Unpublished research report to Alberta Department of Agriculture, Part I, December.
- _____. 1976. A Simplified Method to Evaluate the Efficacy Potential of Spray-On Bird Repellents Under Simulated Natural Conditions in Corn Fields. Publication pending. American Society for Testing and Materials.
- _____. 1976. The Impact of Pocket Gophers (*Thomomys talpoides*) on the Quantitative Productivity of Rangeland Vegetation in Southern Alberta: A Damage Assessment Tool. Publication pending. American Society for Testing and Materials.
- CLARK, DELL O. 1975. Vertebrate Pest Control Handbook. California Department of Food and Agriculture.
- DE REVCK, A., M. GOLDSMITH and J. KNIGHT, Eds. 1968. Decision Making in National Science Policy. A Ciba Foundation of Science and Science Foundation Symposium, pages 170-175.
- GURBA, J.B. and D.E. ALSAGER. 1975. Alberta Rat Control News Item. Alberta Department of Agriculture year-end Program summary, December.
- NATIONAL ACADEMY OF SCIENCES. 1970. Principles of Plant and Animal Pest Control. Volume 5. Vertebrate Pests: Problems and Control. Washington, D.C. 153 pgs.
- RANVANYI, R. 1972. Protecting Coniferous Seeds from Rodents. Proceedings Fifth Vertebrate Pest Conference. pages 29-35.
- SENATE SPECIAL COMMITTEE of the Government of Canada for Science Policy. 1970, 1972. A Science Policy for Canada, Volumes I & II.
- SOLMAN, V.E.F., C.D.E. MILLER and G.W.J. LAIDLAW. 1975. A Report on Vertebrate Damage to Canadian Agriculture, unpublished report. Environment Canada.