THE BENEFITS OF FIREARMS OWNERSHIP – HUNTING AND WILDLIFE MANAGEMENT

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INTRODUCTION

This report is part of a series on the benefits to society of gun ownership. Traditionally, firearms have been used for hunting to provide food and sport as well as to protect the economic viability of farms against wildlife. In recent years it has been argued that the decline in hunting activity has had costly consequences even for Canadians who are not members of the hunting community.

Humans live, make their livelihoods and travel in close proximity to wildlife. Although increasing urbanization is often argued to be a major trend in the late 20th century, green areas have been taken over for housing, new roads have been built and existing roads upgraded to allow more and speedier traffic. Housing has been brought closer to, or infringed on, foraging areas. Displaced wildlife can wander on to roadways with often quite disastrous consequences for both wildlife and motorists. On the farm, crops and animals can be attractive food sources to nearby wildlife.

Predation is natural for wildlife. When human activity expands closer and closer to the wild, the opportunities for unwanted confrontations with animals increase. These comments are not made to blame wildlife, but to point to the need for comprehensive measures. Among these is hunting. Hunting can perform a useful role in maintaining the wildlife population in a sustainable balance with humans and agriculture.

Hunting for sustenance is of great significance for First Nations people, but as a non-market activity its magnitude and importance are not well measured.

Sport hunting attracted 1.2 million Canadians in 1996 and sustained 14,200 jobs. Hunters spent over $823.8 million on their sport. Since the late 1970s hunting has attracted fewer participants. Higher costs, more restrictive gun laws, fewer people living close to hunting areas and an increasing range of other leisure activities have often been put forward to explain this trend.

This trend has been viewed with concern, because hunting has been one instrument for maintaining a balance between human needs and animal populations. Wildlife management may be hampered if the level of hunting falls. Hunting is an attractive tool because hunters pay to remove animals that might otherwise become a nuisance by causing traffic accidents, roaming into backyards or damaging farms. Without hunting, the wildlife services might have to pay professional hunters to cull the animals.

Vehicle collisions with wild animals, have been increasing recently in most parts of Canada. Severe injuries can follow head-on crashes with moose, caribou and deer when the animal is thrown through the windshield against the driver and front passenger. Among the various methods of alerting drivers and keeping wildlife off the roadway, fencing is the most effective but also the most expensive, and too costly for many locations. Hunting can help by keeping animal numbers in check.

Nuisance wildlife can enter backyards, private property and farms, causing damage and perhaps danger. One international organization has surveyed its wildlife conservation department members in the United States and Canada to ask their professional opinions about how much stocks of wildlife would grow if private hunting and trapping were banned, and how many animals would have to be professionally removed to keep nuisance and damage to an acceptable level. This analysis points out how cost-effective hunting can be.

HUNTING

A. Sustenance Hunting

The purpose of sustenance hunting is to feed the hunters and their families. Sustenance hunters can apply to have their licence and registration fees waived for non-restricted firearms such as rifles and shotguns. In 2002, Chief Firearms Officers[1] waived fees for 2,817 such applicants.

First Nations peoples traditionally consider hunting a part of their culture which bonds people with the spiritual side of nature. Killing an animal for sustenance is a sacred act and sovereign right. The spirit of the animal is praised and the Creator is thanked for providing

(1) See RCMP, *The Registrar's Report to the Solicitor General on the Administration of the Firearms Act*, Ottawa, 2003.

food. Many Aboriginal people believe that hunting, as part of a traditional lifestyle, is a right that is guaranteed by treaty. From this point of view, all Aboriginal people should be considered sustenance hunters.

The number of sustenance hunters and the family members they support is not measured by the usual data collection methods. Information on people's occupations is gathered in the labour force section of the census, which measures participation in the wage economy. Hunting and fishing for sustenance rather than for commercial purposes, however, are part of the non-wage economy, which is not measured by Statistics Canada. At the end of 2002, there were 400,000 Registered Indians on reserve or Crown land, and just over 300,000 off reserve. Assuming an average family size of three or four, and one or perhaps two hunters per family, it would seem that the number of waived fees, 2,817, is rather low. It should be pointed out that low-income non-Aboriginal people who are sustenance hunters may also have their fees waived.

B. Sport Hunting

Sport hunting for big game, small game, and migratory birds contributes to the economy in many ways. Wildlife management and predator control help maintain a balance in nature. Hunters purchase hunting licences and buy guns and ammunition, other sporting goods and recreational vehicles. These items need maintenance and repair by gunsmiths and garages. Hunters travel to hunting areas, rent accommodation and buy meals. Guiding and outfitting are important sources of income in some rural areas. Provinces may require big game hunters to hire licensed guides.

According to hunters, the attraction of hunting is not the kill itself but the chase. The natural evolution of man has been that of a predator. Hunting appeals to an inherent part of human nature. This deep satisfaction may explain the quite large sums of money that hunters are willing to pay to pursue their sport.

The most satisfactory way of assessing the economic importance of sport hunting is to examine actual spending by sport hunters and then map out the effects of these expenditures on the economy. Fortunately, Statistics Canada has undertaken a series of such surveys and analyses in the past. Unfortunately, the last survey was for the year 1996, and new surveys have been indefinitely postponed.

The Federal-Provincial-Territorial Task Force on the Importance of Nature to Canadians sponsored these surveys.(2) The Task Force is made up of agencies responsible for the environment and tourism. These economic impact studies looked at both consumer spending and the effect on the national economy of outdoor activities in natural areas, wildlife viewing, recreational fishing and hunting. Statistics Canada conducted surveys for the Task Force in 1981, 1987, 1991 and 1996. The 1996 survey covered 87,000 respondents nationwide. It was mailed out in conjunction with the Labour Force Survey and there was a telephone follow-up, which ensured a response rate of over 70%.

The survey asked respondents to distinguish between primary and secondary reasons for trips. In 1996, 10.3 million Canadians aged 15 and over took part in outdoor activities, with 4.2 million fishing and 1.2 million hunting. According to the survey, men and women enjoy the Canadian outdoors equally; however, 85% of recreational hunters are men, as are 66% of recreational fishers.

Respondents were asked to report their detailed expenditures for mainly nature-related activities over a 12-month period. In just under half of the reported trips, the participants undertook more than one activity. The survey estimated that over $7.2 billion was spent on outdoor activities in natural areas in 1996, including $1.3 billion on wildlife viewing as both a primary and secondary activity. Canadians spent $1.9 billion on fishing and $823.8 million on recreational hunting.

Table 1
Expenditures on Hunting in Canada, 1996

Category of Expenditure	Primary		Total	
	$ million	%	$ million	%
Accommodation	38.7	5.8	39.0	4.7
Transportation	166.5	25	166.5	20.2
Food	99.3	14.9	99.4	12.1
Equipment	285.9	42.9	382.9	46.5
Other items	76.0	11.4	136.1	16.5
Total	666.4	100.0	823.8	100.0
Average yearly ($)	$669		$692	
Average daily ($)	$54		$41	

Source: Federal-Provincial-Territorial Task Force on the Important of Nature to Canadians, *The Importance of Nature to Canadians: The Economic Significance of Nature-related Activities*, Ottawa, 2000.

(2) Details are available at: http://www.ec.gc.ca/nature/index_e.htm.

Equipment (see Table 1) includes such things as camping gear, special clothing, guns and accessories, game carriers, calls, dogs, decoys, boats and vehicles purchased in 1996. Other items include rental costs of equipment, licences, entry fees, guide fees, and ammunition.

Hunting is more expensive than recreational fishing, which had an average daily cost per participant of $27, or wildlife viewing at $17 per day.

The annual average spending was highest for participants from British Columbia, at $1,017; Yukon was second at $901, and Alberta third at $843. Spending in Newfoundland, Quebec, Ontario and Saskatchewan was close to the national average.

More detailed data are available when hunting is the main activity. Large game hunters spent $420.6 million in 1996, which accounted for nearly two-thirds of total hunting expenditures. Waterfowl hunters spent $83.3 million, hunters of birds other than waterfowl spent $100.7 million, and small game hunters spent $61.7 million.

Spending is only one facet of the economic importance of outdoor activities. Unlike market goods, such as a visit to the cinema, outdoor activities do not usually entail a direct cost to participants for the public open space they use. It is possible, then, that the direct benefit of outdoor activities to participants is higher than the costs incurred. As well as this additional benefit, spending on outdoor activities generates further economic income and production as it ripples through the economy.

The direct benefit of outdoor activities is the value participants assign to those activities. The Statistics Canada survey used standard willingness-to-pay methods. First, respondents were asked to put down their actual spending on outdoor recreation, broken down by transport, food, accommodation, equipment and other. Second, they were asked if they would have still made the trips if the cost were higher. Third, those who would have been willing to pay more were asked how much more the trips would have to cost before they would decide not to go. The respondent was asked to select a range for this additional cost. These ranges started with $0 to $49, and the top range was $800 and more.

In 1996, total willingness to pay for the enjoyment of nature, for all activities, was estimated to be $13.0 billion. Canadians made actual expenditures of only $11.0 billion. Thus the size of the direct benefits – the economic value of enjoyment received but not paid for – is estimated at $2.0 billion, which is quite substantial.

Table 2 shows the value hunters attribute to their activities. Large mammals are the most expensive to hunt, costing an average of $586 per year, but the additional pleasure of hunting large game is valued by hunters at $150 on average.

Table 2
Annual Average Expenditures and Economic Values of Nature-related Activities for Canada in 1996 ($)

Nature-related Activities	Expenditures per Participant	Direct Value per Participant	Willingness to Pay
Outdoor activities in natural areas	704	132	836
Wildlife viewing	332	78	410
Recreational fishing	427	105	532
Hunting			
Large mammals	586	150	736
Small mammals	297	71	368
Waterfowl	384	121	505
Other birds	288	73	361
All hunting	669	181	850

Notes: 1) "Outdoor activities" include both primary and secondary activities; the others are primary activity only.

2) The "all hunting" average includes many participants who hunt more than one species.

Source: *The Importance of Nature to Canadians: The Economic Significance of Nature-related Activities*.

The indirect economic contribution caused by the $11 billion of spending on nature-related activities as it ripples through the economy was calculated by Statistics Canada using the input-output model. Purchasing hunting equipment, for example, directly raises incomes and employment in the retail sector and indirectly in the sectors that support the retail sector (e.g., providing the necessary raw materials, producing the goods, and transporting them to the stores). Input-output analysis takes account of all these interrelationships.

The $11 billion of spending on all nature-related activities accounted for $11.4 billion of gross domestic product (GDP). The various levels of government received revenues of $5.1 billion. A total of 201,400 jobs was sustained.

Hunting as both a primary and a secondary activity was responsible for:

Expenditures	$823.8 million
GDP	$815.2 million
Government revenue from taxes	$383.9 million
Number of jobs sustained	14,200

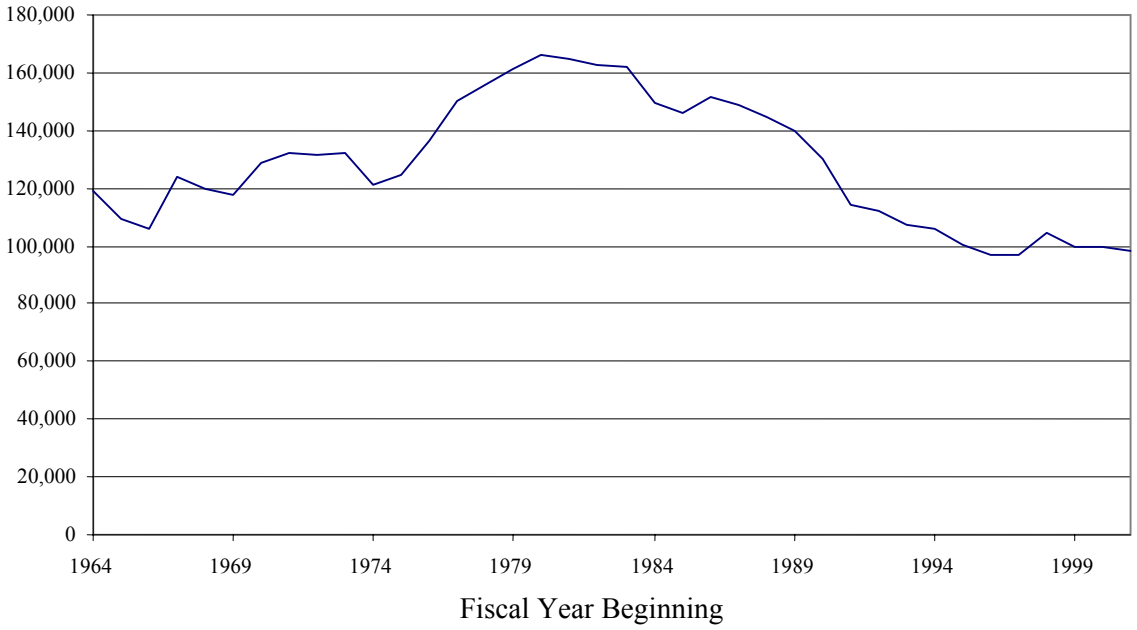
The survey also attempted to gauge whether current rates of participation in nature-related activities would change in the future. Nearly three-quarters of Canadians indicated great or some interest in participating in outdoor activities in natural areas, such as camping, picnicking, hiking, riding, cycling, skiing, snowshoeing, off-road vehicle use, swimming or boating. The actual participation rate for these outdoor activities in 1996 was 44%. This potential for increased participation was also seen in recreational fishing and hunting. Nearly 40% of Canadians expressed great or some interest in participating in recreational fishing, which was twice the rate of active participation in recreational fishing (17.7%). Just over 5% of Canadians hunted in 1996, but 10.6% showed great or some interest in participating in hunting.

International tourism for nature-related activities is important for Canada, but is not measured by this survey, because Statistics Canada only queries Canadians through the domestic labour market survey.

Participation in hunting is declining – a matter of some concern from the point of view of spending and income generation by tourists and visitors. Hunting licences also fund conservation programs in many provinces. All hunters in Alberta, for example, must buy a basic Alberta Wildlife Certificate, and additional permits are needed to hunt some species. Figure 1 shows wildlife certificate sales(3) between 1964 and 2001.

(3) For more details, see Alberta, Sustainable Resource Development, Number of Hunters in Canada, available at http://www.srd.gov.ab.ca/fw/hunting/numberhunters.html.

Figure 1
Alberta Wildlife Certificate Sales



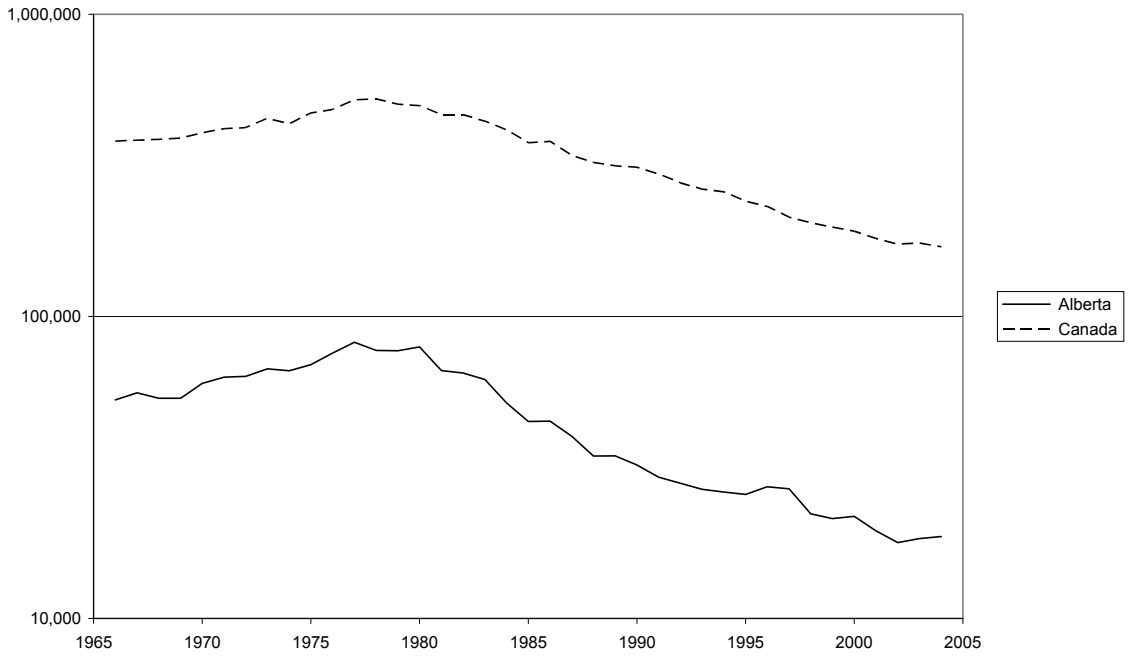
Source: Alberta Ministry of Sustainable Resource Development.

Licence sales increased between 1964 and 1980 by just over 40,000, or about one-third. During this time, the population of Alberta grew from 1.4 million to 2.2 million, increasing by just over one-half. Thus, the number of hunters in Alberta increased slightly more slowly than the population during this period. After 1980, however, sales of wildlife certificates began to decline, reaching a level of 100,000 sales – 20,000 below the 1964 level, in spite of the Alberta population growing to 3.1 million, and a similar expansion in the rest of Canada and the United States.

The Alberta Ministry of Sustainable Resource Development argues that, in the early 1980s, the decline in waterfowl numbers reduced hunting opportunities, and many waterfowl hunters left the sport. At the same time, the cost of hunting licences increased. This increase, combined with more restrictive gun control laws, has made hunting less attractive. Moreover, increasing urbanization means that fewer potential hunters live close to wildlife areas. Finally, the range of leisure activities has expanded, increasing the competition for leisure time

This trend is not unique to Alberta. Figure 2 compares sales of Canada Migratory Game Bird Hunting Permits in Alberta and Canada between 1996 and 2004. To hunt migratory game birds in Canada, the hunter needs a hunting permit as well as a Habitat Conservation Stamp. The current costs are $17.00 for the permit and $8.50 for the stamp. Additional provincial permits may also be required.

Figure 2
Sales of Migratory Game Bird Hunting Permits, Alberta and Canada (Log Scale)



Source: Canadian Wildlife Service.(4)

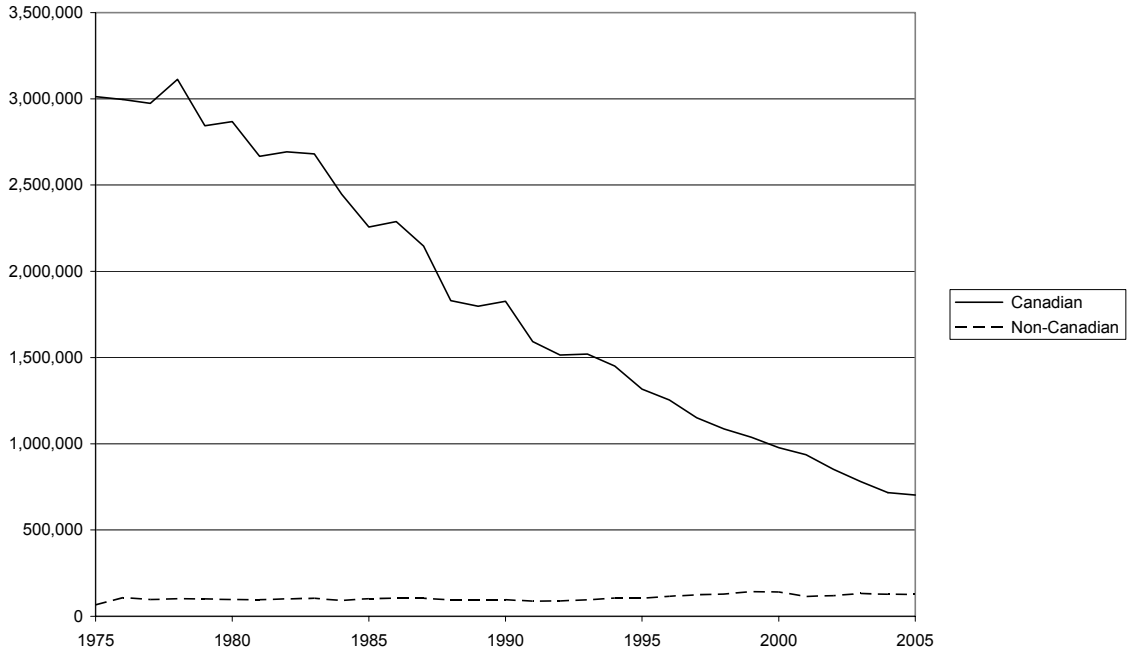
The vertical axis is on a log or logarithmic scale. This scaling transforms a data series that is changing at a constant rate into a straight line. Another useful feature is to move numerically small and large series so that they seem to be closer together for easier visual comparison. Figure 2 shows a common pattern of slight growth before the late 1970s in Alberta and Canada and then decline. The sales decline seems to have been slightly greater in Alberta than in Canada.

The Canadian Wildlife Service sends out a harvest questionnaire survey each fall to approximately 45,000 hunters chosen randomly. The survey is used to estimate the harvest of migratory game birds and level of hunting activity in Canada. The responses may be queried on-line.(5) One question asks about the amount of time spent hunting. Figure 3 shows the estimated total number of days spent hunting by both Canadians and non-Canadians.

(4) See http://www.cws-scf.ec.gc.ca/publications/status/dec05/pdf/app_d_e.pdf.

(5) See http://www.cws-scf.ec.gc.ca/harvest/default_e.cfm.

Figure 3
Days Spent Hunting Waterfowl, Canada by Nationality



Source: Canadian Wildlife Service, Harvest Questionnaire Survey.

The amount of time spent hunting waterfowl by Canadians dropped by three quarters between 1975 and 2005, while hunting by tourists for waterfowl increased slightly. The non-Canadian numbers may seem low, but the major attraction for foreign hunters is large game. The United States is the main source of hunting tourists for Canada, and the migratory birds fly over the United States.

WILDLIFE MANAGEMENT

Wildlife management aims to manage a wild species within its habitat to ensure the maintenance of the species while providing for recreational and economic benefits. It involves finding a balance between nature and people. Wildlife needs space to live, find food, and sustain its offspring. If these areas are next to human habitation, issues of safety, public health and damage to property are raised. The tradition of pest management in rural Canada has been well described by Arthur Kroeger, a former deputy minister in several departments:(6)

(6) As reported by James Baxter in the *Edmonton Journal*, 8 December 2003.

> The gun registry was exactly what you'd expect from a Toronto, urban minister with no sensitivity to the culture of rural Canada and most particularly, the rural West. When I was growing up on the farm, the .22 rifle hung above the kitchen door and when you saw the coyote heading for the chicken coop, you took down the rifle. You didn't need to open a locked cabinet and take a psychological test before you could. There was no sensitivity in the gun registry and how it would be viewed in the rural West.

Options for wildlife management and pest control will depend upon the species and the environment they live in. Moreover, the actual sustainable population level for a particular species is a subject for scientific debate. Scientists may also debate whether culling is necessary, or whether there is some natural balancing process.

A. Traffic Collisions

Alcohol, excessive speed and distraction are well known as the major causes of traffic accidents, but collisions with animals are surprisingly prevalent. Every hour in Canada between four and eight vehicle collisions with large animals take place.(7) In Ontario about one out of each 21 collisions is caused by wild animals on the highway.(8) In rural Alberta, almost one-third to one-half of all collisions involve an animal. In 2001, there were five fatal and 313 injury collisions out of 10,468 wildlife-vehicle crashes in Alberta.(9)

Data quality is often a problem with administrative records, such as collision records. The motorist involved may not wish to report only damage or minor injury to his or her insurance company or the police may not wish to record minor accident incidents. Fatalities are usually the most accurate data, but also the least frequent. In spite of these difficulties, a number of authoritative sources point to an increasing trend in collisions between large wild animals and motor vehicles.

Canada is not alone is facing the problem of animal-vehicle collisions, but the severity of the damage problem depends on the number of large wild animals and the volume of road traffic on the roads that the animals roam onto. The United States maintains quite

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(7) See L-P Tardif & Associates Inc., *Collisions Involving Motor Vehicles and Large Animals in Canada*, p. 3.

(8) See Elzohairy *et al*., *Characteristics of Motor Vehicle-Wild Animal Collisions An Ontario Case Study* p. 2.

(9) See Lo, Allan. "Wildlife-Vehicle Collision Countermeasures," p. 6.

comprehensive federal statistics on fatal collisions. Khattak[10] has studied the period 1991 to 2000. There were 1,270 reported animal-vehicle collisions resulting in human fatalities. About one-fifth of the accidents were multi-vehicle. The total 1,270 accidents resulted in 1,350 deaths.

According to Khattak, the states with the five highest numbers of crashes in the 10-year period were:

Fatal Collisions 1991-2000

Texas	111
Pennsylvania	53
Wisconsin	50
California	47
New York	47

These figures give a measure of the overall seriousness of the animal-vehicle problem, but do not show the relative dangerousness of being on the road. By area, Texas and California are the second and third largest states. By population, California, Texas and New York rank as the three largest states. It is not surprising that these states should appear in the list above. A measure of the risk to which the driver is exposed can be derived by considering the amount of driving in each state. The U.S. government estimates Vehicle Miles Traveled (VMT) by state. Khattak performs the scaling operation and finds a different picture. The five most dangerous states are:

Fatal Collisions 1991-2000 per 100 billion VMT

Alaska	37.89
Montana	32.53
Wyoming	27.94
Maine	19.35
South Dakota	18.14

(10) See Khattak, Aemal J. *Human Fatalities in Animal-Related Highway Crashes*, in particular p. 2 and p. 6.

Thus, in Alaska for every 100 billion miles traveled nearly 38 fatal collisions would occur in a 10-year period.

The contrast between the two presentations above as total numbers or rates per mile traveled is interesting. The states in which a driver is most likely to hit an animal with fatal consequences all border Canada.

1. Hitting a Moose

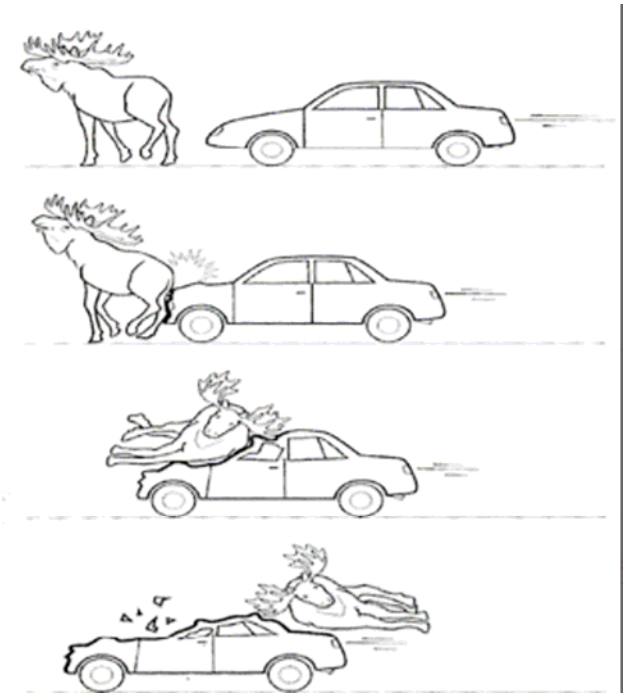
The likelihood of a collision leading to serious injury or death depends on the mechanics of the collision. Based on their practical experience in treating accident victims in Thunder Bay in Northern Ontario, a group of healthcare professionals has studied collisions, particularly with moose. They write:(11)

> The body of a moose causes a pattern of injury that is different from that of most motor vehicle collisions with animals. Adult male and female moose weigh an average of 450 and 350 kg respectively; their average height from hoof tip to scapula is 180 cm. Owing to the high centre of gravity (undersurface of abdomen at or above the level of the vehicle hood) and long legs of these large animals, there is significant impact to the roof in 48% of moose–vehicle collisions and to windshield supports in 24%. This characteristic impact translates to injuries to the human head and neck.

They provide a useful graphic to illustrate an accident in which a moose is hit directly.

(11) Sit *et al*., "Ocular injuries in a victim of a motor vehicle collision with a moose," p. 201.

Figure 4
Moose Impact on Vehicle



Source: Sit *et al*. Fig. 3.

The type of accident pictured above can cause particularly nasty injuries. Sit *et al*. describe one such accident in which a male heavy-machine operator hit a moose with his truck. The truck hit the moose in the legs. The moose was thrown on to the front windshield, which shattered. The moose fell through the windshield falling against the man, cutting its stomach open on the broken glass. There were significant injuries to the face and eyes of the driver. The whites of his eyes were totally green, coloured by moose bile. The pupils were dilated and the area around the eyes showed dramatic swelling and lacerations. Foreign material, including moose blood, stomach contents and glass particles, was found in the wounds and eyes. Along with the physical damage, there were infections that had to be controlled. The left eye had to be removed because of damage to the eye itself and to the connective tissues.

In another accident, Pynn *et al*.[(12)] report that a bull moose darted out of the bushes and was hit by a truck. Hit in the legs, the moose smashed through the windshield, cutting its stomach open. The driver and passenger suffered major facial fractures, lacerations

(12) Pynn *et al*., "Maxillofacial Injuries from Moose/Motor Vehicle Collisions," *Oral Health Journal*, Vol. 95, No. 12, 2005, pp 15-20.

and minor orthopaedic injuries. One patient had skull fractures horizontal at the level of the eye sockets and fractures leading from the bridge of the nose to jaw line. The other passenger had a complex fracture of the upper jaw with a laceration through the upper and lower eyelids. Both patients had nasal fractures. Glass fragments, entrails, twigs and dirt had to be removed from the injuries.

Safety experts quite rightly emphasize the importance of buckling-up in well-fitting, approved seat belts, as well as having airbags. Unfortunately these devices cannot project the driver and passengers against an animal projectile coming through the windshield. To make injuries worse, the animal may have considerable momentum. Not all collisions involve a direct hit on the animal, but sideswiping or swerving can result in death as the vehicle looses control or hits other vehicles. As was pointed out above, about one in five fatal animal collisions in the United States included more than one vehicle.

Risk and damage in collisions depends on relative speed and mass. Most deer tend to be smaller than moose. An average white-tailed deer weighs 110 kg, exceptionally 200 kg. The moose is the largest member of the deer family, whose North American members also include elk, white-tailed deer, mule deer, and caribou. The giant Alaska-Yukon moose subspecies can weigh as much as 800 kg. The dark brown colour of moose may make it harder to see the moose in poor light, and moose eyes do not reflect light as noticeably as white-tail deer eyes do. Most accidents tend to occur just before dawn or just after sunset.

2. Collisions in Selected Provinces

Canada does not have a uniform national system for the collection of data on collisions with animals, and care should be taken in making comparisons between provinces.

a. British Columbia

In B.C. since 1991, motor vehicle collisions are reportable if they result in personal injury or death or aggregate property damage in excess of $1,000 ($600 for a motorcycle). Before 1991 the damage level threshold was $400. A driver is required to report a collision to the police within 24 hours or 48 hours if the collision occurred outside a municipality. The police do not attend all reportable collisions, putting the obligation on the driver to provide an account of a reportable collision at a police station. A number of police jurisdictions no longer accept self-reports at the counter, and in 1996, many police agencies

changed their standards or practices for collision reporting. The result of all these changes in police reporting is that B.C. does not produce reliable data on vehicle collisions with just property damage, and that there were probably varying degrees of underreporting of collisions that involve minor injuries over the years. Table 3 shows some data on vehicle collisions in B.C.

Table 3
B.C. Traffic Collisions 1995-2004

Year	Wild Animals as a Contributing Factor			As a % of all Factors
	Injury	Fatal	Total	
1995	280	4	284	0.78
1996	206	1	207	0.63
1997	230	1	231	0.78
1998	261	2	263	0.90
1999	251	5	256	0.88
2000	290	0	290	0.99
2001	349	2	351	1.19
2002	395	5	400	1.33
2003	412	3	415	1.28
2004	396	10	406	1.15

Source: British Columbia Collision Statistics,[13] various years.

As well as the measurement errors discussed above, the subjective nature of some of these figures should be noted. A contributing factor is a circumstance or event that the attending police officer thinks contributed to the collision. Some collisions would be reported by the driver and would contain the driver's assessment of contributing factors.

A collision may have many contributing factors. The list of possible factors is long and deals with the environment, vehicle and driver. In 2004, wild animals were a factor in 10 fatal accidents. It may well be that as well as the presence of wild animal, the brakes failed, or the driver was affected by alcohol, or the weather was bad, or the light was poor. In 2004, wild animals made up 1.15% of all the factors that were judged to cause accidents. This percentage might seem much smaller than the measures of the wild animal involvement elsewhere, but it should be noted that the absolute size of this percentage depends on how many items are in the list and on how many factors are checked off on the accident report. Calculated on the basis of a single factor, wildlife is in the top 10 accident causes in B.C.

(13) See http://www.icbc.com/library/research_papers/traffic/index.asp.

From Table 3 it can be seen that wild animals as a percentage of contributing factors increased by approximately 70%, showing that wild animals are an increasing danger to B.C. motorists.

Auto insurance statistics provide an alternate source of information. The Insurance Corporation of British Columbia (ICBC) is a provincial Crown corporation that provides universal auto insurance in B.C. It also handles driver licensing, vehicle registration and licensing. L-P Tardif reports the consolidation:

Table 4
Number of Animal-Vehicle Collision Claims for B.C. 1997-2001

Year	Claim Count		Injured Participant Count
	Number	Amount ($)	Number
1997	7,267	15,970,890	218
1998	8,156	18,276,328	215
1999	8,506	20,872,119	233
2000	8,546	23,665,065	282
2001	9,789	27,384,820	386
Total	42,264	106,169,223	1,334

Source: L-P Tardif and Associates from ICBC data.

As might be expected from the discussion of how collisions are reported and recorded, the numbers in the Tables 3 and Table 4 do not mesh together exactly, but the overall trends are consistent and show the increasing cost of wildlife-vehicle accidents in B.C.

b. Ontario

In Ontario, motor vehicle collisions are reportable if they result in personal injury or death or property damage over $1,000. Between 1985 and 1998, the damage level threshold for reporting was $700. In 1997, self-reporting for collisions with only property damage was introduced for incidents without injury or criminal driving with the establishment of collision reporting centres.

Table 5
Ontario Wild Animal Collisions, 1993-2003

Year	Property Damage	Personal Injury	Fatal	Total
1993	6,655	347	4	7,006
1994	7,040	344	4	7,388
1995	7,036	403	7	7,446
1996	7,050	335	4	7,389
1997	7,309	403	5	7,717
1998	7,803	394	3	8,200
1999	8,390	466	4	8,860
2000	9,826	506	6	10,338
2001	10,565	482	4	11,051
2002	12,255	534	8	12,797
2003	13,321	510	4	13,835

Source: Elzohairy *et al*., and Ontario Ministry of Transportation.

The number of fatal crashes is small, ranging between three and eight accidents per year, and does not show any strong trend. Collisions with only property damage showed substantial increases. The raising of the reporting limit from $700 to $1000 on 1 January 1997 does not seem to have made a significant dent in the growth of this series. However, the property damage and personal injury series do tend to move together over time.

From Table 5 it is clear the wildlife collisions present an increasing problem in Ontario. The following table puts this trend in context.

Table 6
Ontario Collision Injuries and Deaths, 1993-2003

Year	Persons Killed	Persons Injured
1993	1,135	91,149
1994	999	90,030
1995	999	89,572
1996	929	88,445
1997	899	85,527
1998	854	83,192
1999	868	84,062
2000	849	85,009
2001	845	81,782
2002	873	84,192
2003	831	77,879

Source: Elzohairy *et al*., and Ontario Ministry of Transportation.

Driving in Ontario became safer between 1993 and 2003. Table 6 shows that fatalities fell by about 20% and injuries by about 10%. During the same period wild animal collisions that resulted in injury have increased by about 50%. In relative terms, the seriousness of the wild animal problem has increased.

The accident data system in Ontario records the extent of the damage to the vehicle. Light damage consists of scratches, small dents, or minor cracks in glass that do not affect safety or the performance of a vehicle. Moderate damage means the vehicle must be repaired to make it safe for the road, but can be driven for short distances. Severe damage means that the vehicle is repairable, but cannot be driven and requires towing. Demolished means repairs would not be feasible. Table 7 shows how often vehicles are severely damaged or demolished.

Table 7
Ontario Vehicle Damage in Wild Animal Collisions, 1996-2001

Year	Severe	Demolished
1996	963	152
1997	993	178
1998	1,117	184
1999	1,135	181
2000	1,264	193
2001	1,333	205

Source: Elzohairy *et al*.

Severely damaged or demolished vehicles make up about 15% of reported wild animal collisions.

c. Nova Scotia

In Nova Scotia, all collisions on public roads involving injuries, fatalities, or property damage over $1000 must be reported to the police or the Registry of Motor Vehicles. Deer are the large animal of most interest. Nova Scotia also records collisions involving other wild animals and domestic animals.

Table 8
Deer-Vehicle Collisions in Nova Scotia, 1996 –2004

Year	Property Damage	Personal Injury	Fatal	Total
1996	594	63	0	657
1997	697	66	0	764
1998	736	74	2	812
1999	759	77	0	836
2000	710	90	0	800
2001	637	75	1	713
2002	516	58	1	575
2003	365	33	0	398
2004	411	51	0	462

Source: Nova Scotia Transportation and Public Works for 1999-2004, Tardif for earlier years.

Note: The two sources differ on average by under 2%.

In Nova Scotia, human fatalities caused by deer collisions are very infrequent. Personal injuries and property damage peaked in the period 1999 to 2000, and have since declined below the levels of 1996 and 1997, but only nine years of observations were available.

Table 9
Other Wild Animal-Vehicle Collisions in Nova Scotia, 1996 –2004

Year	Property Damage	Personal Injury	Fatal	Total
1996	29	22	0	51
1997	36	12	0	48
1998	40	18	1	59
1999	46	19	0	65
2000	44	28	1	73
2001	52	23	0	75
2002	46	18	1	65
2003	29	23	0	52
2004	34	16	0	50

Source: see above.

Collisions with deer in Nova Scotia that result in over $1,000 of property damage are much more frequent that those with other wild animals by a factor of over fifteen, but for collisions resulting in personal injury the factor is only three times. These other wild animal collisions peaked in 2000 and 2001.

Table 10
Domestic Animal-Vehicle Collisions in Nova Scotia, 1996 –2004

Year	Property Damage	Personal Injury	Fatal	Total
1996	50	19	0	69
1997	66	10	0	76
1998	52	24	2	76
1999	48	21	1	70
2000	50	28	0	78
2001	48	19	1	68
2002	42	13	1	56
2003	41	12	0	53
2004	27	11	0	38

Source: see above.

Domestic animal collisions are fairly similar to other wild animal collisions, with 15% more cases of property damage and 15% fewer cases of personal injury. It should be pointed out that damage and injury can be caused by secondary impacts or by swerving to avoid the animal. There is much less of an apparent peak to the domestic animal data.

d. Other Provinces

In Saskatchewan, SGI, the provincial auto insurance agency, reports[14] that in 2004 there were 10,442 collisions causing property damage in which a wild animal was a major contributing factor. There were a further 252 collisions which resulted in personal injury. Manitoba Public Insurance[15] reported that in 2004 a total of 10,924 wildlife collision claims were filed resulting in a cost of $20.4 million. In the prior two years, there had been four deaths attributed to collisions or avoiding wildlife on the roadways. In New Brunswick, Christie and Nason[16] present some data from the Department of Transportation. Between 1995 and 2000 there were 4,239 deer-vehicle collisions and 1,482 moose-vehicle collisions in New Brunswick, representing over 8.6% of total accidents. The moose collisions resulted in 20 fatalities and 550 injuries. The deer collisions resulted in one death and 405 injuries.

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(14) See http://www.sgi.sk.ca/sgi_pub/road_safety/trafficcollisionstats/pdf/2004/section03.pdf.

(15) See http://www.mpi.mb.ca/English/newsroom/articles/2005/nr_Oct26_05.html.

(16) See Christie, J. S., and S. Nason, *Analysis of Vehicle Collisions with Moose and Deer on New Brunswick Arterial Highways*, p. 3.

3. Mitigation Measures

Collisions between wildlife and vehicles are costly and dangerous. Consequently, considerable effort has been devoted to finding methods to mitigate the problems. Some of these measures try to change the behaviour of motorists by warning them of danger or improving the roadways and driving conditions. Other measures attempt to reduce the number of incidents of animals gaining access to the roadways. Hunting as a wildlife management tool helps to keep herd size under control.

Motorists expect to be warned of danger ahead on a highway. The jumping deer sign warns of a high concentration of deer. These signs may be accompanied by a lowered speed limit. The effectiveness of highway signs is limited by driver complacency. As signs become frequent on long stretches of road, drivers become less attentive to them. To emphasize the potential danger and break complacency, oversized signs have been tried to warn against large wild animals such as moose or caribou. Some testing in Newfoundland shows a significant increase in collisions over a 10-year period even after the larger signs were displayed. Electronic signs that can be changed to reflect current risks may be more effective at catching attention.

Lowering the speed limit is another strategy. Parks Canada has instituted a 70 km per hour limit near Jasper. This has resulted in a 5% reduction in elk collisions.(17) This approach may not work on open highways in most rural areas. Jasper is well-known for the quantity of its wildlife and these roads are well patrolled, unlike most rural areas.

Using hi-tech reflectors mounted on poles along the roadside to redirect headlight beams has been tried. These beams form a light barrier between road and the land. When there is no traffic, deer can freely cross the roads, but when there is traffic at dusk or night the vehicle headlight beams are transformed into a barrier of light along the edge of the roadway as they strike the reflector poles. The idea is attractive, but the question is whether deer see these light beams and are deterred. This technology has been evaluated, but the studies are inconclusive. This system costs upwards of $10,000 per km.

Special lighting for those sections of road with a bad record for wildlife collisions has been tried. Animal accidents usually occur between dusk and dawn, and it was hoped drivers would be able to see and thus avoid the wildlife more readily. However, improving the lighting may also encourage faster driving. The research tends to show increased lighting is ineffective in reducing accidents and is expensive.

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(17) See Lo, Allan. “Wildlife-Vehicle Collision Countermeasures,” Technical Standards Branch Newsletter, Infrastructure and Transportation Government of Alberta, Vol. 2, Issue 1, 2003, p. 6.

Apart from crossing a road to another forage area, wildlife can also find the roadside nurturing. Road salt attracts animals. Caribou stand on the roadways in October and November, licking the salt away. Similarly, roadside grass is very appealing to many herbivores. Possible solutions are chemical treatments to repel the animals, for example adding lithium chloride to road salt, or planting varieties of grass that animals like less.

Fencing both sides of the road to keep animals off the highway is the most expensive method of wildlife control. If the roads cut off forage areas or migratory routes, alternate passage has to be provided by underpasses or bridges, and the fences have to been designed to funnel the animals to these safe passages. The movement, distribution and behaviour of the wildlife have to be studied before the fencing and safe passages can be planned. Deer have been known to walk many hundred meters around a fence they cannot jump. They will crawl underneath a fence at erosion gaps. A high buildup of snow in winter adjacent to the fence may allow deer to easily jump over. The worst consequence of animals breaching fences is that they can be trapped on the highway after jumping over or crawling under fences with no obvious escape, panicking and presenting a danger to road users.

Well designed fencing may be the most effective method for reducing animal-vehicle collisions, but the cost is high. Cost can be close to $30,000 per km for fencing and over $1 million for an underpass sizeable enough for large animals. Construction and maintenance costs may be prohibitively high for many areas.

Ideally, deciding how to control and mitigate collisions should be based on a rigorous analysis of effectiveness, costs and benefits. Unfortunately, much data is lacking. Some provinces do not publish consistent data on collisions. Data collected by self -reporting usually underestimate the true magnitudes.

The benefits of lowering collisions would include reductions in property damage, in personal injuries, in deaths, and in harm to animals and nature. In those provinces with a single automobile insurer, there is some data on claims, filed or paid, but there is no information on damage amounts below the limit, nor is it known how many of accidents with lower damage there are. The medical costs treating injuries are not measured. The injuries caused by a moose coming through a windshield can be grave, involving a multidisciplinary surgical team and a series of operations over a long period.

Many economists prefer to evaluate costs which are difficult to measure directly, such as injury and death, by asking people what they would be prepared to pay to have the risk reduced or avoided all together. Transport Canada[18] researched this issue and came to a figure of $1.5 million in 1991 dollars to avoid a road fatality. This would be about $1.9 million currently.

Deaths from animal collisions have been ranging between 20 and 30 annually for all Canada in recent years. In round numbers, this range gives a nationwide cost of death between $40 million and $60 million. To scale this range, consider the reported Manitoba insurance claims at $20.1 million and the B.C. insurance claims recently in the range of $20 million to $30 million. Property damage from animal collisions is more costly than the cost of fatalities. Death imposes a high cost but is relatively so infrequent that it has a smaller effect on total cost. Unfortunately, property damages from animal-vehicle collisions are not well measured. Injuries are much more frequent than fatalities, but less frequent than property damage. Although there are average estimates of auto injury costs for all auto accidents, it is not known how close this number is to the average for large animal collisions.

This discussion leads to some wariness about comparing the costs and benefits of different mitigation methods, because the costs of animal-vehicle collisions are badly measured. However, the effectiveness of different methods can be compared.

The technical literature finds that fencing and overpasses or underpasses are the most effective method, but also the most expensive. Most other methods have, in general, been evaluated as having at most slight effects.

Wildlife management can have an important role. By controlling the animal numbers by hunting, the risk of mixing wildlife and traffic can be reduced. Many factors affect the size of wildlife stock, but the concurrent growth of animal populations, increases in animal-vehicle collisions and decline in hunting must be viewed together with some concern. Hunting as an animal control method has many attractions to the frugal policymaker. It is self-financing, generates local income, and licence fees can be put towards conservation efforts, as well as giving pleasure and maintaining a link with traditional lifestyles.

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(18) See http://www.tc.gc.ca/pol/en/Report/anre1997/ANNUAL97/TC97_C06.HTM#Note%206-1.

B. Nuisance Animals

Each species and habitat raises different issues, but a recent Ontario report(19) provides an interesting analysis. The Nuisance Bear Review Committee was required to review all the factors in black bear management. Concerns about the orphaning of cubs had led to the 1999 decision to cancel the spring bear hunt. This cancellation remains controversial.

Black bears are omnivores, varying their sources of food by season. They have well-developed navigational abilities, and a keen sense of smell. The supply of spring foods that they eat is quite stable, but the summer and fall foods, particularly berries and soft fruits, are unpredictable in timing and availability. Poor berry crops may cause animals to search for other sources of food, perhaps crossing into human habitations to scavenge or take crops. Thus, they become nuisance bears.

Apiaries are an attractive target for nuisance bears, but corn, oats, and other field crops can also be damaged and livestock killed. Table 11 shows the compensation for black bear damage paid by the Province of Ontario. On average during 1995-2002, compensation was paid annually for 44 livestock, including poultry, valued at $13,291 and 595 beehives valued at $49,615. Total compensation paid for damage by black bears in one calendar year averaged $62,906.

It should be noted that this table does not reflect the total damage black bears cause. First, compensation is paid on market value up to a limit for livestock. This cap is $1,000 for cattle and buffalo, $500 for horses, and $200 for sheep, swine and goats. The compensation is $35 for a bee colony and $75 for equipment. Secondly, crops and soft fruit are not covered. Moreover, Table 11 does not include the costs of damage to private and commercial property as well as control costs, such as relocation, which reportedly amounts to $800 per bear.

(19) Ontario, Ministry of Natural Resources, Nuisance Bear Review Committee. *Report and Recommendations*, Toronto, 2003, at http://www.mnr.gov.on.ca/mnr/ebr/nbrc/index.html.

Table 11
Compensation for Black Bear Damage in Ontario, 1995-2002

Year	Livestock		Beehives	
	Killed or Injured	Compensation Paid ($)	Beehives or Colonies Destroyed	Compensation Paid ($)
1995	–	–	519	42,475
1996	12	5,486	350	31,206
1997	13	4,860	689	59,629
1998	14	5,678	266	24,070
1999	32	15,263	892	67,855
2000	26	10,159	729	61,936
2001	74†	21,907	832	70,413
2002	138†	29,685	481	39,335

Note: † includes poultry.

Source: *Nuisance Bear Review Committee Report*, Appendix 20.

Currently, a black bear hunting licence for Ontario residents costs $36. Non-residents are charged $180. Most non-residents are required to use the services of a licensed outfitter or guide, unless they own hunting property or go hunting with a relative who is an Ontario resident. The number of bear licences and revenues generated during 1993-2002 are reported in Table 12.

Table 12
Ontario Recreational Bear Hunting Licences, 1993-2002

Year	Licences Issued			Revenue ($)
	Resident	Non-resident	Total	
1993	10,409	10,442	20,851	1,942,295
1994	12,287	13,439	25,726	2,335,060
1995	12,369	13,713	26,082	2,410,983
1996	9,697	12,913	22,610	2,239,819
1997	9,831	12,421	22,252	2,171,458
1998	10,208	12,069	22,277	2,183,096
1999	10,264	7,058	17,322	1,763,512
2000	10,473	7,766	18,239	1,949,369
2001	12,424	7,495	19,919	2,034,800
2002	11,737	7,924	19,661	2,099,678

Note: 2002 data are estimates.

Source: *Nuisance Bear Review Committee Report*, Appendix 21.

The Ontario Ministry of Natural Resources has conducted a mail sample survey of bear hunters in various years. Hunters were asked to report their spending on travel, supplies and services directly related to black bear hunting. The findings are shown in Table 13.

Table 13
Economic Impact of Bear Hunting in Ontario,
in Millions of Constant Year (2000) Dollars

Year	Directly Related Expenditures			Contribution to Gross Provincial Income
	Residents	Non-residents	All Hunters	
1997	5.1	25.2	30.3	31.6
1999	6.2	14.3	20.5	21.7
2000	6.1	15.5	21.6	22.8

Source: *Nuisance Bear Review Committee Report*, Appendix 21.

Non-resident hunters spend more on hunting black bears. On a per capita basis, the difference is striking: In 2000, resident bear hunters spent on average under $600, and non-residents spent about $2,000. Once the indirect effects of this spending had rippled through the Ontario economy, an estimated $22.8 million of provincial income was sustained.

Although the measurements of the costs of nuisance bears and the benefits of black bear hunting are partial, a crude cost-benefit analysis comes out strongly in favour of the bear hunt.

The Committee found a clear connection between fluctuations in natural food abundance and nuisance activity, but no connection between the cancellation of the spring bear hunt and recent increases in nuisance bear activity. In other words, there was no evidence that, before 1999, the spring bear hunt had reduced nuisance activity by black bears. Changes in bear nuisance activity levels in Quebec and Manitoba had paralleled those in Ontario, but Quebec has only a spring black bear hunt, and Manitoba has both a spring and a fall hunt. This suggests that the choice of spring or fall hunts, or both, does not affect bear nuisance activity levels.

Many Ontario municipalities and outfitters reported increased economic hardships after the spring black bear hunt was cancelled in 1999. In the light of this and the economic impact analysis, the Committee recommended that a limited spring black bear hunt be reinstated for socio-economic reasons, with strict conditions. However, the Committee suggested other measures, for example subsidies for electric fences to protect beehives, to deal directly with nuisance bears.

The black bear, for example, is an animal with many abilities and skills. It can live close to people, often too close. Research suggests that nuisance behaviour is driven by temporary food shortages; and because such behaviour is not a factor, unlike the level of the dollar and economic conditions, that leads U.S. hunters to head up North or motivates Canadians to hunt, it seems unlikely that managing the levels of hunting activity would effectively counteract changes in the levels of nuisance bear activity.

After the Committee reported, Ontario held a provincial election, which resulted in a change of government. In recent years, the spring bear hunt has generated political debate, and, not unsurprisingly, the change of provincial government brought in a change of bear policy, now called "Bear Wise." It is argued that the new policy concentrates on prevention and education to reduce incidents, in contrast to the previous policy, characterized as trap, relocate, and destroy. It is too soon to for any evaluations to have been published.

C. Costs of Losing Hunting and Trapping

The International Association of Fish and Wildlife Agencies, IAFWA, came into being in 1902 in the United States as the National Association of Game Wardens and Commissioners. Since then some Canadian members have joined. The IAFWA put together a report[20] to underline, as the title proclaims, that sport hunting and trapping are indispensable tools for wildlife management. Particularly in the United States, this message has come under some attack, as campaigns and ballot initiatives for more restrictive laws have been mounted. The idea for this report was first proposed by Manitoba Department of Natural Resources, showing the importance of this issue for Canadians.

1. The IAFWA Estimates

As more and more wildlife habitat, such as forest, farmlands, and river banks, is developed, the displaced populations of wildlife have little choice but to roam in backyards. These conflicts become labelled as nuisance wildlife complaints. An IAFWA survey of fish and wildlife agencies in 2004[21] indicated that, over the last five years, nuisance wildlife complaints for deer, beaver and bear have increased over 20% across the United States. Yet populations of these same species have increased just over 11%. In Canada, the survey showed a larger problem, with bear complaints growing three times faster than the bear population.

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(20) International Association of Fish and Wildlife Agencies, *Potential Costs of Losing Hunting and Trapping as Wildlife Management Methods*. Updated 25 May 2005.

(21) *Ibid*., p. 3.

Trapping is the only practical means to capture furbearer species, such as beaver, raccoon, and skunk, because they are nocturnal and cannot be hunted using traditional techniques. Beaver causes the most damage. According to the 2004 IAFWA survey[22] beaver populations have increased 6.8% over the previous five years in the United States and 4.5% in Canada. The IAFWA[23] attempts to estimate the cost if trapping beavers was stopped. As a conservative estimate, the IAFWA reckons that half the current beaver harvest would have to be removed to keep damage at a reasonable level. Statistics Canada reports at least 164,500 beavers harvested in 2002-2003 at a total value of $3,718,902, or $22.61 per pelt. The IAFWA estimates the cost of removing half of these beavers at a cost between US$75 and US$150 each, based on Massachusetts data. Private businesses, homeowners and other who expected to suffer the damages from increased beaver populations would have to pay an additional $7 million to $16 million annually.

The major harvested furbearers, apart from beaver are raccoon, muskrat, nutria, opossum, mink, red fox, coyote, skunk and grey fox. In 2002-3, $23.6 million worth of wild pelts were harvested in Canada, according to Statistics Canada. From the IAFWA survey,[24] provincial wildlife agencies estimate that damage would increase 58.3%, if trapping were banned. To maintain current damage levels without increase, the IAFWA estimates that between one quarter and all of the current harvest levels for many trapped species may have to be taken. Taking the lower figure, an additional 223,677 problem animals would need to be removed annually. At a cost of US$75 to US$150 each, total costs could range between $17 million and $34 million.

Agriculture can be adversely affected by wildlife. Losses include destruction or damage to crops in the field and death or injury to livestock. The IAFWA[25] method to estimate these losses is to take an independent estimate of crop and livestock damage and multiply this by its estimate of the increase in wildlife damage if there were no hunting and trapping. The IAFWA estimate of wildlife damage growth is based on local expert opinions. Some readers may find this methodology reasonable but disagree with the choice of initial estimate for damage in Canada.

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(22) *Ibid*., p. 9.

(23) *Ibid*., p. 11.

(24) *Ibid*., p. 12.

(25) *Ibid*., p. 14.

In 1998, the Canadian Federation of Agriculture and Wildlife Habitat Canada(26) came to an estimate for wildlife damage of $22.6 million for all Canada. The IAFWA scales this up by 58% to give new damage estimate of $35.7 million. Compared to more recent figures, the 1998 figures seem too low. The Ontario Soil and Crop Improvement Association(27) in 2000 estimated annual agriculture losses in Ontario alone to be $41 million, plus $7.5 million annually in abatement costs. The joint federal – provincial wildlife compensation plan(28) paid out $28.3 million in 2004. Not all provinces took part in this program, and not all costs are covered. This program has been criticized by farming groups as being outdated, underfunded and far too restrictive. Looking at these newer and larger numbers, the IAFWA estimate of $35.7 million could easily be increased by a factor of three to five times.

The IAFWA(29) presents a case study of deer. In the United States, most deer populations are at record levels. This has led to an average increase in state expenditures for deer damage of 23% over the previous five years. In Canada, over the same period, provincial wildlife agencies spent 6% more to tackle deer damage, and devoted 7.9% more time to deer damage complaints, which have risen by 10.7%. The IAFWA attributes lower increases in Canada relative to the United States to the harsher climate reducing deer population growth and more lightly populated northern areas with fewer people to be adversely affected.

Apart from examining the costs of various types of wildlife damage, the IAFWA makes the case that hunting and trapping are the most cost efficient ways to keep wildlife damage at socially acceptable levels by controlling animal numbers. The alternatives can be more expensive or less effective.

Trap and transfer, or translocation, of nuisance deer is no longer a viable option. Deer are trapped, often tranquilized and then transported to another location. The problems are a lack of suitable places for excess deer to be released, and that released deer do not settle well in their new locations. They often die from stress during the translocation or are killed on roadways as they try to wander back to familiar habitats. Translocation costs between $500 to $4,000 per deer. Birth control has not been effective in controlling population growth in

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(26) Proposal for a National Agricultural Stewardship Program: A Wildlife Damage Prevention and Compensation Program for Farmers, April 1998.

(27) “Wildlife Impact Assessment for Agriculture” (March 2000), coordinated by the Ontario Soil and Crop Improvement Association.

(28) See Agriculture and Agri-Food Canada, *2004-2005 Departmental Performance Report*, p. 23.

(29) *Ibid*., p. 18.

free-ranging deer herds, according to a University of New Hampshire study, which looked at a favourable case of a relatively small isolated deer population with good access to administer the drugs. The cost was $1,500 per deer for two years. Not enough females could be treated to limit population growth. Sharpshooting has been successful for small-scale deer problems. However at a cost of about $400 per deer removed, it would be a prohibitively expensive method to cull free-ranging deer populations over large areas.

Sheepdogs have always guarded sheep, but historically shepherds have been in control. Acting alone as guard dogs without supervision, sheepdogs may fail because of ineffective training, become ill, may wander off from the flock, or become overly aggressive, worrying the livestock. They can be killed by wolves and coyotes.

Scare tactics, such as scarecrows, bells and noisemakers, and nowadays electronic sound and light devices, all are limited by the capacity of animals to learn in the long run that these devices are really not a danger. Using plants, shrubs and trees that certain types of wildlife find unpalatable will work provided the animals are not too hungry.

Fencing is costly, but will keep some predators out. Some predators can climb very well, coyotes and foxes, and some can jump very well, deer or elk. Net roofing or extra-tall fencing increases installation and maintenance costs.

2. Provincial Reports

The IAFWA sent a questionnaire to the state and provincial wildlife agencies, asking about local wildlife levels and problems in the previous five years. The Canadian responses are summarized below.

Manitoba has seen deer, beaver and elk populations increase moderately, while the bear population has remained stable at an already high level over the past five years. Deer and bear nuisance complaints have increased 20%. The assessment in Manitoba is that if hunting and trapping were no longer available as a management tool, wildlife damage levels would increase substantially, with an expected increase of 200% for deer and bear, and 300% for waterfowl. Beaver complaints have increased steadily during the past five years.

Nova Scotia has seen deer and raccoon numbers decrease, while coyote and bear populations have increased over the past five years. Beaver populations have remained constant. Nuisance bear complaints have only slightly increased, and complaints for most other species have remained stable or slightly decreased. The assessment in Nova Scotia is that if hunting and trapping were no longer available as a management tool, beaver and bear damage levels would

be expected to increase by 150% and raccoon damage by 100%. Deer damage is typically affected by the severity of the winter. Despite the overall decline in wildlife numbers, the impact on humans has increased. The Canadian National Railway has reported that beaver ponds have flooded rail beds, creating significant safety concerns. In residential developments in rural communities there has been a significant increase in deer damage and an increase in deer-vehicle collisions.

Saskatchewan Environment paid $57.8 million in compensation for waterfowl damage between 1980 and 2000. It paid out more than $8.1 million damage for big game damage between 1996 and 2000.

The Yukon Territory is sparsely populated by both humans and animals. This leads to very few nuisance encounters. Bison, wolves and coyotes are the species involved in wildlife damage in Yukon. Moose and caribou, especially caribou, are the species most frequently hit by vehicles. In some areas, vehicle killings of caribou had equalled the annual growth in the herd. The Yukon government has initiated a successful project to reduce nuisance bear problems through the use of electrical fencing around landfills, dumps and remote camps, often using solar panels are used to power these fences. Hunting wood bison in the Aishihik herd was started because a large number of nuisance encounters and high levels of damage. Hunting has kept the strong growth of this bison herd in check.

D. How to Control Nuisance Wildlife

There is a difference of opinion between the Nuisance Bear Review Committee and the IAFWA that deserves examination. The Ontario Nuisance Bear Review Committee found there was no evidence that, before 1999, the spring bear hunt had reduced nuisance activity by black bears, but that there was a clear connection between fluctuations in natural food abundance and nuisance activity. The Committee recommended allowing a limited spring bear hunt for reasons other than to control nuisance bears. Hunting generates income.

The IAFWA recognizes the importance of helping residents in bear country to understand how to live with bear and that the likelihood of human-bear conflicts increases substantially during times of increased bear populations or decreased supplies of natural foods. The IAFWA argues:[30]

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(30) *Ibid*., p. 32.

> To slow the growth of bear populations and reduce conflicts, over half of all states and most provinces have established regulated bear hunting seasons. Many wildlife agencies in jurisdictions without bear seasons, but where bear populations are close to reaching the cultural carrying capacity (the limit that human populations are willing to accept), are beginning to put hunting seasons in their plans. The primary goal is to keep bear populations healthy yet keep their populations within cultural tolerance limits. Wildlife managers do not want bears returning to a nuisance/pest status. Therefore, managers need all of the tools available to them, hunting being one of the most important methods for controlling populations.

Any analysis of a statistical phenomenon which has a mean trend and considerable fluctuations about this trend has to be done carefully. Unfortunately, wildlife data tend to be very short statistical series, and often of poor quality. Testing the hypotheses that hunting affects the number of bears and that the number of nuisance incidents depends upon the number of bears and the supplies of natural foods and of foods that humans think they own or control requires more and better data than are available.

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