

**Large Canada Geese in the Central Flyway:  
Management of Depredation, Nuisance and  
Human Health and Safety Issues**

Prepared for  
**The Central Flyway Council**

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Large Canada Geese in the Central Flyway:  
Management of Depredation, Nuisance and Human Health and Safety Issues

**Executive Summary**

The Central Flyway is an administrative unit for migratory game bird management. It is comprised of ten states (MT, WY, CO, NM, TX, OK, KS, NE, SD & ND), two Canadian Provinces (Saskatchewan & Alberta), the Northwest Territories and Nunavut. The Central Flyway Council, established in 1948, is an advisory body to the U.S. Fish and Wildlife Service (USFWS) and assists the Canadian Wildlife Service (CWS) in matters regarding migratory game birds.

In cooperation with the USFWS and the CWS, the Central Flyway (Flyway) manages five populations of Canada geese. Two of these (the Tall Grass Prairie and Short Grass Prairie populations) breed in the Arctic and are comprised of small races of birds and are beyond the scope of this document. They are, however, an important consideration in the management of large Canada geese. The three populations of Canada geese comprised of large races that are the primary subject of this document are the Hi-Line, the Western Prairie and the Great Plains populations. In addition, some information about the Rocky Mountain Population is included. These populations are distinguished from one another by their geographical distribution in the summer and winter as well as their racial makeup.

The Flyway has adopted management plans for each of these populations. Each of these has a similar Goal: Maximum recreational opportunity consistent with the welfare of the population, international treaties, habitat constraints and the interests of all Central Flyway provinces and states." The plans contain population objectives and estimates of population size are obtained annually, most often by winter counts.

All populations of Canada geese in the Central Flyway are above objective levels. This was achieved through careful and coordinated management decisions made over many decades. At the Flyway level, the primary action that contributed to this achievement was facilitating coordinated implementation of hunting regulations geared toward keeping mortality at an appropriate level. At the state and provincial level, many activities were undertaken to increase the population size including the release of captive-reared goslings, the release of adults and the implementation of special hunting regulations. More than 120,000 geese were handled for restoration purposes between 1960-99 in the Flyway.

The 1997-99 average winter count of total Canada geese in the Central Flyway was 1.5 million birds, up from about 206,000 in the 1960's. Of the 1.5 million, about 620,000 were from the three populations of primary interest in this document. This is about 60% above objective levels.

Along with these successes comes a new set of problems. As both total and local populations of geese have grown, so has the frequency of interactions between geese and people. Some of these interactions such as the sharing of city parks, housing developments, airports and agricultural crops are not welcomed by some humans. All jurisdictions in the Flyway, including federal agencies, have been working on preventing and/or alleviating these problems for over a decade using many tools. Some of the limited number of tools provide a higher success rate than others. Some are considerably easier than others for a local jurisdiction to implement in an expeditious, effective, socially acceptable manner. Constraints have been traditionally placed on actions by state and provinces by their respective federal agencies as well as society.

As a partial response to possibly reducing some of these constraints, the US Fish and Wildlife Service, in August 1999, announced its intent to prepare an Environmental Impact Statement (EIS) on Resident Canada Geese. This document provides the necessary

background and current data about Central Flyway resident Canada geese to satisfy a request from the USFWS for assistance in the preparation of the EIS.

The Goal of the Central Flyway specified in this document is: Manage resident Canada geese in the Central Flyway to achieve maximum benefits from these birds while minimizing conflicts between geese and humans.

In preparation for discussion of objectives and associated strategies to address growing populations of resident Canada geese, a history of restoration efforts, population changes, harvest, problems caused and problem resolution activities is presented. The document is intended to be a summary but much detailed information is presented in appendices. An important section is a summary of information on a state by state or province basis.

Five objectives are identified, each with a set of strategies the Central Flyway believes will assist in meeting them. They are:

1. Ensure that the positive values associated with resident Canada geese are maximized.
2. Implement control methods directed at problem resolution and/or goose population reduction that are socially and biologically acceptable, site-specific, efficient and effective.
3. Implement public awareness campaigns and cooperative programs to maximize the effectiveness of preventative and problem resolution methods..
4. Monitor goose populations, the number and type of problems they cause, attempts to solve those problems and the social acceptance of management actions.
5. Establish mechanisms for evaluation of objectives and strategies.

An Action Matrix is provided that identifies current and potential actions that would lead to problem abatement. Each action is defined and associated with an assessment of social acceptance and effectiveness.

Finally, a philosophy about the future, a data needs section and literature references are included.

While this document is designed to address problems caused by Canada geese as they affect humans, their property and, in some cases, their safety, it is in no way intended to reduce the high value the Central Flyway places on this renewable resource. Canada geese are part of the larger natural community the Flyway seeks to conserve. Beyond that, they provide an immense and increasing amount of recreation to citizens of the Flyway, from the Queen Maude Gulf in the Northwest Territories to Brownsville, Texas. And the Central Flyway is committed to the conservation of that recreation.

This document was produced by P. Joseph Gabig, Natural Resource Consulting ([www.wildlifeconsult.com](http://www.wildlifeconsult.com)), under contract with the U.S. Fish and Wildlife Service, Region 6, Denver, Colorado (Ref No. 601819Q616). It was extensively reviewed and edited by the Central Flyway Waterfowl Technical Committee.

## **Introduction**

The Central Flyway is an administrative unit for migratory game bird management. It is comprised of ten states (MT, WY, CO, NM, TX, OK, KS, NE, SD & ND), two Canadian Provinces (Saskatchewan & Alberta), the Northwest Territories and Nunavut. The Central Flyway Council, established in 1948, is an advisory body to the US Fish and Wildlife Service (USFWS) and assists the Canadian Wildlife Service (CWS), in matters regarding migratory game birds. There is a Technical Committee that advises the Council on technical issues and provides recommendations regarding potential actions.

The Central Flyway (Flyway), in cooperation with the USFWS and the CWS, manages five populations of Canada geese (*Branta canadensis*). The Short Grass Prairie and Tall Grass Prairie populations breed in the Arctic and are comprised of small races of Canada geese (e.g. *B. c. parvipes* and *hutchinsii*) and are beyond the scope of this document. They do, however,

play an important role in management decisions and will be included in some discussions. The other three populations of Canada geese are the Hi-Line (HL), the Western Prairie (WP) and the Great Plains (GP) populations. These populations are comprised of the large races of geese (*B. c. moffitti*, *interior* and *maxima*) and are the primary subject of this document. In addition, some western states in the Flyway deal with management issues of an expanding Rocky Mountain Population (RMP), which is largely oriented to the Pacific Flyway, and this population will also be discussed.

These populations of geese are distinguished from one another by their geographical distribution in the summer and winter as well as their racial makeup. Hi-Line birds are oriented to the western portions of the Flyway while GP and WP birds are exclusively oriented to the east tier of states and Saskatchewan with a portion of the breeding range extending into Manitoba (Appendix 9).

The focus of this document is address problems caused by resident Canada geese - those that largely or totally spend the entire year within a state or province.

The Flyway has adopted a management plan for each of these populations. A single plan was adopted in 1988 for the WP and GP because they had become impossible to separate during winter surveys that are used to index population size. However, a distinction was drawn between their respective breeding grounds. Population objectives for all populations identified in their respective plans are primarily derived from winter indices. For decades prior to the winter of 1998-99, some goose population estimates were made in December and some in January. Since then, all population objectives have been based on a coordinated January survey.

All populations of Canada geese in the Central Flyway are above objective levels. The Flyway considers this a positive response to careful and coordinated management decisions. Many strategies were developed and implemented over the decades with the objective of increasing the size of Canada goose populations.

Along with actions at the Flyway level, most states and Alberta and Saskatchewan conducted programs to increase the number and expand the range of breeding Canada geese within their jurisdictions. Restoration programs trace their origin to the early 1950's and others to the 1970's. Programs in northern areas were being terminated while those in more southern areas were just beginning. Later, this report will provide a brief review of these efforts and their outcome but for the moment, suffice it to say that these programs were successful.

Current estimates of population size are considered symbols of success. Canada geese are now accessible for viewing, hunting and other recreation to more people than ever before. The 3-year (1997-99) average winter-count of all Canada geese in the Flyway is 1.5 million, including a few thousand birds from the RMP and Eastern Prairie populations and several thousand not classified into a population.

Along with success, however, frequently comes a new set of problems. Such is the case with Canada geese in the Central Flyway. As both total and local populations of geese increased, so did interactions between people, their property and geese. Some of these interactions such as sharing city parks, airports or agricultural crops with geese are not wanted or caused safety concerns. Some problems with "too many waterfowl", such as those in southern Canada, date back to the 1960's when provinces began paying compensation to farmers for damage caused by waterfowl eating crops in the fall. States began to see their own, mostly urban problems in the early 1980's. Since then, the number of problems and the number of states which need to deal with them has steadily increased.

In many cases, states continued to expend efforts to increase the number and distribution of resident Canada geese while at the same time dealing with problems that ranged from nuisance to aircraft safety. Initial actions by states to address "too many geese"

often included trapping them and moving them to unoccupied areas. This was partially successful until there were few or no places left to put geese. In some instances, scare devices, such as those that make noise or flash in the sun were used. However, this tended to forestall larger problems or just move it to another location.

Between the early 1970's and 1990's, the Flyway and individual states maintained a conservative hold on hunting regulations. As population objectives were achieved after decades of effort, there was a concern that liberalizing regulations too quickly might cause an unwanted population decline. Ultimately, regulations were slowly liberalized, harvest increased and populations continued to grow. The Flyway, working with the USFWS and other flyways began to search for new tools to assist states in controlling local flocks of resident geese. One outcome of this effort is that all states in the Flyway can now hold early (September) and/or late (January) hunting seasons under USFWS approved guidelines. Some other tools were available but were cumbersome and required considerable federal oversight. The Migratory Bird Treaty Act and other federal regulations still constrained states from adding substantial management options to address growing populations.

In an attempt to find solutions to these problems, the USFWS announced its intent to prepare an Environmental Impact Statement (EIS) on Resident Canada Geese (USFWS 1999b). The USFWS requested that the Central Flyway assist in the preparation of the EIS and this document provides the necessary background and current data about Central Flyway Canada geese to accomplish that. Beyond that, it identifies the Flyway's viewpoint, strategies and associated justifications regarding possible changes in the federal regulations that govern what states can do to address the problem of "too many geese." It also identifies actions that will lead to improved responses by agencies to problems caused by Canada geese.

For this document, nuisance and problem Canada geese are defined as geese, goose flocks or local populations of birds that create problems for humans by fouling parks or ball fields with their droppings, eating agricultural crops intended to produce income for a farmer, eating plants used in landscaping or erosion control or threaten the safety of air travel. In most cases, these are flocks of large Canada geese that reside within a city or town but may include flocks that use some other kind of refuge from which to stage their foraging activity and regional populations in rural areas. Between fall and spring, some of these flocks include migrant geese including small Canadas from the SGP and TGP populations.

Many different types of data and data sources were used for this report. Some were tabulated from a survey of state and provincial migratory bird biologists who scoured local records for needed information. Some were obtained from existing state publications. Information from U.S. Department of Agriculture Wildlife Services (WS) was valuable. Other data were obtained from the U.S. Geological Service (USGS), Biological Resources Division Bird Banding Laboratory, the Central Flyway Harvest and Population Survey Data Book (Sharp 1999), and USFWS and USGS files. In addition, Management Plans adopted by the Central Flyway Council were used. Data were analyzed using Microsoft Access 97 and Excel 97, Statistix and custom programs written in Visual Basic. Specific methods are referenced in the various sections of this document.

While this document is designed to address problems caused by Canada geese as they affect humans, their property and their safety, it is in no way intended to reduce the high value the Central Flyway has placed on this renewable resource. Canada geese are part of the larger natural community the Flyway seeks to conserve. Beyond that, they provide an immense and increasing amount of recreation to citizens of the Flyway, from the Queen Maude Gulf in the Northwest Territories to Brownsville, Texas. And the Central Flyway is committed to the maintenance of that recreation.

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## **Goal and Purpose**

### **GOAL**

***Manage resident Canada geese in the Central Flyway to achieve maximum benefits from these birds while minimizing conflicts between geese and humans.***

### **PURPOSE**

The Central Flyway Council has placed a high priority on Canada goose management since its inception in 1948. Management issues have included population size, inventory, habitat quality and quantity, distribution, restoration and recreational use by humans including hunting.

Canada goose populations have increased significantly in the last three decades. These populations include those that migrate through Central Flyway States and those that are resident. It is primarily these resident birds that sometimes cause “problems” for humans.

The purpose of this document is to discuss the history of resident Canada goose management in the Central Flyway and reflect on that history to identify effective strategies to address problems caused to humans, their property and safety by Canada geese.

### **History and Current Status of Canada Goose Management in the Central Flyway**

“40 years ago, when wild geese, and I mean Canadas at that, were as plentiful almost as the ducks ... there were many geese killed much larger than any that have been killed ... during the past quarter of a century....” Sandy Griswold, Sporting Editor, Omaha World Herald, 1927. (Nebraska Game and Parks Commission 1979).

Griswold went on to predict the “absolute extinction of the Canada geese within a period of not more than 20-25 years.” According to Delacour (1954), who reported that the giant Canada goose was extinct, Griswold hit the mark. The primary reason for this was that a Canada goose was worth \$0.50 on the eastern game markets in 1905 (\$8.86 in 1998 dollars). Additionally, spring hunting was a common practice.

However, even before Hanson (1965) announced the rediscovery of giant Canada geese, members of the Central Flyway had begun restoration projects. Captive breeding flocks were housed at four National Wildlife Refuges (NWR) in North Dakota and South Dakota between 1938 and 1941 (Lee et al. 1984) and the first breeding flocks were established in Nebraska in 1936 (Gabig 1986). These early efforts experienced mixed success in terms of re-establishing flocks of Canada geese but much success in learning about what worked and what didn't. Over the next 40 years, captive flocks of breeding adults were established in most states and Alberta and Saskatchewan (Table 1). Goslings from these flocks were allowed either to free fly from their hatching location or, more frequently, transported to a new location with suitable breeding habitat. The nature of the bird, particularly females, to return to the area where they fledged after reaching sexual maturity allowed for nucleus breeding flocks to become established.

By 1960, attempts to establish breeding flocks were ongoing in several states, including Colorado, Kansas and Wyoming. Between 1960-62, 259 wild geese were trapped at Bowdoin NWR in Montana and transplanted to Saskatchewan. The pace quickened in the 1970's, when over 18,000 geese were released in the Flyway, including over 12,000 in the U.S. (Table 2). In the two decades that followed, over 85,000 birds were handled (Table 2). Kansas and



Oklahoma started major programs in this period while Wyoming and Alberta terminated theirs.

Canada geese and their restoration were important topics across North America during this period. Between 1968 and 1998, five symposia were held where the topic was exclusively Canada geese (Hine and Schoenfeld 1968; Canada Goose Production Workshop 1971; Kuck and Schroeder 1974; Johnson 1982; Rusch et al. 1998). All but the latter had a significant focus on restoration of populations. *Homegrown Honkers* (Dill and Lee 1970) was published in 1970. In 1984, *Rearing and Restoring Giant Canada Geese in the Dakotas* (Lee et al. 1984) was published. The 79 page book contained 414 "Selected References."

**Table 1. Locations and average flock size of captive breeding adult Canada geese in the Central Flyway.**

<u>Area</u>	<u>Period</u>	<u>Flock Size</u>
Alberta	1960-80	25
Colorado	1955-60	120
Kansas	1980-91	485
Montana	1945-66	30
Nebraska	1968-84	360
North Dakota	1965-80	230
Oklahoma	1980-90	200
Saskatchewan	1973-80	?
South Dakota	1963-71	90-250

**Table 2. Number of Canada geese released either as goslings from captive flocks or as the result of trap and transport programs in the Central Flyway.**

<u>Period</u>	<u>AB</u>	<u>SA</u>	<u>MT</u>	<u>ND</u>	<u>SD</u>	<u>WY</u>	<u>NE</u>	<u>KS</u>	<u>CO</u>	<u>OK</u>	<u>NM</u>	<u>CF States</u>	<u>CF Total</u>
1967-98	0		0	0	12,278	0	0	0	0	0	0	12,278	12,278
1960-69	156	1737	371	0	0	121	0	0	1,800	0	0	2,292	4,185
1970-79	2,299	4118	0	5,546	0	1,021	3,803	0	2,000	0	176	12,549	18,966
1980-89	1,265	7075	0	4,457	0	1,049	4,224	10,701	730	13,057	432	34,650	42,990
1990-99	0	9702	0	3,563	0	0	4,447	17,836	2,220	5,556	0	33,622	43,324
Total	3,720	22,632	371	13,566	12,278	2,191	12,474	28,537	6,750	18,613	0	95,391	121,743

There was a change in the focus of activity over these three decades. In the 1970's, 87% of the releases in the U.S. were goslings and 75% of these were from captive flocks held by states (Appendix 1). During the 1980's, 54% of the releases were goslings but this decreased to 43% in the 1990's. In addition, only 23% of the goslings were from captive flocks between 1980-1999. The reason for this shift in the source of birds is that they became available both from other locations within a state and from other states and/or provinces (Appendix 1). In the decade 1990-99, more than 21,000 geese were trapped and translocated within a jurisdiction and another 18,500 were moved from one jurisdiction to another (Appendix 1). The availability of Canada geese was directly related to population size (supply) and problems being caused by geese (i.e. the desire to reduce the number of geese in some places). Many adults were available. Essentially all geese translocated in the 1990's were available because they were causing problems.

As of 1999, only Colorado had an active restoration program and it is scheduled to terminate in 2000. All other states and provinces had terminated their programs though Saskatchewan, Oklahoma, Kansas, Nebraska, South Dakota and North Dakota were still moving birds from places where they were causing problems to less populated locations.

Beyond moving birds, the Central Flyway, states, provinces and federal organizations have taken a number of other actions to address problems. WS has, in particular, been working with airports in the U.S. portion of the flyway in implementing management methods designed to prevent problems from developing as well as solving current problems. Transport Canada, the federal agency that deals with commercial air safety in Canada, has an active program with the same emphasis.

Rather than wait for problems to reach crisis levels on a state by state basis, the Flyway has requested and received authorization from the USFWS for all states to be able to implement September and January hunting seasons directed at resident Canada geese. As of 1999, three states (SD, KS and ND) had used this option. In addition, the USFWS has allowed more liberal regular season hunting regulations directed at large Canada geese in the 1990's, as requested by the Flyway. Harvest has increased and may be effective at addressing the problem on a large scale.

However, these actions may not be effective at the local level (e.g. within an urban community). To address these site-specific problems, states have published information for home and golf course owners to assist in problem prevention and resolution. Some states have had discussions with urban planners and developers. The principle problems experienced and philosophies of states and provinces are discussed in Appendix 2.

### **Population Size and Distribution**

There are two primary time periods that it is reasonable to attempt to obtain an index to population size of Canada geese - at the time of breeding when pairs and "flocks" are counted and in the winter, when birds are relatively concentrated and total counts can be obtained. There is a long history of the latter survey in the Central Flyway and the results are discussed below. First, however, surveys of breeding populations will be reviewed.

#### **Breeding Bird Surveys**

Population indices in this report are from several sources. Many are from the annual May Breeding Duck Survey (Wilkins and Cooch 1999) conducted across a broad range of northern North America. While some Canada goose data were recorded on this survey designed to estimate duck population size as early as 1955, data available from 1970 to 1999 were used in this report for HL, RM and WP populations and that portion of the GP population that occurs in Canada (Nieman et al. 2000). The May Survey data also were used to estimate goose populations in North Dakota, South Dakota and Montana. Population information was obtained from the state wildlife agencies where the May Survey is not conducted or data sets were not available. These latter data were based on state-directed surveys and, in some cases, the best professional judgement of waterfowl biologists. Projections for 2010 were made linear and exponential regression equations unless states did their own projection (Appendix 3).

All populations of Canada geese in the Central Flyway are increasing including the RMP which is largely oriented to the Pacific Flyway. The index for total large Canada geese for the three populations in the Central Flyway in 1999 was over 900,000 birds, 95% higher than in 1990 and 680% larger than in 1980 (Table 3). There is evidence that the explosive growth in population of the 1970's and 80's has slowed (Table 3). The sum of the point projections for 2010 indicates a 161

% growth from the 1999 estimate to about 2.4 million birds (Table 3).

The Breeding Bird Survey (Peterjohn 1994) supports the conclusion that Canada goose populations are growing in most parts of the Central Flyway (Table 4). Significant ( $P < 0.1$ ) positive annual trends range from 12% to 36% for the period 1980-98. Only the New Mexico data show a significant ( $P < 0.05$ ) negative trend.

State and provincial waterfowl biologists were asked to provide their judgement about the rate of increase they expected in the breeding population of Canada geese in their jurisdiction

compared to present (1995-99) rate. Five biologists (from AB, SK, NE, ND, NM) believed that the population would continue to grow at the present rate, five (CO, WY, MT, OK, KS) believed the increase would proceed at a slower rate and one (TX) believed the rate would increase. South Dakota believed that their population would stabilize.

**Table 3. Indices of the number of Canada geese in the spring in the Central Flyway, potential population size in 2010 and population objectives.**

	<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>1999</u>	<u>2010<sup>1</sup></u>	<u>Objective<sup>2</sup></u>
<b><u>Great Plains Population</u></b>						
Canada	1,900	4,900	20,800	43,000	359,700	
North Dakota	0	3,700	26,600	104,500	516,600	60,000-100,000
South Dakota	900	3,400	46,200	111,800	100,000	50,000 <sup>3</sup>
Nebraska	4,000	8,000	12,000	32,000	36,800	30,000-50,000
Kansas	200	200	8,000	30,000	37,500	37,500
Oklahoma	30	30	11,100	43,900	75,000	20,000-40,000
Texas		500	600	750	900	750
<b>Total</b>	<b>7,030</b>	<b>20,730</b>	<b>125,300</b>	<b>365,950</b>	<b>1,126,500</b>	
<b>% Change</b>		<b>195%</b>	<b>504%</b>	<b>192%</b>	<b>208%</b>	

**Western Prairie Population**

Canada	22,000	35,700	145,500	247,500	618,500	
<b>% Change</b>		<b>62%</b>	<b>308%</b>	<b>70%</b>	<b>150%</b>	

**Hi-Line Population**

Canada	17,800	21,800	111,500	212,100	456,300	
Montana	40,500	27,500	69,500	62,200	141,600	80,000
Wyoming	1,000	3,900	9,700	15,800		9,700
Colorado	3,600	7,900	10,000	14,500	18,000	12,500
New Mexico	50	75	200	1,700	3,300	5,300
<b>Total</b>	<b>62,950</b>	<b>61,175</b>	<b>200,900</b>	<b>306,300</b>	<b>659,200</b>	
<b>% Change</b>		<b>-3%</b>	<b>228%</b>	<b>52%</b>	<b>115%</b>	

**Sub-Total - Central Flyway Large Canada Geese**

	91,980	117,605	471,700	919,750	2,404,200	
<b>% Change</b>		<b>28%</b>	<b>301%</b>	<b>95%</b>	<b>161%</b>	

**Rocky Mountain Population**

Canada	20,700	15,300	41,500	125,700	168,900	
Montana	8,400	8,900	28,000	41,400	64,700	45,000
Wyoming	2,000	3,600	5,500	7,900	12,500	6,000
<b>Total</b>	<b>31,100</b>	<b>27,800</b>	<b>75,000</b>	<b>175,000</b>	<b>246,100</b>	
<b>% Change</b>		<b>-11%</b>	<b>170%</b>	<b>133%</b>	<b>41%</b>	

1. Most estimates are based on a regression fitted exponential equation [ $Y = e^{(b * year)}$ ] (see Appendix 3). By its nature, this equation accounts for historical growth and there is no certainty that such growth can be sustained. An estimate of a linear nature is provided for many locations in Appendix 3.
2. The population objectives in this table are based on the best knowledge and information available. In addition, they represent state or provincial-wide objectives. As such, jurisdictions may modify population objectives and/or address the size of sub-populations as needed.
3. This estimate was provided by SD Game, Fish and Parks and represents a management objective they intend to attain.

**Winter Surveys**

Winter surveys have been conducted for Canada geese in the Central Flyway since the 1930's. Since the winter of 1981-82, estimates of individual populations have been made. Procedures for assigning geese to a population are contained in the Management Plans for each population (Central Flyway Council references) and include leg band recoveries and neck

collar observations. Winter surveys are used to establish population objectives that in turn identify points at which hunting regulations may be changed.

**Table 4. Trends of the number of Canada geese in the Central Flyway as reported by the Breeding Bird Survey.**

Region	***** 1966-1998 *****					***** 1980-98 *****		
	Trend	P	N	95% Conf. Int.	R.A.	Trend	P	N
Alberta	9.8	***	57	1.9	17.8	7.78	7.2	58
Colorado	8.8	**	17	0.5	17.2	2.63	12.5	****
Kansas	39.6		9	*****	218.1	0.68	34.5	8
Montana	25.7	****	27	8.4	43.1	4.35	30.6	***
Nebraska	15.2	**	7	2.5	27.9	2.25	9.1	6
New Mexico	-7.6	**	5	-9.9	-5.3	0.40	-9.1	***
North Dakota	50.6	****	31	16.0	85.2	5.62	36.6	***
Oklahoma	17.5	***	6	10.8	24.3	0.34	17.5	**
Saskatchewan	8.1		32	-4.5	20.7	10.04	12.8	***
South Dakota	27.1	*	11	-7.6	61.8	0.71	15.3	11
Wyoming	-4.8		25	-18.8	9.2	8.67	-3.5	25

No Canada geese were reported in Texas

Trend is estimated percent change per year

R.A: Relative abundance - birds seen per route

\* P<0.2 that the trend is zero: \*\* P<0.1: \*\*\* P<0.05: \*\*\*\* P<0.01

All populations of Canada geese in the Flyway are above objective levels (Table 5) and the total Canada geese counted in the winter is continuing to increase (Table 6). The three populations of large geese (with the WP and GP populations counted as one in the winter) of most concern in this report are growing at a similar rate (P>0.9, equal slopes) (Fig 1). The three-year running averages have been increasing since data estimates were first computed for each population (Table 7). Projections of population size indicate that the total number of Canada geese in the flyway will be 1.96 million by 2010, 31% larger than in 1999. This estimate is comparable to the 28% growth rate computed from breeding population data.

**Table 5. Population objective indices, current status and projected index for 2010 for Canada goose populations in the Central Flyway based on winter surveys.**

Population	Objective	Average 1997-99 Index	Amount (Percent) Above Objective	Projected Population Index - 2010 **
Tall Grass Prairie	250,000	380,961	130,961(52%)	329,000
Short Grass Prairie	150,000	434,829	284,829(189%)	852,000
Western Prairie & Great Plains	300,000	467,603	167,603(56%)	644,000
Hi-Line	80,000	152,991	72,991(91%)	247,000

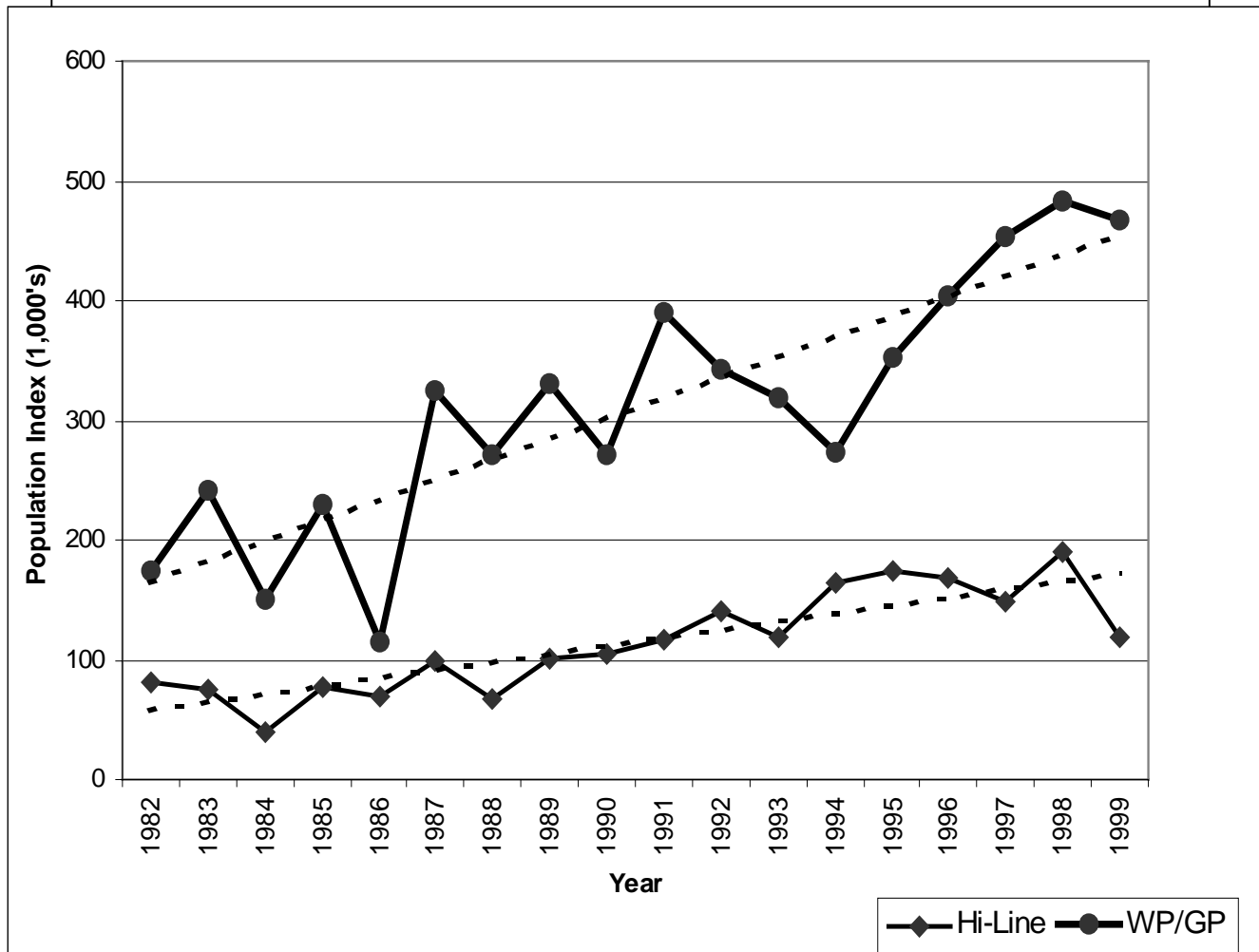
\*\* See Appendix 4 for equations used.

**Table 6. Average indices of Canada geese in the Central Flyway based on winter surveys.**

Percent change from the previous period is shown.

Period	Average	% Change	Period	Average	% Change
1948-59	145,505		1970-79	445,834	54%
1960-69	205,806	29%	1980-89	729,912	39%
			1990-99	1,359,837	46%

Figure 1. Population indices from winter surveys in the Central Flyway for Hi-Line and Western Prairie and Great Plains Canada goose populations.



### Harvest

A common goal of Central Flyway goose management plans is “Maximum recreational opportunity consistent with the welfare of various populations, international treaties and habitat constraints” (Central Flyway references). Thus, harvest and hunting regulations play an important role in the perspective of the Flyway. Each of the management plans for the populations of Canada geese contain population objectives that are the benchmark used to restrict or liberalize hunting regulations. These regulations were restrictive during the 1970’s and into the 1980’s including early season closing dates, daily bag limits of one or two and time frames (or windows) within which the limit could change. As states worked to increase their resident flocks, they instituted more restrictive regulations within their boundaries. While attempts were made to maximize “recreational opportunity” for populations that could withstand higher harvest, management practices put into place to protect a sub-population often provided for reduced harvest of populations that didn’t require it.

The management plans also describe the distribution of populations within the flyway, sometimes to the county level within a state, during the fall migration and winter. In addition, procedures are described to separate “small” from “large” Canada geese in the harvest by measuring tail feathers procured from hunters through the USFWS Parts Collection Survey. Using these two tools, an estimate of the harvest can be made at the population level.

**Table 7. Three-year running averages and percent change for populations of Canada geese in the Central Flyway using winter survey results.**

Winter	Hi-Line		West. Pr. & Grt. Plns		Short-Grass Prairie		Tall Grass Prairie	
	3 -Yr Avg.	% Change	3 -Yr Avg.	% Change	3 -Yr Avg.	% Change	3 -Yr Avg.	% Change
1983-84	65,767		189,041		157,567		231,583	
1984-85	63,933	-3%	207,504	10%	165,267	5%	207,797	-10%
1985-86	61,900	-3%	165,172	-20%	167,867	2%	215,743	4%
1986-87	81,433	32%	223,098	35%	183,667	9%	181,863	-16%
1987-88	78,233	-4%	236,985	6%	170,333	-7%	218,162	20%
1988-89	88,333	13%	308,743	30%	204,933	20%	226,080	4%
1989-90	90,933	3%	291,104	-6%	267,333	30%	221,873	-2%
1990-91	107,533	18%	330,421	14%	390,467	46%	221,533	0%
1991-92	121,000	13%	334,295	1%	502,267	29%	242,612	10%
1992-93	125,186	3%	349,976	5%	485,631	-3%	272,257	12%
1993-94	141,098	13%	310,805	-11%	460,836	-5%	245,286	-10%
1994-95	152,396	8%	314,337	1%	486,696	6%	234,839	-4%
1995-96	168,751	11%	342,767	9%	564,357	16%	244,395	4%
1996-97	163,482	-3%	403,057	18%	573,227	2%	257,283	5%
1997-98	169,012	3%	446,322	11%	487,490	-15%	286,224	11%
1998-99	152,991	-9%	467,603	5%	434,829	-11%	380,961	33%

In about 1990, as populations remained above objectives and continued to increase, the Central Flyway Council started a slow progression of liberalizing regulations (Appendix 5). These first occurred in the west tier of states (NM, CO, WY and MT and in west TX) where SGP and HL birds are harvested. Between about 1990 and 1999, there was a change in the east tier of states (TX, OK, KS, NE, SD and ND) from 72 days to hunt Canada geese with a bag limit of one to 95 days and a bag limit of three. In addition, South Dakota provided the first early September season in the Flyway in 1996 with the objective to decrease the local Canada goose population in the northeast and east-central portions of the state. In 1999, Kansas and North Dakota instituted their first September season.

During the nearly four decades between 1962 and 1998, Canada goose harvest increased more or less with the increase in population size despite a concurrent decline in the number of adult waterfowl hunters (Table 8; Fig 2). The percentage of the Flyway's total goose harvest that was Canada geese increased from about 40% prior to the mid-1980's to greater than 60% in the late-1990's. There were some minor changes in the distribution of the Canada goose harvest in the Flyway, most notably a decline in Texas (from 21% of the Flyway's total in the 1970's to 12% in the 1990's) and in North Dakota (19% to 14%). These "percentage points" of harvest were distributed across all the other states except New Mexico and Kansas which have maintained a relatively stable percentage of the Flyway's harvest.

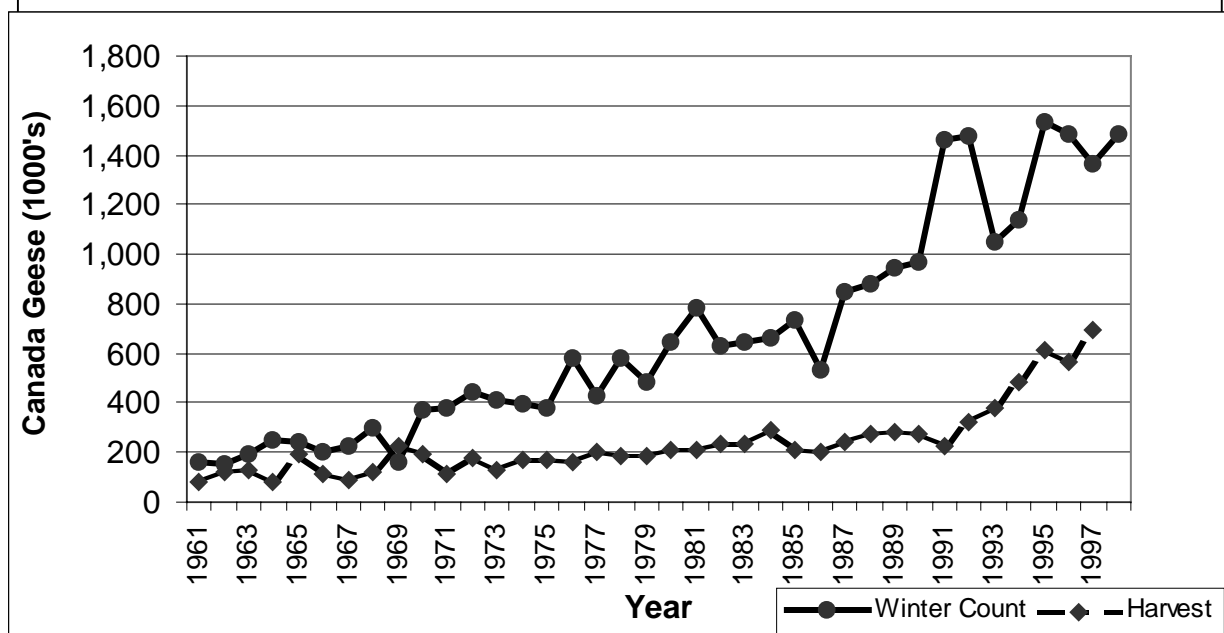
At the same time the total harvest of Canada geese has increased, so has the proportion that are large geese (Table 9) in nearly every jurisdiction (Appendix 6) over the last two decades. Only in Colorado and Montana has this proportion been stable rather than increasing. The magnitude of the change in Central Flyway states over the period 1995-98 has been influenced by several factors, including more liberal regular season hunting regulations.

**Table 8. Harvest and percent change in winter indices of Canada geese and adult waterfowl hunters in Central Flyway States.**

<u>Period</u>	<u>Average Harvest</u>	<u>% Chg. - Harvest</u>	<u>% Chg. - Winter Pop*</u>	<u>% Chg. - Hunters</u>
1962-69	115,430			
1970-79	174,227	51%	54%	51%
1980-89	229,161	32%	39%	-27%
1990-98	426,180	86%	46%	-13%

\* Percent change for winter indices is calculated for whole decades (e.g. 1960-69 and 1990-99). Harvest data first became available in 1962 and the 1999 data are not available at this writing.

**Figure 2. Winter count and harvest of Canada geese in Central Flyway states.**



**Table 9. Total and large race Canada goose (regular season) harvest in the Central Flyway.**

Period	** Central Flyway States **			* Alberta & Saskatchewan *			***** Total *****		
	Total	Large	% Lrg	Total	Large	% Lrg	Total	Large	% Lrg
1980-84	215,340	112,040	52%	200,395	130,305	65%	415,735	242,345	58%
1985-89	242,982	146,596	60%	204,455	135,029	66%	447,437	281,626	63%
1990-94	297,030	190,874	64%	191,392	130,618	68%	488,422	321,492	66%
1995-98	587,365	409,346	70%	228,478	167,573	73%	816,096	576,938	71%

See Appendix 6 for state and provincial details.

### Problem Overview

Canada geese have proven to be adaptable and able to breed and live near and essentially within human communities. Humans often provide the right ingredients for Canada geese: a lake (water) surrounded by Kentucky bluegrass for grazing (food) with few predators and frequent handouts of desserts (bread, popcorn, etc.). (Schullery 1980; Conover et al. 1995) This has created opportunities for frequent human/goose interactions.

Besides airport safety issues discussed below, the primary problem caused by these interactions is geese leaving their droppings on golf courses, people's back yards and city parks. Secondary problems are created when geese eat vegetation, often prized landscape

plantings. In one incident in Nebraska, Canada geese destroyed a planting intended to reduce shoreline erosion on an urban lake (R. Winter, Nebraska Game and Parks Comm., pers. comm.)

Obtaining specific information about damage and problems caused by Canada geese in Central Flyway states is somewhat difficult. Wildlife Services operates in all the states in the Flyway but does not deal with Canada goose issues in each. Each state has an agency that also deals with wildlife issues and in some states there is formal agreement between the state agency and WS about who will deal with problems caused by Canada geese. In other states, WS deals with some problems (e.g. airports) while the state agency deals with other types of problems. Many state agencies consider dealing with these problems “all in a day’s work” and do not have adequate reporting systems to track their occurrence. However, WS implemented a system-wide reporting system in 1994 and where they deal with Canada goose problems, the records are more complete since then.

In many cases, while problems caused by geese were being addressed, state agencies continued working toward an objective of increasing the number of geese. Many times, they would simply take advantage of “too many geese” in one place and trap and transport the nuisance birds to a place that appeared to be able to handle increased numbers. As the number and in some cases, the severity of problems increased, states gradually reduced efforts to increase the number of birds and spent more time attempting to identify solutions to the problem of “too many geese.”

Many people enjoy seeing and hearing the geese - until there are “too many” (Decker 1991). According to the Oklahoma Department of Conservation (ODC), “too many” can range from a dozen to several hundred geese in an urban situation. ODC also reported problems with Canada geese involving agriculture back to 1983, but the first urban problem was reported in 1990. The number of urban incidents addressed by the ODC has increased from one to nearly 50 in 1999 (Table 10). These data are in agreement with those provided by WS for Oklahoma (Table 10). All ten states in the Central Flyway and Alberta and Saskatchewan reported incidents of resident, large Canada geese causing problems in urban situations. In the Flyway as a whole, the number of incidents of urban problems has been increasing throughout the 1990’s (Table 10). Although, these types of problems seldom result in reportable, direct economic damage, WS in OK reported \$44,000 in damage in 16 incidents on golf courses in 1992 and a total of \$68,000 in damage in urban settings between 1992 and late-1999. WS reported over \$4,000 in damage between 1993 and 1997 in Colorado. Many of these incidents occur in the summer, pointing directly to resident geese as causing them.

Another type of problem caused by Canada geese involves damage to agricultural crops. This type of problem was reported by every state in the Flyway and Alberta and Saskatchewan. Much of this damage occurs in the fall and spring in the north and winter in the south, making it difficult to attribute to resident rather than migrant birds. However, some of this damage does occur in summer months. In South Dakota, practically all of the damage to agricultural crops occurs between May and July as geese forage on soybeans and corn. In fiscal year 1999, the South Dakota Department of Game, Fish and Parks spent \$148,000 on Canada goose damage management. The state estimated \$397,000 in damages occurred to agricultural crops in 1999.

In Oklahoma, WS reported over \$400,000 in damage to agricultural crops during the period 1992-99. Over \$130,000 in damage was identified in North Dakota between 1995 and 1999. The number of incidents in the Central Flyway States is increasing (Table 10).

Human health issues have been raised as they relate to increasing resident Canada goose populations. Friend (1987) indicated that several bacterial diseases that infect waterfowl can be transmitted to humans. These include: chlamydiosis which is much more prevalent in pet birds, domestic fowl and pigeons than waterfowl and treatable with antibiotics; salmonella, which occurs at a low level in wild birds and can be prevented by good personal hygiene ; and



avian tuberculosis, which also occurs at a low level in wild migratory birds and to which humans are considered to be highly resistant. In addition, it has been shown that *Giardia* cysts and *Cryptosporidium parvum* oocysts can persist in Canada goose intestines and be found in feces (Graczyk 1998). While there is the potential for individual humans to become seriously ill from some diseases associated with Canada geese, the risk to the human population is small. As of February, 2000, no Canada geese with West Nile Virus have been identified (National Wildlife Health Center (NWHC) 2000). However, some Canada geese from New York City had anti-bodies to the disease indicating past exposure (pers. comm. Linda Glaser, NWHC). To date, all known cases of West Nile disease have occurred in NY, NJ and CT.

**Table 10. Selected data on incidents of problems caused by Canada geese**

Year	Urban <sup>1</sup>				Agriculture					
	Oklahoma			Central Flyway	Oklahoma			North Dakota		Central Flyway
	State <sup>2</sup>	Wildlife Serv. <sup>3</sup>			State	Wildlife Serv.		Wildlife Serv.		
	Inc. <sup>4</sup>	Inc.	\$\$	Inc.	Inc.	Inc.	\$\$	Inc.	\$\$	Inc.
1992	1	24	47,600	71	0	16	2,400			59
1993	6			56	4	32	17,600			84
1994	3	24		76	2	32	13,600			80
1995	8	8	2,000	294	2	24	13,600	12	31,250	176
1996	8	8		301	4	40	43,400	13	16,000	258
1997	21	8	6,000	349	3	64	110,880	4	3,915	278
1998	28	88	2,000	409	10	56	212,800	17	38,175	343
1999	49	56	10,400	170	6	56	5,000	12	4,2250	423
Totals	126	216	68,000	1,710	31	320	419,280	58	13,1590	1,701

1. Urban is all incidents that do not involve agriculture.

2. Oklahoma Department of Wildlife Conservation

3. U.S. Department of Agriculture, Wildlife Services

4. Inc. = Incident count

While there have been some anecdotal reports of people being chased and even bitten by nesting Canada geese, the primary safety issue involves interference at airports and actual bird strikes on aircraft. The impact of a large bird striking an aircraft flying at 500 knots creates nearly 1.5 million foot/pounds of energy (Transport Canada 1999). The engines on most medium size jet transport aircraft are designed to withstand bird strikes involving 1.5 pound birds, about 15% of the weight of a large Canada goose. Large flocking birds such as Canada geese and pelicans (*Pelecanus onocrotalus*) are considered to be the greatest threat to aircraft (Transport Canada 1999).

In the U.S., there have been over 2,500 bird strikes on civil aircraft annually between 1990-98 (Bird Strike Committee USA 1999). In Canada, there has been an average of 762 bird strikes annually between 1993-98. Between one and nearly three percent of these Canadian strikes were caused by Canada geese, allowing that between 30% and 45% were caused by unknown species.

The U.S. Air Force reported over 2,500 bird strikes annually between 1985-98 (Bird Strike Committee USA 1999). Between 1985 and August 1999, the cost of these strikes was over \$500 million (U.S. Air Force BASH 1999). Canada geese ranked second in terms of the

cost of these strikes at over \$81 million and thirty-second in terms of the number of strikes (54). Only the American white pelican caused more damage.

Between 1990 and August 1999, there have been 69 reported strikes by waterfowl on commercial aircraft in Central Flyway states (FAA 1999), at least 57 (83%) by geese. The other 12 reports listed "Ducks, geese, swans" as the species involved. Most of the entries for "Geese" do not list species but 13 show that Canada geese were involved (FAA 1999). There were an average of nearly seven strikes annually with the highest number (12) being recorded in 1998. Reported losses were over \$2.2 million including \$1.4 million in one incident in Colorado in 1998. Strikes have been reported in seven of the ten Central Flyway states with Nebraska and Texas accounting for a combined total of 53% of the reports. Between 1985 and 1996, in North America, 95% of the strikes on aircraft of known goose species (129) were by Canada geese, allowing that that 65% (241) of the total reports did not identify the goose species involved (Seubert 1996).

The above facts show some of the history and current extent and nature of problems caused by Canada geese. To gain some insight into the future, 12 state and provincial migratory bird managers in the Flyway were asked their professional viewpoint about projected changes in the number and/or severity of problems caused by Canada geese between 1999 and 2010. Each indicated that they expected an increase to occur as goose populations increase. The primary problems expected is an increase in urban problems in both Canada and the U.S. One biologist stated that increasing human populations would lead to increased human/goose interactions even if goose populations stabilized. A number of biologists indicated that the public's tolerance of nuisance geese was becoming lower. This was reflected in statements about the nature of people moving into new housing developments, their apparent desire for golf courses and lakes as well as the longevity of existing problems at established sites. There also was some belief that problems associated with agriculture would also increase.

Some managers believed that the severity of the problems would stay the same and others were certain this aspect would increase. Profit margins in agriculture have an effect on perceptions of severity. In addition, as more airports experience interactions with geese, the severity of problems will likely increase. Overall, there was concern by all managers about the effect of dealing with increased problems caused by Canada geese on agency staff and budgets.

### **Objective and Strategy Identification**

The Central Flyway has had and maintains a significant interest in Canada goose management. The adoption of management plans in the 1980's was a significant step in a decades long commitment to this renewable resource and the people who use and enjoy it. The simple act of identification of populations required much data gathering and research. A six-year program in the early 1990's to re-examine the parameters of the delineation of some populations required a major commitment of resources by the Central Flyway and required a large, international and inter-flyway coordination effort. Significant efforts by states and provinces in cooperation with partners such as the USFWS, the CWS, private land owners and sportsmen, were expended to improve the status of Canada geese. These efforts have been highly successful as demonstrated by increases in population size, the broadened distribution of breeding birds and harvest estimates.

Along with this success have come some problems for humans which have become increasingly more frequent and, in some case, more severe. As outlined above, these problems include fouling of urban parks and lakes, destruction of private property at golf courses and housing developments, destruction of agricultural crops and threats to airplanes.

Members of the Flyway along with WS have been addressing these problems almost on a case by case basis. Further, they have been under some constraints from the USFWS due to

the their responsibility to manage migratory birds. In addition, record keeping associated with both problem identification and remedial actions taken has been incomplete.

To efficiently and effectively deal with resident, large Canada geese that are causing problems in the Flyway, five objectives and associated strategies are identified. They address interactions between government agencies and the public, identification and implementation of control methods, monitoring and evaluation. It is the intention of the Flyway to apply control methods as needed, at all scales of problem resolution ranging from Flyway-wide to specific locations such as a golf course or airport. However, most control actions will be implemented at local scales even though larger scale population objectives have not been met.

**Objective 1. Ensure that the positive values associated with resident Canada geese are maximized.**

Justification: The states and provinces in the Central Flyway have worked individually and jointly over several decades to establish resident Canada goose populations. This has been accomplished through active release programs, hunting season restrictions and by dealing with problems created by expanding human and goose populations. The Central Flyway believes that its human residents have significantly benefited from these efforts and wishes to maintain and enhance those benefits.

Strategy 1. Maintain hunting seasons that are commensurate with population size and objectives and in accord with population based Management Plans.

Strategy 2. Maintain important viewing opportunities during all times of the year.

Strategy 3. Identify and implement measures that can prevent problems associated with “too many geese” from occurring.

Strategy 4. Assure that the health of populations of migrant Canada geese is maintained by implementing respective management plans.

Strategy 5. Make certain the public is aware of the significant efforts that have been expended across the Flyway and the economic and recreational benefits derived from those efforts.

**Objective 2. Implement control methods directed at problem resolution and/or goose population reduction that are socially and biologically acceptable, site-specific, efficient and effective.**

Justification: The identification of effective problem control activities should assist in bringing a comprehensive list or menu from which management agencies can choose. This list should allow the selection of a particular action that is commensurate with the nature of the problem and the desired outcome. Maximizing local (state, provincial, community) input and having a broad range of tools available for control activities will also likely maximize effectiveness.

Strategy 1. Maintain and distribute a matrix of actions (Table 11) that might be taken to address problems caused by Canada geese and which identifies the social acceptability, cost and the potential of a goose population change or problem resolution.

Strategy 2. Encourage the U.S. Fish and Wildlife Service and the Canadian Wildlife Service to adopt federal regulations (e.g. depredation or conservation order) that would give states and provinces the authority to manage resident Canada geese where and when necessary.

Strategy 3. Adopt changes in framework dates for establishing regular hunting seasons in the U.S. that would allow for early September opening dates.

**Table 11. An Action Matrix to address problems caused by Canada geese with measures of social acceptance, relative cost and projected effects on populations.**

The assumption is made that most actions are taken on a largely local rather than flyway-wide basis. See Appendix 7 for a description of actions.

Action	Social Acceptance	Relative Cost	Projected Effects On The		
			Greater Population <sup>1</sup>	Local Population <sup>2</sup>	Problem
None	Low	Low	None to minimal increase	None to moderate increase	None to moderate increase
Provide technical advice only (e.g. terminate feeding, vegetative changes)	Moderate	Low / Moderate	None	None to minimal reduction	Small to moderate reduction
Scare hardware, chemicals, denial of access	Moderate	Moderate	None	None	Moderate reduction
Reproductive inhibitors, contraceptives, sterilization	Moderate	High	None	Unknown	Unknown
Use of other animals (falcons, dogs) as a scare device	High	Low / Moderate	None	None	Small to moderate reduction
Trap & transplant	High	High	None	Moderate reduction	Small to moderate reduction
Reducing egg hatchability	Moderate	High	Minimal reduction	Moderate reduction	Small to moderate reduction
Increased "regular season" sport hunting	High	Low	Low to moderate reduction	Moderate to high reduction	Moderate to high reduction
Special hunting seasons	High	Moderate	Low to moderate reduction	Moderate to high reduction	Moderate to high reduction
Conservation and Depredation Order	Moderate	Moderate	Low reduction	Moderate to high reduction	Moderate to high reduction
Habitat management programs	Low / High	Low / High	Minimal reduction	Minimal to high reduction	Low to moderate reduction
Trap, process and donate to charity	Moderate	High	Minimal reduction	Moderate reduction	Moderate reduction
Issue kill permits	Low / Moderate	Low	None	Minimum reduction	Low to moderate reduction

1. Effect on, for example, the size of the Great Plains Canada Goose Population.

2. Effect on a flock of birds using a lake or park, a larger sub-population using a city or a small region of a state or province.

Strategy 4. Amend the Migratory Bird Treaty to remove the 107 day constraint on hunting season length and consider other changes that would remove constraints on the management of migratory game birds.

Strategy 5. Continue and improve programs conducted by the U.S. Department of Agriculture, Animal and Plant Health Inspection Services, Wildlife Services that deal with problems caused by Canada geese in the U.S.

**Objective 3. Implement public awareness campaigns and cooperative programs to maximize the effectiveness of preventative and problem resolution methods.**

Justification: Identification of methods in Objective 2 by professional waterfowl management community is only the first step in implementing them. The public and other institutions need to be aware of available solutions so acceptable ones can be chosen. Beyond that, people need to know which control actions require federal and/or state permits. Actions are best taken after local decision making processes and sometimes need to be taken quickly.

Strategy 1. Develop printed guides for the general public and institutions that identify problem control methods that can be adopted by them without special permits or additional help from agencies.

Strategy 2: Develop programs with associated printed guides primarily directed at institutions and larger land owners that identify problem control methods that may need the assistance of management agencies or special permits.

Strategy 3: Encourage cooperation between federal, state and provincial agencies, including those responsible for military and commercial aircraft, so consistent information is provided to the public, record keeping is enhanced and responsibilities are clearly defined.

Strategy 4: Make information available to the public and others via agency World Wide Web sites. Consider the possibility of establishing a central location for information that applies generally across the flyway with contact lists and links to associated sites.

**Objective 4. Monitor goose populations, the number and type of problems they cause, attempts to solve those problems and the social acceptance of management actions.**

Justification: Canada goose populations are growing in every part of the Central Flyway. However, in many places, there is little information to identify the rate of that growth or current information being gathered can be improved. It is important to know if management actions that are directed at population control are being effective. This requires information about population size to detect both positive and negative changes. In addition, to properly plan budgets and manpower needs, it is important to develop a mechanism to document actual problems caused by Canada geese. Lastly, it is important to document what management actions were taken so managers can learn about what control methods works under what conditions. These items taken together, provide justification for managers to take or not take future actions.

Strategy 1: Obtain agreement from all agencies involved on the exact geographic locations (e.g. latitude/longitude) that describe a population. This would, for example, facilitate publication of May Breeding Bird Survey strata and transects on which birds counted would be assigned to one population or another. In addition, large Canada geese that are currently in the “unaffiliated” class in the winter survey would be better accounted for.

Strategy 2: Identify scientifically justifiable, economical and acceptable methods to obtain indices to breeding Canada geese. Encourage states, provinces and federal governments to adopt methods with as much standardization as possible.

Strategy 3. Acknowledge that these and other efforts will allow improved population objectives to be established and that provincial and state-wide objectives need not be met before actions to reduce a local population are taken.

Strategy 4: Identify a data-base system to store information associated with management of problems caused by Canada geese. This system should not duplicate existing systems but be able to interface with them so data needs are met with a total data base available. This system should be available to federal, state and provincial organizations alike. Queries and reporting should be able to be done by the user. The best "location" for such a system is on an access-controlled Internet site. This also would facilitate making these data available to the public on an "as requested" basis. At a minimum, the data base should contain: date, location (state/province, nearest town, latitude/longitude), who is reporting (agency), resource affected category, detail resource affected, size of area affected, wildlife species involved (this could be a general goose data base), number of birds involved, action taken (provide for more than one), estimate of effort for the action (man-days, equipment), estimate of dollar loss. Assure the system can capture proactive, preventive measures taken.

Strategy 5. Develop a Geographical Information System (GIS) based data set to facilitate tracking, mapping, analysis and reporting of this information.

Strategy 6. Determine the social acceptance of various management actions under various scenarios (an estimate of social acceptance has been included in the Action Matrix under Objective 2 but affirmation of these estimates is needed).

#### **Objective 5. Establish mechanisms for evaluation of objectives and strategies**

Justification: In order to learn if methods selected to address problems caused by Canada geese are effective and socially acceptable, control methods must be evaluated. This evaluation should include population modeling, measuring human and goose responses to control methods, cost and research on alternative methods of problem and population control. Ultimately, this will lead to implementation of Adaptive Resource Management as a tool to improve efficiencies and provide justification for future actions.

Strategy 1: Develop *a priori* designed, periodic analysis and reports that would be useful to managers and agencies and built from the data base established under Objective 4 and population indices. Use these data to achieve more effective and efficient responses by agencies.

Strategy 2. Describe research needs as they relate to dealing with data gathering methods, changing Canada goose populations and methods for dealing with associated problems caused by geese.

#### **The Future**

All Canada goose populations in the Central Flyway are above objective levels and continue to increase. This has led to increased recreational use of these birds and is considered a positive effect of long-term management decisions and actions. Along with increasing numbers of Canada geese have come increasing interactions with humans. However, some of these interactions are not desirable. States, provinces and federal agencies have taken a wide array of actions to reduce the problems caused by "too many" Canada geese. In addition, they are expending increasing amounts of manpower and dollar resources to address these problems.

Many problems caused by Canada geese are site-specific to a county, a ranch or farm, a city, a lake or golf course. While many of these have similar attributes across states, each has their own characteristics that requires site-specific solutions. These characteristics include

the speed at which a solution must be found, the number of birds involved, the social acceptance of various action alternatives, the resource being affected and the landscape itself.

As goose populations and the associated problems they cause continue to increase, agencies whose responsibility it is to deal with them will need maximum flexibility in deciding how and when to use existing methods and to try new ones. Thus, the number of options available to those agencies needs to be increased.

If local or regional populations of Canada geese can be controlled or even reduced on a local basis soon, the amount of effort needed for maintenance of a population will be less than if pursuit of solutions is forestalled.

### **Summary of Data and Data Analysis Needs**

While compiling and analyzing the information available for this report, it became apparent that much data have been collected about large Canada geese in the Central Flyway. It also became apparent that some of these data have not been used in the most effective manner. There had never been a synthesis of the restoration efforts of all states and provinces in the Flyway. Information about the types and extent of the problems caused by Canada geese was scattered across many organizations (states, provinces, and federal agencies such as the FAA, the military and WS). Even though regulations had been changed to increase the harvest of large Canada geese, the data reflecting the percent large geese in the harvest have not been updated for several years. Information about the success and failure of methods to address problems caused by Canada geese was not available in one place. Many geese had been banded (Appendix 8) but without coordination in the Flyway. And little analysis of the recoveries, including recaptures, had been done.

The following list is an attempt to identify important tasks designed to overcome some of the deficiencies in information sharing and, more importantly, to better use the information already available (and still being collected) about large Canada geese. Accomplishing these tasks should lead to being able to make improved science-based and better informed decisions about Canada goose management.

#### **Banding and Recovery Data**

- Determine / map recovery distribution
- Determine survival and recovery rates
- Determine if birds banded with different Status codes have similar distribution, survival and recovery rate characteristics
- Determine best approaches to use recapture information to estimate population parameters (e.g. survival, size)
- Identify future banding needs

Determine the best methods to describe population size

Determine the best methods to describe reproduction parameters

Determine the extent and effects of molt migrations on population surveys, survey timing, banding and harvest

Determine social values associated with the presence of Canada geese in urban and rural setting and regarding hunting and acceptance of problem and population control measures

Determine efficient mechanisms to track and report on problems, actions, action effectiveness

Continue research regarding problem and population control techniques

Develop population models to assist with management decisions

Determine the best approach to implementing Adaptive Resource Management for resident Canada goose management

## References

- Alge, T.L. 1999. Airport bird threat in North America from large flocking birds (geese). Joint Meeting, Birdstrike Comm USA and Birdstrike Comm. Canada. May 1999. 13 pp.
- Atlantic Flyway Technical Comm and USDA Wildlife Services. 1999. Atlantic Flyway Resident Canada Goose Management Plan (Draft). 41 pp.
- Bird Strike Committee USA. 1999. <http://www.birdstrike.org>
- Bruggink, J.G., T.C. Tacha, J.C. Davies and K.F. Abraham. 1998. Nesting biology of Mississippi Valley population Canada geese. P 73. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Caithamer, D. 1996. Unpublished report. U.S. Fish & Wildl. Serv., Office of Mig. Bird Mgmt., Laurel, MD. 14 pp.
- Canada Goose Production Workshop. 1971. Unpubl. Rpt. Jamestown, ND.
- Central Flyway Council. 1988. Management Plan for Large Canada Geese Wintering in the Eastern Tier States of the Central Flyway. 16 pp.
- Central Flyway Council. 1998. Management Guidelines for Hi-Line Canada Geese. 40pp.
- Central Flyway Council. 1982. Management Plan for Short Grass Prairie Canada Geese. 28 pp.
- Central Flyway Council. 1985. Management Plan for Tall Grass Prairie Canada Geese.
- Conover, M.R. 1998. Reproductive biology of an urban population of Canada geese. P 67-70. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Conover, M.R., W.C Pitt, K.K Kessler, T.J. DuBow and W.A. Sanborn. 1995. Review of data on human injuries, illnesses and economic losses casued by wildlife in the United States. *Wildl. Soc. Bull.* 7:129-131.
- Cummings, J.L., D.L. Otis, J.E. Davis, Jr. and K.A. Crane. 1998. Evaluation of methyl anthranilate and DRC-156 as Canada goose grazing repellents. P 193-198. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Decker, D.J. 1991. Implications of the wildlife acceptance capacity concept for urban wildlife management. P 45-53. *In* Proceedings of the Symposium on Perspectives in Urban Ecology, Denver, CO Museum of Natural History..
- Delacour, J. 1954-64. The waterfowl of the world. Vol 1-4. Country Like Ltd., London.
- Dill, H.H. and F.B. Lee. 1970. Homegown Honkers. U.S. Fish & Wildl. Serv. Twin Cities, MN
- FAA. 1999. Federal Aviation Administration Wildlife Strike Database.
- Friend, M., ed. 1987. Field Guide to Wildlife Diseases. U.S. Fish and Wildl. Serv. Resource Pub 167. 225p.
- Gabig, P.J. 1986. Canada geese - managing the comeback. Nebraska Magazine. 15pp.
- Gosser, A.L., M.R. Conover and T.A. Messmer. 1997. Managing problems caused by urban Canada geese. Berryman Institute Publ. 13, Utah State Univ., Logan. 8pp.
- Graczyk, T.K., R. Fayer, J.M. Trout, E.J. Lewis, C.A. Farley, I. Sulaiman and A.A. Lal. 1998. Giardia sp. cysts and infectious Cryptosporidium parvum oocysts in feces of migratory Canada geese (*Branta canadensis*). *Applied and Environ. Microbiology.* July 1998:2736-2738.
- Gulick, M.G., J.A. Cooper, J.S. Lawrence and D. Wells. 1998. Effect of experimental hunting seasons on Canada geese in westcentral Minnesota. P 160. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.



- Hanson, H.C. 1965. The giant Canada goose. Southern Illinois Univ. Press, Carbondale. 225pp.
- Heinrich, J.W. and S. R. Craven. 1998. Attitudes of Wisconsin farmers toward Canada geese near Horicon National Wildlife Refuge, Wisconsin. P185-192. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Hine, R.L. and C Schoenfeld. 1968. Canada Goose Management. Dembar Ed. Reserch Serv. Madison, WI.
- Huskey, S.J., D.E. Baker, T.T. Fendley and T.L. Ivey. 1998. Canada goose nesting biology in the Central Piedmont of South Caroline. P 47-52. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Huskey, S.J., T.T. Findley and T.L. Levy. 1998. Canada goose gosling survival on farm ponds in the Central Piedmont of South Carolina. P 95-99. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Johnson, F.A. and P.M. Castelli. 1998. Demographics of "resident" Canada geese in the Atlantic Flyway. P 127-134. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Johnson, M.A. 1982. Ed. Canada Goose Symposium. No. Dakota Chap. and Central Mtns. & Plains Sect, The Wildl. Soc. Bismarck, ND.
- Kraft, M.J. and H.D. Funk. 1990. Goose Management in the 90's: A Central Flyway perspective. Trans. 55<sup>th</sup> N.A. Wildl. & Nat. Res. Conf.: 321-326.
- Kuck, T.L. and C.H. Schroeder, eds. 1974. Eds. A Canada Goose Symposium. Central Mtns. & Plains Sec. The Wildl. Soc. Jamestown, ND
- Lawrence, J.S., M.R. Riggs and W.D. Klimstra. 1998. Gosling survival of giant Canada geese from Westcentral Illinois. P 101. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Lee, F.B., C.H. Schroeder, T.L. Kuck, L.J. Schoonover, M.A. Johnson, H.K. Nelson, C.A. Beauduy. 1984. Rearing and Restoring Giant Canada Geese in the Dakotas. No. Dakota Game & Fish Dept; So. Dakota Dept Game, Fish & Parks; USDI-FWS.
- Malecki, R.A. and R.E. Trost. 1998. Status of breeding Canada geese in North America. P 3-8. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- McCabe, R.E. (Ed). 1990. Goose Management in the 90's. Trans. 55<sup>th</sup> N.A. Wildl. & Nat. Res. Conf.: 283-377.
- Mississippi Flyway Council Technical Committee. 1996. Mississippi Flyway Giant Canada Goose Management Plan. 61 pp.
- National Wildlife Health Center. 2000. Wildlife Health Alert #99-02B.
- Nebraska Game and Parks Commission. 1979. Sportsman's Scrapbook. Nebraskaland Magazine. v57.
- Nelson, H.K. and R.B. Oetting. 1998. Giant Canada goose flocks in the United States. P 483-496. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp., Milwaukee, WI.
- Nieman, D.J., A.B. Didiuk, J.R. Smith and F.D. Caswell. 2000. Status of Canada geese nesting in the Canadian Prairie. Unpubl. Report, Canadian Wildlife Service. 17 pp.

- Pacific Flyway Council. 1992. Management Plan for the Rocky Mountain Population of Canada geese. Pacific Flyway Study Committee (c/o USFWS), Portland, Oregon. Unpubl. report.
- Peterjohn, B.G. 1994. The North America Breeding Bird Survey. *Birding Jrnl. Amer. Bird. Assoc.* 26:386:398.
- Rollins, K.S. and R.C. Bishop. 1998. Canada goose damage abatement and farmer compensation at Wisconsin's Horicon Marsh. P 207. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. *Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp.*, Milwaukee, WI.
- Rusch, D.H., M.D. Samuel, D.D. Humburg, and B.D. Sullivan, eds. 1998. *Biology and management of Canada geese. Proceedings of the International Canada Goose Symposium, Milwaukee, WI* 151 pp.
- Sauer, J.R., J.E Hines, I. Thomas, J. Fallon and G.Gough. 1999. The North American Breeding Bird Survey, Results and Analysis 1966-1998. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD. ([www.mbr.nbs.gov/bbs/bbs.html](http://www.mbr.nbs.gov/bbs/bbs.html))
- Schullery, P. 1980. *The bears of Yellowstone. Yellowstone Library and Museum Assoc. Yellowstone Natl. Pk., WY.*
- Seubert, J.L. 1977. Birdstrike hazards to turbine-powered aircraft. *World Bird Strike Comm. Europe Mtg.* 16 pp.
- Seubert, J.L. 1994. Assessing the implementation of wildlife hazard management programs at civil airports. *Bird Strike Comm. Europe Mtg. (Revised June 1995).* 9 pp.
- Seubert, J.L. 1996. Do populations of North American Canada geese pose an increasing threat to aviation? *Bird Strike Comm. USA Mtg. Revised June 1998).* 16 pp.
- Sharp, D.E. and T.J. Moser. 1999. Central Flyway harvest and population survey data book. Unpubl. Report. U.S. Fish & Wildl. Serv. Denver, CO. 139 pp.
- Smith, A.E., S.R. Craven and P.D. Curtis. 1999. *Managing Canada geese in urban environments. Jack Berryman Institute Publ. 16 and Cornell Univ. Coop. Extension, Ithaca, NY.* 42pp.
- Smith, G.W. 1995. A critical review of the aerial and ground surveys of breeding waterfowl in North America. *Bio. Sci. Rpt. 5. USDI. Nat. Biol. Serv.* 252 pp.
- Statistix for Windows. Analytical Software, Tallahassee, FL
- Transport Canada. 1999. <http://www.tc.gc.ca/aviation/aerodrome/birdstrike/>
- US Air Force BASH. 1999. <http://www-afsc.saia.af.mil/AFSC/Bash/stats/>
- US Fish and Wildlife. 1999a. Migratory Bird Special Canada Goose Permit. *Fed. Reg. V 64. N 116:32766-32776.*
- US Fish and Wildlife. 1999b. Notice of intent to prepare an Environmental Impact Statement on resident Canada goose management. *Fed. Reg. V 64. N 160:45269-45274.*
- Vaa, S, P. Mammenga, P. Coughlin, B. Hauk, G. Heismeyer, R. Schauer, W. Morlock and R. Fowler. 1998. *South Dakota Resident Canada Goose Management Plan.* 9 pp.
- Wilkins, K.A. and E.G. Cooch. 1999. *Waterfowl Population Status, 1999. U.S. Fish and Wildlife Service, Office of Migratory Bird Management, Branch of Surveys and Assessment.*
- Zenner, G.G. and T.G. LaGrange. 1998. Densities and fates of Canada goose nests on islands in Northcentral Iowa. P 53-60. *In* D.H. Rusch, M.D. Samuel, D.D. Humburg and B.D. Sullivan, eds. *Biology and Mgmt. of Canada Geese. Proc. Intnatl. Canada Goose Symp.*, Milwaukee, WI.

## Appendices

### Appendix 1. Number of Canada geese released in the Central Flyway Most were released as part of restoration efforts.

Year	Source <sup>1</sup>	Alberta		Saskatch- ewan <sup>2</sup>		Montana		North Dakota		South Dakota <sup>3</sup>		Wyoming		Nebraska	
		Ad.	Yng.	Ad.	Yng.	Ad.	Yng.	Ad.	Yng.	Ad.	Yng.	Ad.	Yng.	Ad.	Yng.
1967-98	Within									49	934				
	External									15	280				
	Cap Flk									550	10450				
	Unknown														
1960-69	Within		156	1737									121		
	External														
	Cap Flk						371								
	Unknown														
1970-79	Within	389	1771	4118								7	459		
	External											285	50		
	Cap Flk	3	136					1217	4329					10	3793
	Unknown												220		
1980-89	Within	186	659	7075				598	3292			76	168		
	External											102	436		
	Cap Flk		420					567							4224
	Unknown												267		
1990-99	Within			9702				511	3052					589	190
	External														300
	Cap Flk														3368
	Unknown														
Totals	Within	575	2586	22632	0	0	0	1109	6344	49	934	83	748	589	190
	External	0	0	0	0	0	0	0	0	15	280	387	486	0	300
	Cap Flk	3	556	0	0	0	371	1784	4329	550	10450	0	0	10	11385
	Unknown	0	0	0	0	0	0	0	0	0	0	0	487	0	0
Grand Totals		578	3142	22632	0	0	371	2893	10673	614	11664	470	1721	599	11875

(Continued →)

### Appendix 1 (Continued)

Number of Canada geese released in the Central Flyway, mostly as part of restoration efforts.

Year	Source	Kansas		Colorado		Oklahoma <sup>4</sup>		New Mexico		Central Flyway States <sup>5</sup>			Central Flyway Total		
		Ad.	Yng.	Ad.	Yng.	Ad.	Yng.	Ad.	Yng.	Ad.	Yng.	Total	Ad.	Yng.	Total
1967-98	Within									49	934	983	49	934	983
	External									15	280	295	15	280	295
	Cap Flk									550	10450	11000	550	10450	11000
	Unk.									0	0	0	0	0	0
1960-69	Within			125	1675					125	1796	1921	1862	1952	3814
	External									0	0	0	0	0	0
	Cap Flk									0	371	371	0	371	371
	Unk.									0	0	0	0	0	0
1970-79	Within			50	1950					57	2409	2466	4564	4180	8744
	External							90	89	375	139	514	375	139	514
	Cap Flk									1227	8122	9349	1230	8258	9488
	Unk.									0	220	220	0	220	220
1980-89	Within	67	4282	250	480					991	8222	9213	8252	8881	17133
	External	4790	1562			9374	3683		432	14266	6113	20379	14266	6113	20379
	Cap Flk									567	4224	4791	567	4644	5211
	Unk.									0	267	267	0	267	267
1990-99	Within	3548	1593	500	1720					5148	6555	11703	14850	6555	21405
	External	8864	3831			5006	550			13870	4681	18551	13870	4681	18551
	Cap Flk									0	3368	3368	0	3368	3368
	Unk.									0	0	0	0	0	0
Totals	Within	3615	5875	925	5825	0	0	0	0	6370	19916	26286	29577	22502	52079
	External	13654	5393	0	0	14380	4233	90	521	28526	11213	39739	28526	11213	39739
	Cap Flk	0	0	0	0	0	0	0	0	2344	26535	28879	2347	27091	29438
	Unk.	0	0	0	0	0	0	0	0	0	487	487	0	487	487
Grand Totals		17269	11268	925	5825	14380	4233	90	521	37240	58151	95391	60450	61293	121743

1. "Within" means birds were captured within the jurisdiction; "External" means birds were obtained from another jurisdiction; "Cap Flk" means birds, mostly goslings, were obtained from production from a captive flock.
2. All Saskatchewan birds are shown as adults in the "within" category; the number of goslings included is unknown.
3. SD birds not distributed to decade.
4. OK- 1980-89 goslings includes 2853 raised from eggs between 1986-92.
5. The table does not include: 548 birds prior to 1960 from WY; 914 unknown age birds from WY; 200 unknown age birds from KS, 102 birds from CO. Texas did not release any birds.

## Appendix 2. State and Provincial Summaries

The following contains a brief overview of the status of resident Canada geese in the states and provinces of the Central Flyway. Some information presented is common to all entries. Only banding data for June through August for the period 1970-98 are included in the discussion (Appendix 8). All states conduct a winter inventory of Canada geese as part of a coordinated survey so this is not listed as a "Monitoring effort" below. Regarding the "Distribution" of breeding Canada geese, it should be noted that there is a high level of variability in densities within a state or province. Reported harvests for states are from U.S. Fish and Wildlife Service (USFWS) surveys to make estimates comparable across the U.S. portion of the Flyway. Harvest estimates for Alberta and Saskatchewan are derived from annual harvest surveys conducted by Environment Canada. Although private individuals held captive flocks of geese for gosling production or otherwise participated in restoration efforts, "Restoration History" sections below only discuss state, provincial or federal government efforts. Breeding Bird Survey (BBS) data were obtained from the USGS World Wide Web site (Sauer et al. 1999). Trend is defined by the BBS as the estimated percent change per year. Data on strikes on commercial aircraft by geese were provided by the FAA (Federal Aviation Administration 1999). In many cases, these data do not show the species of goose involved, only showing "Geese" in the species column. In addition, the species involved in some strike data only shows "Ducks, geese swans." "Current" population size refers to that in 1999. The population objectives below are based on the best knowledge and information available. In addition, they represent state and provincial-wide objectives. As such, jurisdictions may modify population objectives and/or address the size of sub-populations as needed. Finally, no distinction is made between the three races of large Canada geese.

### Alberta

**Restoration History:** The range of the Rocky Mountain (RMP), Hi-Line (HLP) and Pacific (PP) populations occur in the Province. The RMP and HLP occupy contiguous habitat in the southern two-thirds of the province with the PP occurring in the northwestern portion of the province. Alberta maintained a small captive flock of Canada geese between 1969 and 1981. The goslings from the flock were released throughout the southern two-thirds of the province in the range of both the HLP and RMP. In addition, both adults and goslings were wild-trapped during the same period and moved to unoccupied areas. In total, 3,720 birds were handled. During the 1970's, the province also conducted a program directed at providing hay bales as nesting platforms for geese. There are no current efforts directed at restoration in the province.

### Population

Survey Method: The May Breeding Duck survey conducted annually by the USFWS, Canadian Wildlife Service (CWS) and Alberta Environment (AENV) is used to index the total population size. Data are available back to 1955. Corrections for visibility from the aerial surveys were first applied in 1996 and all earlier data were adjusted accordingly.

Objective (Total birds in Spring): AENV is awaiting final figures from the USFWS and CWS regarding the historical and current size of the three populations (RMP, HLP and Pacific Population) of Canada geese that occur in the Province to establish population objectives.

Current size (Total birds in Spring): The 1997-99 average for southern Alberta is 151,000 and 64,700 for central Alberta (215,700 total) based on the May data.

Trend: Increasing. There are data only for the period 1989-99 for central Alberta and the annual rate of increase for those 11 years is about 20%. For southern Alberta, the annual rate of increase has been about 6% over the last 30 years. Data from the BBS for the province indicates a significant ( $P < 0.05$ ) trend of 9% between 1966-96. The trend for 1980-96 is positive but non-significant at 7%.

Distribution: RMP Canada geese nest throughout the western portion of the southern two-thirds of the province and HLP Canada geese nest throughout the eastern portion of the southern two-thirds of the province. Pacific population Canada geese nest throughout the northwest portion of the province.

**Harvest:** Harvest of large Canada geese increased substantially during the 1980s and has been stable or increasing slightly during the 1990s. Average harvest of HLP geese during the 1980s (22,000) increased by 139% over that of the 1970s (15,800) and harvest during the 1990s (27,000) increased by 123% over that of the 1980s. Harvest of RMP geese during the 1980s (30,900) increased by 183% over that of the 1970s (16,900) and harvest during the 1990s (34,600) increased by 112% over that of the 1980s. On average, 80% of the total Canada goose harvest is large birds (Appendix 6).

### **Monitoring efforts**

Banding: Between 1970 and 1991, more than 38,000 Canada geese were banded in Alberta. There were very few geese banded between 1992 and 1999 (Appendix 8).

Harvest survey: The Province relies on Environment Canada for harvest estimates.

### **Problem identification**

Typical or primary problem type: Over the decades, the primary damage caused by waterfowl has been to agriculture with ducks being the primary culprit. However, in the last decade, the damage caused by geese in the Fall has surpassed that caused by ducks in Alberta. Some of this damage is caused by migrant snow, Ross', white-fronted and small Canada geese from Arctic nesting areas but much is due to the increasing population of resident birds. Damage caused by resident birds in the Summer has been increasing and five or six cities are now experiencing problems. It is anticipated that urban problems will take on increasing importance.

Aircraft safety: Between 1991-99, there were six strikes on aircraft at Calgary International Airport by Canada geese. It is clear from Transport Canada's Web site that they believe that Canada geese are an important threat to aircraft safety. Their publication Controlling Canada Geese (Transport Canada 1999) contains many suggestions for airport management.

Frequently used responses: The Alberta Environment, in cooperation with the Government of Canada, delivers an active damage prevention program and provides compensation for crop losses for damage to agriculture caused by geese. Responses to urban situations includes providing advice about the prevention of problems and methods for their resolution.

**Management Philosophy and Expectations:** Urban goose population numbers and resident intolerance of high populations of Canada geese will continue to increase. While the presence of geese within urban settings provides excellent opportunities for interaction with wildlife, AENV expects that dealing with of nuisance geese and goose damage in urban centers will take on increasing importance. Increased pressure for problem resolution can be anticipated. Agricultural producer tolerance to high goose population levels is also strained. There is an expectation that the level of effort (compensation, active prevention) regarding agricultural damage will need to be maintained. Long hunting

seasons and liberal bag limits do not address urban goose conflicts and do not result in sufficient harvest to ameliorate conflicts with agricultural producers.

## Colorado

**Restoration History:** The Colorado Division of Wildlife (CDW) maintained a small captive flock of Canada geese between 1955-60. Goslings from this flock were used to increase the breeding population along the northern Front Range. Through 1999, Colorado has released about 6,700 adults and goslings in the Central Flyway portion of the state for restoration purposes. Many of these birds were collected from areas within the state where populations were considered too large. They are presently conducting one restoration program and that is scheduled to be completed in 2000.

### Population

Survey Method: Historically, local goose populations in several portions of the state have been surveyed annually, typically in April or July. All surveys are currently being reviewed and modified.

Objective (Total birds in Spring): 12,500

Current size (Total birds in Spring): 14,500

Trend: Increasing. The BBS for the state as whole indicates a significant ( $P < 0.2$ ) positive trend of 11% between 1966-96: for the period 1980-96, the trend is significant ( $P < 0.05$ ) at 19%.

Distribution: Throughout the Central Flyway portion of the state.

**Harvest:** Increasing. The average harvest for Central Flyway Colorado in 1995-98 (136,000) was 146% larger than the 1990-94 average and 204% larger than the 1980-89 average. Nearly 75% of this harvest is large Canada geese (Appendix 6).

### Monitoring efforts

Banding: CDW maintained a banding program from at least 1970 to 1987. Several hundred goslings were banded between 1996-98 but few bands were put on between 1988-95 (Appendix 8).

Harvest survey: CDW no longer conducts a state waterfowl harvest survey, but relies on annual federal harvest estimates.

### Problem identification

Typical or primary problem type: Urban problems are the primary concern in Colorado though there are some localized agricultural problems occur.

Aircraft safety: Between 1990-99, eight strikes by "geese" of commercial aircraft were reported in Colorado. Two of these records referred to "Canada geese."

Frequently used responses: Thousands of Canada geese were trapped and transported to other states by the CDW between the mid-1970's and mid-1990's. The state's philosophy is to use available sport hunting regulations to manage populations. The state is also working with developers and urban planners in an attempt to avoid future problems.

**Management Philosophy and Expectations:** The CDW believes that resident Canada geese provide valuable opportunities for recreational hunting and aesthetic appreciation by the public. The management goal is to manage the size and distribution of resident Canada geese to achieve an optimal balance between positive values and conflicts between humans and geese. To achieve this balance, large changes in the overall population size are probably not needed. As the human population continues to grow along the Front Range and adjacent eastern plains, some increase in the number of nuisance complaints

about Canada geese in urban areas is expected. A few nuisance situations may continue to be created by geese on agricultural areas. The CDW intends to use available options for hunting regulations to manage the size and distribution of resident geese where they are likely to be effective. The CDW desires like a broad range of control options for urban situations so that effective, publicly-acceptable control techniques can be selected on a case-by-case basis. Waterfowl managers are taking a proactive approach by providing problem-avoidance guidance to municipal planners and developers.

## **Kansas**

**Restoration History:** The Kansas Department of Wildlife and Parks (KDWP) maintained a captive flock of Canada geese ranging as high as 650 birds for the production of young between 1980-91. In addition, more than 19,000 adults and goslings were obtained from other states. In total, more than 28,500 geese have been handled in restoration efforts by the KDWP since 1980. There is no formal, current restoration program in Kansas. However, some geese that are trapped to resolve problems are released in areas where there are currently few birds.

### **Population**

Survey Method: In 1996, KDWP initiated a roadside survey of nesting Canada geese. The survey has been modified (expanded and improved) each year but is expected to stabilize with the 1999 methodology. Data from this March/April survey combined with Professional judgement associated with unsurveyed areas were used to produce estimates of the breeding population.

Objective (Total birds in Spring): 37,500

Current size (Total birds in Spring): 30,000

Trend: Increasing. The BBS for the state shows a non-significant ( $P>0.1$ ), positive trend of 39% for the period 1966-98 and 34% for 1980-98. The BBS for the Dissected Till Plains physiographic region, that includes eastern Kansas, indicated a significant positive trend of 15% ( $P<0.05$ ) annually for the period 1966-96 and 18% ( $P<0.01$ ) for 1980-96.

Distribution: Statewide

**Harvest:** Increasing. The average 1995-98 harvest estimate of 38,000 is 185% greater than the average for 1990-94 and 193% greater than that for 1980-89. About 80% of this harvest is large Canada geese. Harvest estimates from the 1999 (the first) early September season are not currently available (Appendix 6).

### **Monitoring efforts**

Banding: Between 1982 and 1998, more than 27,000 Canada geese were banded (Appendix 8).

Harvest survey: KDWP conducts an annual survey of waterfowl harvest to supplement information from the federal survey but has some concerns about the manner in which Federal Duck Stamp sales are attributed to the state. Since Duck Stamp sales are important to being able to estimate harvest, the KDWP is not processing information from some recent years until the issue is resolved.

### **Problem identification**

Typical or primary problem type: Urban though about 12% of the 1999 complaints were related to agriculture.

Aircraft safety: There are concerns at the two major airports (Kansas City, though formally in Missouri, and Wichita). These are primarily being addressed in a preemptive



manner by USDA, Wildlife Services personnel. Between 1990 and July, 1999, seven airstrikes of "Geese" (though two incidents listed "Ducks, geese, swans) have been reported in Kansas with one being attributed to Canada geese.

Frequently used responses: deterrents, scare devices and trap / transport. USDA Wildlife Services are working with airports in an attempt to avoid problems. Kansas conducted its first early September hunting season in 1999 near Kansas City.

**Management Philosophy and Expectations:** The KDWP expects that complaints associated with resident Canada geese will increase proportional to increases in the goose population. It is anticipated that the distribution of problems between agriculture and urban situations will remain unchanged. The current approach is to first educate individuals and the public on how to discourage and alleviate their goose problems. If additional effort is needed, KDWP staff review the situation and prescribe techniques that they feel are most appropriate. The KDWP will evaluate the effect of their first early September hunting season (held in 1999) and determine if and how to apply this approach in the future.

## Montana

**Restoration History:** A small captive flock was maintained in Montana at Medicine Lake National Wildlife Refuge (NWR) between 1945-66 and goslings were used to reestablish a breeding population. Bowdoin NWR collected eggs from wild birds with the resultant young being released at several locations within the state. In addition, some captive-reared and wild-caught goslings were transported to Saskatchewan, Nebraska and Colorado. There are no current restoration efforts in Montana.

### Population

Survey Method: The annual May Breeding Duck survey conducted by the USFWS and CWS is used to index the size of the Canada goose breeding population in a large part of Central Flyway Montana. Both the HL and RM populations of Canada geese nest in the state. Information about the relative size of each of these was provided by the USFWS, Office of Migratory Bird Management. There are some geese breeding outside the survey area.

Objective (Total birds in Spring): RMP: 45,000; HLP: 80,000

Current size (Total birds in Spring): RMP: 41,400; HLP: 62,200 (this is a the 1996-98 average)

Trend: Increasing according to the May Survey data for the state. In addition, the BBS data show a positive, significant ( $P < 0.05$ ) trend of 26% annually between 1966-96. The trend for the 1980-96 period is also significant ( $P < 0.05$ ) at 35%.

Distribution: Throughout the Central Flyway portion of the state.

**Harvest:** Increasing. The average 1995-98 harvest was 33,000, 113% higher than the 1990-94 average and 377% higher than the 1980-89 average. Typically, large Canada geese make up about 90 percent of the harvest (Appendix 6).

### Monitoring efforts

Banding: A relatively consistent banding program was maintained between at least 1970 and 1981. Since then, banding has been sporadic and zero in several years. Since 1970, fewer than 7,000 Canada geese have been banded. A new, multi-year banding project was begun in 1998 (Appendix 8).

Harvest survey: The state conducts an annual harvest survey to supplement federal harvest estimates.

## **Problem identification**

Typical or primary problem type: There have been a few urban problems since 1992, principally in three cities. There have been even fewer problems caused to agriculture.

Aircraft safety: Between 1990 and July, 1999, there were five strikes of commercial aircraft by "Geese" reported. One of these was identified as being caused by a Canada goose.

Frequently used responses: Provide advice; trap and transport.

**Management Philosophy and Expectations:** Montana Fish, Wildlife and Parks (MFWP) believes there will be a slight increase in the number of nuisance Canada goose situations, primarily under urban conditions. The agency remains hopeful that sport harvest in Montana and other places will keep goose populations under control although urban goose complaints will likely increase. MFWP is not taking any actions that encourage an increase in urban Canada goose populations. They take an active role in nuisance situations but USDA, Wildlife Services has had the lead role even while working closely with the agency.

## **Nebraska**

**Restoration History:** The first captive flock of Canada geese in Nebraska was established in 1936 at Crescent Lake NWR. Between 1970-97, the Nebraska Game and Parks Commission (NGPC) maintained a captive flock that averaged approximately 360 birds. A separate, smaller flock of about 20 birds also was maintained from 1968-84. Goslings from these flocks were released to increase the breeding population statewide with particular emphasis placed on the Sandhills, the North Platte Valley and Lancaster County. Between 1970-97, >11,000 goslings were released. There is no current restoration program being conducted by NGPC.

### **Population**

Survey Method: Currently, there is no formal survey for breeding geese but several April and September surveys were periodically conducted. Population estimates are based on professional judgement and annual banding operations.

Objective (Total birds in Spring): 30,000-50,000

Current size (Total birds in Spring): 32,000

Trend: Increasing. The BBS shows a significant ( $P < 0.1$ ), positive annual trend of 15% for the period 1996-98 and a non-significant ( $P > 0.1$ ) trend of 9% for 1980-98.

Distribution: Statewide

**Harvest:** Increasing. The average annual harvest for the period 1995-98 of 82,000 is 101% above the 1990-94 average and 228% above the 1980-89 average. Harvest is typically comprised of >85% large Canada geese (Appendix 6).

### **Monitoring efforts**

Banding: All goslings released were banded. Banding of free-flying birds occurred in 1981-1985 and each year between 1989-98. More than 26,000 Canada geese have been banded including over 15,000 goslings for the period 1970-98 (Appendix 8).

Harvest survey: The state conducts an annual survey of waterfowl hunters to supplement federal harvest estimates.

## **Problem identification**

Typical or primary problem type: Urban. Currently, there are few problems regarding damage to agricultural crops by resident Canada geese.

Aircraft safety: There were 17 strikes of "Geese" by commercial aircraft in Nebraska between 1990 and July, 1999 (FAA 1999). Two of these strikes list the species involved as "Ducks, geese, swans" and four of the strikes specifically identified Canada geese as being involved. Aircraft strikes in Nebraska constitute 25% of the total for the Central Flyway states.

Frequently used responses: Technical assistance, scare devices, trap and transport. USDA Wildlife Services has played an active role in preventive measures at airports using a variety of techniques including habitat management and harassment.

**Management Philosophy and Expectations:** The NGPC anticipates that complaints about nuisance Canada geese will increase as the population of Canada geese continues to grow. It is expected that most of these complaints will come from urban centers. The agency depends on district personnel to investigate nuisance situations and determine appropriate actions. Increasing public awareness of problems caused by Canada geese and actions that can reduce their effects was identified by the Agency in their Strategic Plan completed in 1996. Also, the Agency established a position statement about restoration efforts by private citizens and/or organizations and NGPC assistance on those efforts.

## **New Mexico**

**Restoration History:** There has not been an intensive restoration effort by the New Mexico Department of Game and Fish (NMDGF). In the early 1970's and again in the late-1980's, several hundred adults and goslings (600 total) from Colorado were released in the Central Flyway portion of the state.

### **Population**

Survey Method: A combination of professional judgement and state surveys is used to estimate the size of the breeding population.

Objective (Total birds in Spring): 4,000

Current size (Total birds in Spring): 1,700

Trend: Increasing, according to NMDGF. However, the BBS shows a significant ( $P < 0.1$ ) negative annual trend of 8% for the period 1996-98 and 9% ( $P < 0.05$ ) for the period 1980-98.

Distribution: Primarily in the Rio Grande Valley.

**Harvest:** Decreasing. The average 1995-98 harvest was 1,600 Canada geese, 42% below the 1990-94 average and 46% below the 1980-89 average. About 64% of the total harvest is large geese (Appendix 6).

### **Monitoring efforts**

Banding: Fewer than 1,100 Canada geese were banded in NM between 1970-98 (Appendix 8).

Harvest survey: The NMDGF conducts an annual survey of waterfowl hunters and harvest to supplement federal estimates.

### **Problem identification**

Typical or primary problem type: Crop depredation (agriculture). In recent years, there have been problems on a golf course in the Rio Grande Valley.

Aircraft safety: The FAA did not report any strikes of commercial aircraft by geese in NM between 1990 and July, 1999. There were no other reported incidents involving airports.

Frequently used responses: Provide advise on problem prevention; scare devices.

**Management Philosophy and Expectations:** The NMDGF doesn't currently have many problems with resident Canada geese. However, the population in the narrow corridor of the Middle Rio Grande Valley is growing and there is an expectation that problems in urban and agricultural settings will increase. A similar situation exists along the eastern Rocky Mountains in the upper Rio Grande River valley. There remains unfilled goose habitat in the state, which provides an outlet for trap / transplant operations. NMDGF is pursuing increasing the public's awareness of what can be done to limit problems as the goose population increases.

## North Dakota

**Restoration History:** Between 1938 and 1941, captive flocks of geese were initiated at two NWRs in North Dakota. Over the next two decades, several other small flocks were established. Between 1965-1980, a captive flock with an average of 230 birds was maintained first by the USFWS and then by the North Dakota Game and Fish Department (NDGFD). The restoration program shifted to transplanting wild-trapped birds after 1981. Between 1970 and 1999, more than 13,500 birds were handled in restoration efforts, and more than 10,000 of these were goslings. There is no formal, current restoration effort in the state.

### Population

Survey Method: The May Breeding Duck survey conducted by the USFWS provides an index to total Canada geese in North Dakota during the breeding season. Since 1992, the state has conducted several ground transect surveys on which geese are counted in mid-May.

Objective (Total birds in Spring): 60,000-100,000 (Three-year average under average environmental condition)

Current size (Total birds in Spring): 104,500

Trend: Increasing. The May survey data shows that the population increased at greater than 20% annually between 1973 and 1999. The rate of growth has increased since 1994. The BBS shows a significant ( $P < 0.05$ ) positive trend of 78% between 1966-1996. For the period 1980-96, the trend is significant ( $P < 0.05$ ) at 47%.

Distribution: Statewide

**Harvest:** Increasing. The average harvest for the 1995-98 period was nearly 84,000 birds, 121% greater than the average 1990-94 harvest and 188% greater than the average 1980-89 harvest. Just over 40% of the total harvest is large birds (Appendix 6). Harvest during the 1999 (the first) early September season was 1,900 birds.

### Monitoring efforts

Banding: A substantial number of geese were banded in North Dakota in almost all years since 1970, though the number has recently declined. During the period 1970-98, >22,000 Canada geese were banded, including >18,000 goslings (Appendix 8).

Harvest survey: The state conducts a harvest survey of hunters as it has since 1953. These data supplement that provided by the USFWS.

## **Problem identification**

Typical or primary problem type: Crop depredation (agriculture). However, the number of incidents of urban problems is increasing.

Aircraft safety: The FAA did not report any strikes of commercial aircraft in ND between 1990 and July 1999. Four incidents involving "aircraft" were addressed by USDA Wildlife Services between 1994 and 1999 with three occurring between December and March in those same years.

Frequently used responses: Advise on problem avoidance, scare devices, trap / transport. The first early September hunting season was held in 1999.

**Management Philosophy and Expectations:** The NDGFD expects continued expansion of Canada goose populations, particularly if the current good wetland conditions continue. This will increase the number and severity of problems in urban and agricultural situations. The NDGFD believes that Canada geese are a very popular species and are in high demand by hunters and non-hunters alike. Maintaining a balance between this demand and nuisance situations is important. NDGFD, working closely with USDA Wildlife Services, is attempting to help landowners learn to manage these situations and is taking other, direct action to reduce the effects of nuisance situations. NDGFD is evaluating the effects of their first (in 1999) early September hunting season to determine how to apply the method in the future.

## **Oklahoma**

**Restoration History:** The Oklahoma Department of Wildlife Conservation (ODWC) maintained a captive flock for gosling production between 1980-90 with an average of 200 birds in the flock. In addition, a large number of birds, mostly adults, were obtained from other states. In total, more than 18,000 geese were translocated to the state as part of restoration efforts. There is no current restoration program in the state.

### **Population**

Survey Method: Modeling of releases, population growth and structure.

Objective (Total birds in Spring): 20,000-40,000

Current size (Total birds in Spring): 44,000

Trend: Increasing. The BBS shows a significant ( $P < 0.05$ ) positive annual trend of 17% for the period 1996-98 and 17% ( $P < 0.1$ ) for the period 1980-98.

Distribution: Statewide

**Harvest:** Increasing. The average harvest during 1995-98 was 18,000, 26% greater than the 1990-94 average and 91% greater than the 1980-89 average. In recent years, the percent of the total Canada goose harvest that was large birds is near 70%, a change from about 55% in the early 1990's (Appendix 6).

### **Monitoring efforts**

Banding: Between 1982 and 1998, over 28,000 Canada geese were banded in the state, 20,000 of which were adults (Appendix 8).

Harvest survey: A state harvest survey was conducted until 1998 and indicated a similar trend in the number of Canada geese harvested as the federal survey.

## **Problem identification**

Typical or primary problem type: Prior to the mid-1990's, the number of incidents associated with agriculture was higher than for urban problems. Since then, the opposite is true.

Aircraft safety: There are two incidents of airstrikes of commercial aircraft with geese between 1990 and July 1999, one explicitly associated with a Canada goose. Both incidents were on the same date in November in 1996. In addition, five incidents at airports were addressed by state or federal personnel.

Frequently used responses: Scare devices, provision of advice about problem avoidance or abatement and trap/transport.

**Management Philosophy and Expectations:** The ODWC expects that resident Canada goose populations will continue to increase. This will lead to an escalation of nuisance complaints in both number and severity in both urban and agricultural settings. The ODWC requires those with problems to be full participants in the solution by terminating feeding, disposing of domestic waterfowl that could be acting as call flocks and other actions. Trap and transport operations conducted by the ODWC also require full participation by those experiencing the problem. There is an ongoing effort to educate the public about preventing Canada geese from becoming a nuisance and actions they can take to alleviate problem situations when they occur. Implementing an early September hunting season in portions of the state is under consideration. An application for a Migratory Bird Special Canada Goose Permit to assist in managing specific nuisance resident Canada geese has been submitted to the USFWS.

## Saskatchewan

**Restoration History:** Saskatchewan maintained a captive flock from 1973-80, using the goslings produced for restoration purposes in the southern portion of the province. Wild trapped birds were translocated from places with high populations to those with lower levels. There are three populations of Canada geese that nest in the province: Western Prairie (WPP); Great Plains (GPP) and; Hi-Line (HLP). Most releases were in the GPP range. Between 1960-99, more than 22,500 geese were handled as part of restoration efforts. Current restoration efforts are a by-product of removing geese that are causing problems from a few locations to areas in the Province with fewer geese.

### Population

Survey Method: The May Breeding Duck survey conducted by the USFWS and CWS is used to index the number of Canada geese.

Objective (Total birds in Spring): None has been established by the Province. Development of objectives will require the consultation with CWS and provincial stakeholders.

Current size (Total birds in Spring): 300,000 (1997-98 average) for Southern Saskatchewan (as described in CWS/USFWS publications) which includes the range of GPP and HLP birds in the province and a portion of the WPP range. Reports from the CWS/USFWS for Northern Saskatchewan combine data from there and North Central Manitoba and no current estimates of the proportion that occurs in Saskatchewan is available.

Trend: Increasing. The populations in southern Saskatchewan have been increasing more than 7% annually since 1966. The BBS for the province shows a significant ( $P < 0.2$ ) increase of 15% annually between 1966-96 and of 22% annually ( $P < 0.05$ ) between 1980-96.

Distribution: Southern two-thirds of the province.

**Harvest:** Increasing. The average harvest during 1995-98 was 109,000, 27% greater than the 1990-94 average but 17% greater than the 1980-89 average. In recent years, the percent of the total Canada goose harvest that was large birds is near 67%, a slight increase from 61-63% in the 1980's and early 1990's (Appendix 6).

## **Monitoring efforts**

Banding: Between 1970-93, Saskatchewan had a consistent banding program with over 19,000 goslings and nearly 9,000 adults banded. Since then, less than 200 birds have been banded (Appendix 8).

Harvest survey: The Province relies on Environment Canada for harvest estimates.

## **Problem identification**

Typical or primary problem type: Crop depredation (agriculture) by a large margin. Much of this damage is caused by some combination of migrant and resident birds in the Fall but significant problems are caused in Spring and Summer by resident birds. Large Canadas that have been remaining late into Fall and suspected to be mostly resident birds are causing additional problems. Two areas (Regina and Saskatoon ) in the province are experiencing urban problems.

Aircraft safety: While preliminary investigation does not show there have been any incidents of aircraft striking Canada geese in Saskatchewan, it is clear from Transport Canada's Web site that they believe that Canada geese are an important threat to aircraft safety. Their publication Controlling Canada Geese (Transport Canada 1999) contains many suggestions for airport management. There have been incidents involving Canada geese at airports in Regina and Saskatoon.

Frequently used responses: Trap/transport; compensation; lure crops; scare devices.

**Management Philosophy and Expectations:** The Saskatchewan Environment and Resource Management (SERM) believes that Canada goose populations will continue to increase and will lead to increases in problems the agency will need to deal with. There will be effects in urban and agricultural settings. Changes in agricultural practices such as an increase in swath grazing, may also result in increased cost to agriculture. SERM sees little opportunity to expand the hunting season in terms of length, timing or daily bag limits. It is attempting to increase sport harvest of Canada geese by increasing the number of waterfowl hunters with particular emphasis on recruiting youth. They have targeted reducing overabundant urban populations by translocating young birds. SERM is pursuing public awareness efforts about problem abatement through publications and by holding discussions with concerned landowners.

## **South Dakota**

**Restoration History:** Captive flocks were established at two NWRs in South Dakota in 1939 and 1940. Several other larger flocks were in place between 1963-98 and averaged between 100 and 250 birds. Goslings from these flocks were released statewide as part of a restoration effort. A few birds were obtained from Minnesota and about 1,000 were trapped in the state and moved to other locations. Between 1967-98, more than 12,000 birds were handled during restoration efforts with nearly 11,000 of these being goslings from captive flocks. There is no current, formal restoration program in South Dakota though some nuisance geese are trapped and released in areas with fewer birds.

## **Population**

Survey Method: The May Breeding Duck survey is used to index the number of Canada geese.

Objective (Total birds in Spring): 50,000 under average environmental conditions

Current size (Total birds in Spring): 112,000

Trend: Increasing. Data from the May survey indicate that the population has grown by greater than 12% annually between 1966-99. The BBS shows a significant ( $P < 0.2$ )

positive annual trend of 27% for the period 1966-98 and a non-significant positive trend of 15% for the period 1980-98.

Distribution: Statewide

**Harvest:** Increasing. The average harvest during the period 1995-98 of 105,000 is 84% larger than for the period 1990-94 and 117% larger than for the 1980-89 period. Typically, over 80% of the harvest is large geese (Appendix 6). The harvest during the early September seasons, 1996-99, ranged from 12,000 to 17,800, according to estimates made by the state.

**Monitoring efforts**

Banding: Birds were banded essentially every year between 1970-98 in South Dakota though in some years few adults were banded. In total, over 12,500 goslings and 13,400 adults were banded in the period (Appendix 8).

Harvest survey: The state conducts an annual harvest survey to supplement data provided by the federal survey. A special survey was instituted by the state for the special early September season in 1996.

**Problem identification**

Typical or primary problem type: Crop damage (agriculture) by a large measure and the number of complaints has been increasing. There are a few urban problems areas, most notably in Sioux Falls and Watertown.

Aircraft safety: The FAA reports six strikes of commercial aircraft by "Geese" with one of these identified as being caused by Canada geese. The South Dakota Game, Fish and Parks Department (SDGFP) has dealt with several incidents involving Canada geese at the Sioux Falls airport.

Frequently used responses: Provision of advice on avoidance and abatement; scare devices; fences; food plots; habitat management including "goose-friendly" management on state and federal lands; trap/transport. SDGFP has a comprehensive program that has recently been implemented to reduce damage to crops by geese. A part of this program is an early September hunt.

**Management Philosophy and Expectations:** As long as soybeans continue to be a major crop in eastern South Dakota, the SDGFP expect major conflicts between producers and Canada geese, especially during May, June, and July. SDGFP implemented a Canada goose damage management program in 1996. This program is most active in northeast and east central South Dakota, the same area where early September Canada goose seasons have been held since 1996. This program continues to evolve and has grown to be a large consumer of Department manpower and expenses. In FY99, SDGFP expended approximately \$148,000 on Canada goose damage management. The latter half of the 1990's provided exceptional habitat for nesting resident Canada geese with very high recruitment rates. This will not last forever and recruitment should level off. A higher harvest of resident Canada geese from the early September and regular season is needed to stabilize a growing population. SDGFP will continue to use extended hunting seasons when warranted. It is working with wildlife researchers at South Dakota State University to determine goose movements during the summer/early fall period to improve management of the early September hunting season. Except for the airport at Sioux Falls and a few golf courses, there are few urban problems in the state though the number of incidents is expected to increase. SDGFP has translocated geese that caused problems in urban settings and may continue this in the future.



## Texas

**Restoration History:** Texas has had no formal restoration project. No captive flocks were held and there have been no releases of birds by the Texas Parks and Wildlife Department (TPWD). A few birds have been released from private flocks.

### Population

Survey Method: Professional judgement and some local surveys.

Objective (Total birds in Spring): 750

Current size (Total birds in Spring): 750

Trend: Increasing. Canada geese are not present on the BBS bird list.

Distribution: Canada geese have been observed in the Summer in 28 counties scattered throughout the east central and northern portions of the state. Evidence of breeding has occurred in 16 of these counties.

**Harvest:** Increasing. The average annual harvest during the period 1995-98 was 62,000, an increase of 38% from the 1990-94 average and 50% from the 1980-89 average. Typically, about 8% of the total Canada goose harvest is large birds (Appendix 6).

### Monitoring efforts

Banding: None

Harvest survey: The state relies on federal surveys.

### Problem identification

Typical or primary problem type: There is not a large number of problems caused by Canada geese in Texas but both agriculture and urban situations exist.

Aircraft safety: The FAA reported 19 strikes of commercial aircraft striking "Geese" or "Ducks, geese, swans". Eight of these incidents were identified to species with two being attributed to Canada geese. The 19 strikes are 28% (the largest) of the total strikes reported in Central Flyway states.

Frequently used responses: Provision of advice about problem resolution and abatement.

**Management Philosophy and Expectations:** The TPWD presently relies heavily on USDA Wildlife Services personnel to handle the few problems caused by resident Canada geese. TPWD expects that urban problems will increase in the future.

## Wyoming

**Restoration History:** The Wyoming Game and Fish Department (WGFD) did not hold a captive flock of geese. They did engage in restoration activities as early as 1953 through trapping and transporting geese from within the state and obtaining birds from other states. Between 1960-1988, over 2,000 birds were handled in restoration efforts. The range of both the Rocky Mountain (RMP) and Hi-Line (HLP) populations occur in the Central Flyway portion of the state and restoration efforts took place in both ranges.

### Population

Survey Method: Since 1970, a state survey has provided an index to the size of the breeding population.

Objective (Total birds in Spring): RMP (Central Flyway) - 6,000; (Western Region) - 12,000; HLP - 9,700.

Current size (Total birds in Spring): RMP (Central Flyway) - 7,900; (Western Region) - 10,000; HLP - 15,800.

Trend: Both populations are increasing. The total RMP has been growing at about 3% annually with those in the Central Flyway growing at a slightly higher rate since 1970. The HLP has had an annual growth rate of about 8%. The BBS shows non-significant negative trends of -0.4% and -0.3% for the periods 1966-98 and 1980-98, respectively.

Distribution: Throughout the Central Flyway portion of the state

**Harvest:** Increasing. The average annual harvest for the 1995-98 period was 28,500, an 86% increase from the 1990-94 average and 240% above the 1980-89 average. About 90% of the Wyoming harvest is large Canada geese (Appendix 6).

### **Monitoring efforts**

Banding: WGFD had a consistent banding program between 1970 and 1994 except that no birds were banded in 1990. A few birds were banded in 1995. During the period 1970-95, 23,000 birds were banded (Appendix 8).

Harvest survey: WGFD conducts an annual survey of hunters to supplement federal harvest estimates.

### **Problem identification**

Typical or primary problem type: Crop depredation (agriculture). A few incidents of urban problems have recently occurred.

Aircraft safety: No airstrikes involving Canada geese were reported between 1990 and July 1999. No incidents of geese interfering with airport operations were reported.

Frequently used responses: Compensation; fencing; habitat modification.

**Management Philosophy and Expectations:** The WGFD does not expect the goose population in the Central Flyway portion of the state to increase significantly in the next decade. However, the farm economy and new housing developments may present situations that will increase the number of complaints received. The WGFD is currently providing information about how to deal with nuisance geese to affected landowners and paying some damage claims. There is a greater potential for an early September hunting season to be implemented in RMP range than in HLP range.

### **Appendix 3. Methods used to arrive at projected breeding population size in 2010.**

Various data sets and sources were used to make projections of breeding population size of Canada geese in the Central Flyway. Some states (KS, OK, NE, NM and CO) made their own projections and those are included directly in Table 3 in the body of the report and are not shown below (Table A1). The estimate in Table 3 (main text body) for South Dakota (SD) was provided by the state as their projection given an aggressive campaign to reduce the population size. That below assumes, for SD and all other places, a growth patterned after historical information.

A visual examination of plots of the annual estimates available indicated a curvilinear relationship with year was evident. Therefore, an exponential equation [Population =  $e^{(b * \text{Year})}$ ] was fitted to the data (Table A1). Indices for 1970 were used as the beginning year in all exponential regression estimates except as noted (Table A1). Since estimates of population size was zero for "Great Plains - Canada" for 1972 & 1973, only 28 years were in the analysis.

This approach produced some very high estimates for population size in 2010 though none particularly extraordinary given the growth of populations in the last two decades. However, there is some biological question regarding if populations can continue to increase at those same high rates even if only current control methods are available. In fact, growth in the 1990's was considerably less than in the 1980's. That said, a separate population estimate was made using simple linear regression and data from 1980-1999. It was anticipated that these more recent years would better depict current patterns of population growth if a linear relationship is considered appropriate. In many case, these latter estimates are much smaller than those made using the exponential equations.

Data from an unpublished report from the USFWS were used for the HL and RM populations in Montana. Data from Nieman et al. (2000) were used for all entries for Canada. Data from parts of southern and western Manitoba are included as prescribed by population range maps in related Central Flyway Management Plans. Data from the May Breeding Duck Survey (Smith 1995) were used for the Great Plains Population in North and South Dakota. The Wyoming data was provided by the state. For all but 1998 and 1999, only "indicated" breeding pair were included in the report. In order to estimate the total number of Canada geese in the spring, Indicated Breeding Pair was multiplied by 1.56 (from the 1998-99 data) and a visibility correction factor of two was then applied.

Table A1. Some statistical properties from exponential regression equations and associated projections of breeding population size for Canada geese in 2010 (in 1,000's) for some areas of the Central Flyway. Projections from linear regression using 1980-99 data are also shown.

Population & Location	Years	R <sup>2</sup>	F	Pr>F	Constant	Coefficient (Year)	Projected Pop. Size in 2010		R <sup>2</sup> Lin. <sup>3</sup>
							Expon. Est. <sup>1</sup>	Linear Est. <sup>2</sup>	
<b>Great Plains</b>									
Canada	1970-99	0.85	146	0.00	-311.67	0.1614	360	63	0.60
North Dakota	1973-99	0.86	151	0.00	-297.21	0.1544	516	112	0.74
South Dakota <sup>4</sup>	1973-99	0.89	220	0.00	-285.79	0.1488	642	135	0.80
<b>Western Prairie</b>									
Canada	1970-99	0.94	422	0.00	-166.21	0.0893	618	312	0.83
<b>Hi-Line</b>									
Canada	1970-99	0.85	154	0.00	-160.28	0.0862	456	261	0.89
Montana	1970-99	0.57	38	0.00	-96.88	0.0541	142	136	0.57
Wyoming	1970-99	0.89	232	0.00	-154.92	0.0823	40	16	0.67
<b>Rocky Mountain</b>									
Canada	1970-99	0.68	59	0.00	-108.34	0.0600	169	152	0.75
Montana	1970-99	0.64	49	0.00	-114.73	0.0626	65	49	0.60
Wyoming	1970-99	0.76	90	0.00	-77.90	0.0435	12	8	0.38

1. Projected population size for 2010 using the exponential equation reported.
2. Projected population size for 2010 using a linear regression equation for years 1980-99.
3. R<sup>2</sup> for the linear regression equation used.
4. The estimate shown here for SD differs from that in Table 3 - see footnote there.

**Appendix 4. Methods used to arrive at projected wintering population size in 2010.**

The source for the data used in this analysis was the Central Flyway “Data Book’ (Sharp and Moser 1999). Simple linear regression equations were fitted to the data and estimates of the indices were made for the year 2010. The year used was the latter of winter period included (e.g. surveys in the winter of 1982-83 are shown as year 1983). This was necessary since some data prior to 1999 were collected in December of the winter period and some in the following January. While data for the total number of Canada geese are available back to 1948, only the years 1970-99 were used in the projection to more accurately reflect current conditions.

Some statistical properties from regression equations and associated predictions of wintering populations of Canada geese in 2010 for some areas of the Central Flyway. The predicted 2010 values are in 1,000’s of geese.

Population	Years	R <sup>2</sup>	F	P>F	Constant	Coefficient (Year)	2010 Prediction	SE - Predicted
Great Plains & Western Prairie	1982-99	0.74	46.41	0.00	-33741	17.1	644	75.0
Hi-Line	1982-99	0.72	40.97	0.00	-13402	6.8	247	31.7
Short Grass Prairie	1982-99	0.60	23.76	0.00	-50955	25.8	852	157.9
Tall Grass Prairie	1982-99	0.18	3.25	0.09	-8770	4.5	329	72.4
<b>Total Canada Geese</b>	<b>1970-99</b>	<b>0.86</b>	<b>167.2</b>	<b>0.00</b>	<b>-86223</b>	<b>43.9</b>	<b>1,964</b>	<b>185.0</b>

## **Appendix 5. A Summary of goose hunting regulations in the Central Flyway**

### **Early Flyway History and East Tier States Regulations**

(Information about seasons between 1918 and 1990 was available in a report by Marvin Kraft, KS Department of Wildlife and Parks. East tier states include ND, SD, NE, KS, OK and eastern TX.)

#### **1918 through 1990**

From 1918-29, the bag limit for geese was eight daily, with no possession limit. Between 1930 and 1945, the daily bag varied from two to five with a possession limit of double the daily bag. From 1946 through 1960, the daily bag limit varied from four to five geese with a possession limit of one daily bag, with 1946 (bag of 2 geese) and 1957 (bag of 6 geese) being the only exceptions.

In about 1944, the bag limit for dark geese was separated from that for "light" geese (snows and blues), being set at two dark geese. Between then and 1990, the daily bag limit for dark geese in east tier states of the Central Flyway has normally been two Canada geese, or one Canada goose and one white-fronted goose.

From 1918 through 1960 the framework dates (earliest and latest dates for hunting) for geese were the same as for ducks. Beginning in 1961, framework dates for geese were separated from ducks, usually opening earlier and continuing later. Between 1961 and 1990, framework dates for dark geese were from about October 1 to January 15-20.

Season length for geese was the same as for ducks from 1918 to 1954. Beginning in 1955, season length for geese was separated from that for ducks, being 60 days from 1955-1957 and 75 days from 1958 through 1971 (1969 with 86 days, being the only exception). Between 1972 and 1990, the season length for dark geese in the east tier states of the Central Flyway was generally 72 days.

Until 1967, goose regulations were similar for all states in the east tier of the Flyway. There had been some discussion about management of geese on a population basis, but up to this point in time no action had been taken. In that year, a lower bag limit in prescribed areas of ND, SD, OK and TX was implemented because of concern for the welfare of TGP Canada geese. These area-specific restrictions largely remained in effect until 1982.

In 1971, due to concern about the status of large "restoration" geese, KS was required change the daily bag limit of Canada geese from two to one on December 10th. In 1972, the daily bag was reduced to one east of HY 3 in ND and all of SD and after December 10 in KS and NE. Additional restrictions were added in 1973.

In 1974 termination dates for the Canada goose hunting season were enacted in ND, SD, NE, and KS. In the same year, recognition of the range of Short-Grass Prairie Canada geese occurred and two Canada geese were allowed in the bag in NE and KS prior to Nov. 24, when the bag limit changed to one.

Although there were some minor modifications (in some instance for local management purposes), the regulations enacted in 1974 remained unchanged until 1980, when the terminations dates in ND, SD, NE and KS were removed.

In 1981, major regulation changes were adopted based a combination of three motives: 1) concern for maintaining the southern migration tradition of TGP Canada geese; 2) concern for the welfare of increasing numbers of large Canada geese delaying their migration and wintering on Missouri River impoundments in SD; and 3) lingering concern for the welfare of restoration geese in the Dakotas and NE due to the harvest on

the wintering grounds. The harvest of TGP birds was reduced by changes in regulations in northern states, the harvest of late-migrating large Canadas was reduced by changes in mid-latitude states, and an unsuccessful attempt to use late-season hunting to influence geese to migrate from SD was made.

Although there were some minor changes, the regulations adopted in 1981 remained the same through 1990.

#### 1990 through 1999

In 1990, the framework dates for Canada geese were the Saturday nearest 1 October to 20 January. In NE and KS, the season length was 72 days with two Canadas per day allowed through mid-November at which time the daily limit changed to one. The bag limit was generally two throughout the season in the remainder of the east tier states. The 1991 season brought a change in the ending framework date to 31 January. Regulations remained the same until the 1994 season when the season length was increased to 86 days and the bag limit was set at two throughout the season.

In 1995, the ending framework date was extended to the Sunday nearest 15 February (from 31 January) in the west zone of Texas. The 1997 season brought the opportunity for states to split the Canada goose season into three segments: previously, two segments had been allowed. In 1998, the ending framework was set at the Sunday nearest 15 February for all states and the season length was extended to 93 days and the bag limit increased from two to three. Texas was allowed a longer season (107 days) but needed to accept a daily bag of one to use it. In 1999, the east tier was permitted to have a 95 day season, a minor adjustment to manage split seasons better.

An early September season was first used in the Central Flyway by SD in 1996. These seasons are to be directed at reducing the number of resident Canada geese. There are a number of restrictions or conditions placed by the USFWS associated with these seasons (56 Federal Register: 49111: 26 September 1991). In 1999, new early September seasons were established by ND and KS.

#### **Dark Geese in the West Tier States and Alberta**

Since at least 1970, Canada goose hunting regulations in the Central Flyway portion of the west tier of states in the Flyway (MT, WY, CO, NM and a portion of west TX) have been more liberal and stable than in the east. Between 1970-90, between 90 and 95 days were available to hunt Canada geese and the bag limit was two with a possession limit of twice the daily bag. An exception was in MT, where, beginning in the early 1980's, the bag limit was three. In 1990, season length was increased to 100 days and to the maximum allowed under the Migratory Bird Treaty of 107 in 1991. The daily bag limit increased to three (four in MT) in 1990 and to four throughout the area in 1995. It increased to five in 1999. In 1990, the framework (outside dates) for Canada geese were The Saturday nearest 1 October to 20 January. The ending date moved to 31 January for the 1991-92 season. In 1995, hunting was allowed until the Sunday nearest 15 February in a portion of TX and this date became available to all states in the Flyway in 1998.

During the same period (1970-99), hunting regulations in Alberta, which harvests geese from the same populations that occur in the west tier of states in the flyway, were even less variable. Between 95 and 107 days were available for hunting Canada geese during the period 1970-93. During this entire period, the daily bag limit was five with a possession limit of ten. Since 1994 the season length has been 107 days. The daily bag limit was set at six in 1994 and eight in 1996.

## Appendix 6. Total and large race Canada goose harvest in the Central Flyway.

Period	***** Alberta *****			***** Colorado *****			***** Kansas *****		
	Total	Large	% Lrg	Total	Large	% Lrg	Total	Large	% Lrg
1980-84	102,238	73,166	72%	39,546	29,366	74%	12,810	6,166	48%
1985-89	107,706	77,190	72%	49,746	34,381	69%	13,080	8,759	67%
1990-94	105,092	78,237	74%	55,345	40,769	74%	13,284	9,914	75%
1995-98	119,155	94,844	80%	135,895	101,423	75%	37,907	30,146	80%

Period	***** Montana *****			***** Nebraska *****			***** New Mexico *****		
	Total	Large	% Lrg	Total	Large	% Lrg	Total	Large	% Lrg
1980-84	5,905	5,419	92%	18,655	11,733	63%	2,569	1,315	51%
1985-89	7,881	7,302	93%	31,278	24,071	77%	3,507	2,046	58%
1990-94	15,427	14,127	92%	40,763	33,520	82%	2,817	1,771	63%
1995-98	32,858	30,249	92%	81,846	70,521	86%	1,637	1,043	64%

Period	***** North Dakota *****			***** Oklahoma *****			***** Saskatchewan *****		
	Total	Large	% Lrg	Total	Large	% Lrg	Total	Large	% Lrg
1980-84	32,343	8,238	25%	7,763	2,700	35%	98,157	57,139	53%
1985-89	25,993	7,896	30%	10,642	4,619	43%	96,749	57,839	60%
1990-94	37,944	15,319	40%	13,916	6,476	47%	86,300	52,381	61%
1995-98	83,927	36,279	43%	17,587	9,643	55%	109,323	72,729	67%

Period	***** South Dakota *****			***** Texas *****			***** Wyoming *****		
	Total	Large	% Lrg	Total	Large	% Lrg	Total	Large	% Lrg
1980-84	46,959	28,013	60%	42,129	1,915	5%	6,661	5,207	78%
1985-89	49,799	30,273	61%	40,928	3,365	8%	10,126	8,987	89%
1990-94	57,038	41,219	72%	45,097	4,348	10%	15,400	13,981	91%
1995-98	105,061	87,815	84%	62,324	3,875	6%	28,578	24,964	87%

Note: Percent large for west tier states for 1982 was subjectively estimated based on values for nearby years. Percent large for states was estimated from Hand-Tally information collected at the annual Wing Bee (pers. comm. Michael A. Johnson, ND). Percent large for Alberta and Saskatchewan is from CWS reports.



## **Appendix 7. Descriptions of actions included in the Action Matrix (Table 11)**

**Actions** are associated with Objective 2, Strategy 1.

**None:** A determination is made that goose populations are not “too large” and there are not problems severe enough to require action. This could lead to an increase in local population size and problem occurrence and severity.

**Provide technical advice only (e.g. terminate feeding, vegetative changes):** An assumption is made that people experiencing the problem can take care of it themselves if provided information. The effect can be to move the problem elsewhere rather than solve it. Some actions such as removing nest structures and providing human access to islands can be partially effective in reducing population growth. Both the public’s acceptance and cost of this action is dependent on the frequency and severity of problem occurrence. This action includes taking steps to prevent problems from occurring (e.g. meeting with developers, landscapers and airport managers). No special permits are required to implement this action.

**Scare hardware, chemicals, denial of access:** These actions can be provided as technical advice or by agencies but are frequently used in a cooperative effort. For example, an agency might provide flash tape but the individual being affected by geese might install it. These actions frequently only work for a short period of time requiring changing techniques or re-application. They may have different effects in different seasons. Cost and public acceptance can be moderately high though their effect is very local and often moderate at best. There is the potential to move the problem elsewhere rather than solve it. No special permit is required to implement this action.

**Reproductive inhibitors, contraceptives, sterilization:** These actions are currently being used almost exclusively in experimental situations. There has been no wide-scale use to date. They may have the potential to reduce the growth rate of local populations and ultimately a local population size if delivery mechanisms (procedures) prove practical and feasible on a fairly large scale (e.g. city-wide). Permits may be required for some actions.

**Use of other animals (falcons, dogs) as a scare device:** These actions have largely been applied by those experiencing the problem rather than agencies. They must be applied on a regular (nearly daily) basis but some successes in problem reduction have been identified. Effects are specific to a golf course, city lake or airport. There is the potential to move the problem elsewhere rather than solve it. No special permit is required to implement this action except that falconers need to hold a federal permit to own raptors. Some dogs being sold for the purpose of discouraging goose use of an area carry a substantial price tag.

**Trap & transplant:** This high-cost action must be considered as a “stop-gap” or temporary action. In some areas, it is taken annually. Sometimes volunteers or those directly affected by the geese assist with the work, reducing the cost. It assumes there is a viable place to where the birds can be moved. When agencies had active restoration programs, this action was viewed as taking one action to achieve two objectives: reducing a problem population at one location while increasing the population growth rate in a desirable place. However, the number of the places where more geese are desired is rapidly shrinking. It also assumes that few birds will return to the original site. Many times, this action affects mainly sub-adults (i.e. non-breeding birds), reducing the effectiveness. This action tends to treat the symptom rather than the problem (i.e. why the geese are there in the first place). A federal permit is required.

**Reducing egg hatchability:** This includes spraying eggs with oils or otherwise affecting the yolk's ability to develop. It eliminates re-nesting attempts. This is a very labor intensive action and therefore comes with a high cost. It is usually carried out by agencies and a federal permit is required. It only reduces the current year's production and therefore needs to be annually applied. It is best applied to a small area since individual nests need to be found and accessed.

**Increased "regular season" sport hunting:** This generally accepted, low cost action can be applied to a large area and has the potential to be effective in population control. In addition, it may increase hunter interest. It may not be able to be used in urban situations. To fully understand the effect on local, regional and more broadly based populations, data from banding, harvest and other surveys need to be available. No permits are needed.

**Special hunting seasons:** This action can be applied to large and small areas. Under controlled situations, it could be used where a "regular" hunt cannot. There are urban situations where this action is not likely to be available. Under some conditions, there are significant data gathering and reporting requirements by the USFWS that increase the cost of implementation. There is the potential to increase interest in goose hunting via this action. No permits are needed.

**Conservation and Depredation Order:** These actions are not presently available but may be considered in the current Environmental Impact Statement process. Some activities that might be permitted are presently partially available under special, site-specific federal permitting procedures. By having broader options available, federal action would pass much management control of resident Canada geese to the state or provincial agencies. This would allow rapid, tailored response to local situations. General activities under these actions would entail the taking of birds at times of the year when hunting seasons are not available, in manners not traditionally used in hunting seasons and for a variety of uses.

**Habitat management programs:** This action includes site-specific activities that could be used to either increase or decrease goose use of an area. Public acceptance would generally be high and the cost is variable ranging from building a concrete wall to planting hedges. High cost actions may reduce social acceptance. However, there may be long-term benefits from these actions reducing the long-term cost. Unless conducted on a very large scale, there would not likely be a significant effect on goose population size. No permits are needed for implementation.

**Trap, process and donate to charity:** This specific action is currently provided by special permit and may be included as a component of a future Depredation Order. It can be conducted in areas where there are no viable places left to which to transport and release birds or hunting is not a viable option. The use of volunteers can reduce the high cost of this action. Benefits include not having to transport live geese and the provision of nutrition to people in need. Many times, this action affects mainly sub-adults (i.e. non-breeding birds), reducing the effectiveness as a long-term solution - it may need to be carried out annually.

**Issue kill permits:** These special permits are issued on a case-by-case basis by the USFWS. They allow killing a specific, usually low number of geese that cannot be utilized for any purpose. The effect is very local and they are used for the most severe problems (e.g. airports). Killing a few Canada geese on a small area can be an effective deterrent to other birds using the area.

## Appendix 8. Canada goose bandings in the Central Flyway in June through August, 1970-98

Band Year	Alberta		Colorado		Kansas		Montana		North Dakota		Nebraska		New Mexico		Oklahoma		South Dakota		Saskatchewan		Wyoming		Central Flyway <sup>1</sup>			
	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Yng	Ad	Total	
1970	440	89	469	5	86	28	178	42	262	34	122	8	64	30	13	0	105	150	405	4	124	1148	2268	1538	3806	
1971	338	73	525	73	35	1	452	127	214	25	171	17	38	266	23	0	109	197	449	11	190	581	2544	1371	3915	
1972	844	256	409	9	0	0	525	137	1130	53	304	21	20	27	18	4	56	191	684	117	273	841	4263	1656	5919	
1973	1130	169	408	8	0	0	279	31	1231	58	448	24	0	0	0	0	244	518	650	127	365	619	4755	1554	6309	
1974	2054	652	525	754	5	0	362	78	1094	126	497	30	0	0	0	0	479	694	636	147	390	516	6042	2997	9039	
1975	2111	460	265	418	0	0	337	50	1016	286	449	25	0	0	0	0	269	429	857	308	310	777	5614	2753	8367	
1976	2362	438	716	410	0	0	602	104	702	139	568	5	0	0	0	0	779	641	354	479	339	585	6422	2801	9223	
1977	1892	499	400	288	0	0	337	75	257	90	593	28	0	0	0	0	469	469	1195	445	473	1059	5616	2953	8569	
1978	3391	735	515	319	3	0	390	54	503	131	380	19	0	0	0	0	736	143	1914	1074	257	760	8089	3235	11324	
1979	2470	359	218	16	0	0	336	76	434	165	385	45	0	0	0	0	587	1	1849	904	519	917	6798	2483	9281	
1980	1575	324	347	304	0	0	481	165	227	325	73	18	0	0	0	0	874	108	2491	1457	621	900	6689	3601	10290	
1981	2766	244	450	388	0	0	131	65	428	217	346	240	0	0	7	0	772	5	830	225	480	771	6210	2155	8365	
1982	1613	152	350	246	186	74	58	31	578	152	406	159	0	0	124	559	799	3	533	407	529	678	5176	2461	7637	
1983	1930	202	414	298	685	160	23	22	586	134	340	222	0	0	34	609	651	0	357	326	579	1184	5599	3157	8756	
1984	1733	135	327	157	639	409	10	4	700	178	683	191	43	12	462	622	650	10	859	414	188	556	6294	2688	8982	
1985	1630	219	300	105	808	411	197	192	866	206	663	287	69	0	172	1545	279	5	723	303	135	247	5842	3520	9362	
1986	1606	156	368	196	643	532	104	82	711	211	652	2	0	32	554	310	197	18	774	199	95	110	5704	1848	7552	
1987	1402	195	280	479	1065	715	0	0	964	185	615	4	302	0	964	695	756	2207	714	308	421	286	7483	5074	12557	
1988	171	44	0	70	864	1086	91	16	936	222	533	1	130	0	565	1646	671	979	699	357	307	100	4967	4521	9488	
1989	244	88	30	37	874	556	109	20	718	192	599	82	0	0	931	1960	397	2602	276	157	100	1463	4278	7157	11435	
1990	395	69	6	20	694	119	32	4	861	110	796	609	0	0	859	2752	318	886	740	418	229	48	4930	5035	9965	
1991	195	182	17	40	643	368	0	0	471	135	1215	1900	18	0	1115	1996	212	2064	538	241	0	0	4424	6926	11350	
1992	3	0	0	35	1163	1047	0	0	993	223	852	740	12	6	682	1527	419	447	666	181	229	768	5019	4974	9993	
1993	1	0	18	20	1117	2108	0	0	825	192	1164	968	0	0	359	695	136	53	607	346	122	445	4349	4827	9176	
1994	0	0	0	0	834	1934	0	0	821	160	704	700	0	0	336	850	341	93	0	0	226	199	3262	3936	7198	
1995	84	0	61	34	1796	2825	0	0	222	33	629	1652	0	0	307	1058	421	158	80	13	75	63	3675	5836	9511	
1996	36	0	468	50	498	227	7	3	239	66	429	611	0	0	231	1635	679	298	27	0	0	0	2614	2890	5504	
1997	63	0	285	0	667	499	19	0	83	8	379	340	0	0	459	1234	163	18	15	1	0	0	2133	2100	4233	
1998	2	0	464	2	554	412	361	83	147	54	632	1719	0	0	163	605	98	37	38	6	0	0	2459	2918	5377	
<b>Total</b>																										
<b>Adult</b>		5740		4781		13511		1461		4110		10667		373		20302		13424		8975		15621		98965		
<b>Yng</b>	32481		8635		13859		5421		18219		15627		696		8378		12666		19960		7576		143518		242483	

1. There are no bandings in Texas.

# Appendix 9. Range maps of populations of Canada geese that occur in the Central Flyway.

Rocky Mountain Population



Hi-Line Population



Western Prairie Population



Great Plains Population



Appendix 9 (continued). Ranges of Populations of Canada that occur in the Central Flyway

Short Grass Prairie Population



Tall Grass Prairie Population



Eastern Prairie Population

