Snow Geese in Québec 2013–2018 Action Plan

A product of a January 2012 workshop with members of the Greater Snow Goose Management Round Table

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Foreword

Since the Committee for the Integrated Management of Greater Snow Geese in Québec was established in 1996, several initiatives have been introduced to move this Greater Snow Geese (a Snow Geese subspecies) issue forward, including among other things two action plans (1997–2002 and 2005–2010; Canadian Wildlife Service 1997, Bélanger and Lefebvre 2006). Given that there is still an overabundant Snow Geese population, this situation has not yet been resolved and several issues remain. That is why steps were taken to prepare a new Action Plan.

On January 25 and 26, 2012, a workshop organized by Environment Canada's Canadian Wildlife Service was held in Québec City with a facilitator and all members of the Greater Snow Goose Management Round Table (see Appendix II) to share ideas and decide on a vision and strategies for the new Action Plan. Through this approach, all Round Table members contributed to this new plan and are stakeholders in it to ensure sustainable integrated management of the Snow Goose in Québec. Implementing this Action Plan remains a considerable challenge and relies on the participation and cooperation of all stakeholders, according to their respective mandates and the availability of each organization's financial and human resources. As in the past, Environment Canada's Canadian Wildlife Service will continue in its role as coordinator for this issue by facilitating information sharing by holding the Greater Snow Goose Management Round Table.

In an effort to implement new measures, a committee made up of Round Table members was created for each of the four strategic directions described in this report. The mandate for each of these committees is to determine priorities for action, measures to be implemented and the work schedule for the next five years, which is why no designated leader or timeline is established in this report. The measures proposed in this Action Plan will guide the strategic committees. However, these measures may be revised as needed, provided they respect the principles established in this Plan of the direction and vision. The four committees will report on how the issues are progressing and on outcomes at the Greater Snow Goose Management Round Table, held annually in September.

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Introduction

In recent years, wildlife managers have been faced with a new problem: overabundant species. These species are not subject to nature's regulation; that is, their populations are not controlled by the carrying capacity of their environment, by competition or predators, or by the impact of human activities such as hunting or habitat encroachment. Their overabundance causes their habitat to degrade, which in turn has a negative impact on other species, sometimes even decreasing the biodiversity of a region. These overabundant species are often closely associated with human activities because they have been able to adapt their eating habits, causing both positive and negative economic impacts. Their abundance results in conflicts between the different stakeholders affected by the species. And they pose new challenges to wildlife managers, who are more used to managing species with declining populations and for which minimum thresholds need to be set than to managing species whose population size requires setting a maximum or socially acceptable target level.

The explosion of the Snow Goose population—which includes two subspecies, the Lesser Snow Goose in central and western North America and the Greater Snow Goose in the east—is a good example of an overabundant species in North America. Events such as the creation of sanctuaries, decreased hunting pressure, climate change and new agricultural practices have led to the overabundance of the species (Ankney 1996; Batt 1997, 1998; Gauthier et al. 2005). Between 1983 and 1997 the Greater Snow Goose population increased by 9% annually (Reed et al. 1998), and managers at that time feared that breeding, migration and wintering grounds were being severely damaged (Giroux et al. 1998). As a result, after the population expanded rapidly from 25 000 to nearly 1 million geese in less than three decades, a series of special conservation measures were implemented in Canada, starting in the fall of 1998, to limit population growth and stabilize its size at a maximum of 1 million geese, based on the spring estimate.

Because the Greater Snow Goose crosses more than one border during its migration, management of the species involves a number of partners, which requires significant collaboration and cooperation efforts. Since the implementation of special conservation measures in Canada in 1998 and in the United States in 2009, the population has remained relatively stable at between 700 000 and 1 000 000 birds (Reed and Calvert 2007; see Appendix I). Despite these efforts, the balance remains precarious, and we are still a long way from the objective set in the 2005–2010 Action Plan, which was a population of between 500 000 and 750 000 birds (Bélanger and Lefebvre 2006). This population size would allow us to maintain a healthy population and reduce the risks of affecting the ecological integrity of habitats and of biodiversity. It would also allow the population to recover from natural or human-made disasters, while minimizing losses related to agricultural damage and optimizing socio-economic benefits. The Snow Goose is a species that adapts quickly to its environment and knows how to take advantage of it. The factors that led to the species' overabundance have not disappeared, so there remains the possibility of a population boom.

Vision for the Action Plan: What do we want to have in place by 2018?

During the workshop with the Greater Snow Goose Management Round Table members, eight projections were highlighted to illustrate the desired situation at the end of the current Action Plan in 2018. These projections are described below with a list of various courses of action that could make them easier to achieve:

1. Improved development of the resource

Few wild animal species reach population levels that allow for their sustained use. But such is the case of the Snow Goose. Given its current abundance, it should be considered an important resource. Accordingly, we should:

- fully develop the resource so that all stakeholders can draw maximum benefit.

2. Maintenance of the ecological integrity of natural environments

The integrity of the various natural environments used by the Snow Goose during its annual cycle must remain a central focus of this and any future action plans. Regular monitoring of these habitats will allow us to assess their integrity and carrying capacity based on how they are used by the geese.

The arctic environments appear to be kept in balance and even seem to be benefitting from climate warming for the time being. There is, however, no possibility for restoration of tundra wetlands if any degradation were to occur. Consequently, degradation should be avoided so as not to result in a situation similar to that observed for the Lesser Snow Goose along the western coast of Hudson Bay. Certain bulrush marshes located in the St. Lawrence estuary have seen their productivity reduced by grubbing geese. These environments, which are limited in surface area, are also affected by other factors, such as nutrient supply, erosion, ice movement, etc. Additionally, if there are farmlands located next to these environments, they may see increased use by geese, since they

allow for easy movement between feeding and resting sites. However, few recent data are available on the subject. Rehabilitation of the bulrush marshes along the St. Lawrence River is a difficult process that comes with an exorbitant price tag. Accordingly, we should:

- continue annual monitoring of the vegetation in the breeding areas on Bylot Island; and
- reinstate monitoring of bulrush marshes on migration staging areas along the St. Lawrence River (either on the ground or by remote sensing).

3. Improved knowledge of the Greater Snow Goose for adequate response in agricultural zones

The use of farmland by the Greater Snow Goose for migratory stopovers and wintering areas is one of the main causes of the increase in population size. The wide availability of these lands has increased the theoretical carrying capacity of the habitat, resulting in impacts on the natural environments and in crop damage. The behaviour of the geese changes quickly in response to different management techniques (e.g. spring conservation harvest, structured hazing program), changes to farming practices (new varieties of corn, variation in the proportion of the different crops based on the market) or simply by opportunism (use of small-grain fields in the fall around Lac Saint-Jean). Accordingly, we should:

- conduct a precise analysis of the progression of damage to farmlands over time;
- develop a predictive model for potential damage based on the different parameters of the season under study;
- obtain a picture of the impact of hazing on both Snow Geese and crop damage by developing a benefit assessment method, among other things; and
- conduct a study on recent behavioural changes in the Snow Geese (dispersion, flock sizes, etc.) and on the contributing factors, in order to carry out more effective interventions.

4. Reduction of crop damage caused by Snow Geese to an acceptable level

Even though the population size has been stabilized over the past decade and there is no direct relationship between population size and damage claim levels during this period, data from La Financière agricole du Québec show that crop damage caused by waterfowl remains significant (see Appendix III). Accordingly, we should:

- determine an acceptable level of damage, from both a regional and provincial standpoint;
- implement planned measures to reduce damage to crops and affected areas in order to reach these acceptable levels; and
- develop measures, other than hazing, so that the crop damage is not recurring.

5. Development of supplementary measures to reduce crop damage

Over the past few years, a collective hazing program, the Special Goose Hazing Measure (SGHM), has been implemented to limit crop damage caused by snow geese. The spring conservation harvest also contributes to reducing crop damage, albeit indirectly. Despite these efforts, damage to farmland remains significant. In most regions, there is less enthusiasm for the spring conservation harvest now than when it was first introduced in 1999, and hazing activities are requiring more and more human and financial resources. Accordingly, we should:

- explore new ways of controlling the Snow Goose population size;
- reduce the areas being damaged;
- adapt farming practices so that they mitigate the negative impact of the geese while remaining beneficial for farm producers; and
- develop new approaches to improve the effectiveness of hazing activities.

6. Maintenance of the Greater Snow Goose population size at an acceptable level

This is a key element of the population management strategy, from both an ecological and social perspective. The North American Waterfowl Management Plan has proposed a target population size of 500 000 (NAWMP 2004). Since then, socio-economic assessments have suggested that a population of between 500 000 and 750 000 geese would be an ideal size in terms of balancing the benefits and the costs associated with the population (Bélanger and Lefebvre 2006). Despite the relative stability of the population over the past decade, it has remained above the 750 000 threshold nearly every year. On a more local level, Snow Geese tend to concentrate in very large flocks on a small number of sites, which exacerbates the negative impacts of their presence in these areas, regardless of the total population size. In this context, close collaboration should be encouraged between hunters—the primary tool for controlling and dispersing the population—and farmers. Accordingly, we should:

- maintain the special management measures designed to increase harvest by hunting—such as the spring conservation harvest, which is the only measure that has shown to be effective in controlling the population size so far (Reed and Calvert 2007)—for as long as the target population size has not been reached;
- evaluate the need for local measures to help reduce the size of large groups and break up flocks; and
- implement measures to create a win-win situation for farmers and hunters, in both spring and fall.

7. Integrated resource management by local stakeholders and creation of an assistance program

Birdwatching and hunting activities, as well as the level of damage caused by Snow Goose to farmland, all vary from one region to the next. As a result, regional management is needed in order to increase the effectiveness of our measures. Regional stakeholders have the necessary knowledge to identify problem areas and develop tools that meet the needs of their region. Accordingly, we should:

- encourage the implementation of integrated management initiatives at the local or regional level;
- create regional issue tables so that the various stakeholders can work together and in synergy in every region facing this problem;
- improve communication and collaboration between the various stakeholders (hunters, farmers, birdwatchers, etc.) in order to better guide group decision making to manage the resource;
- encourage farmers who are already active and currently taking concrete action; and
- set up a financial, human or material resources aid program to support local integrated management initiatives.

8. Optimization of hunting activities

With a fall hunting period and a conservation harvest in the spring, the overabundant Greater Snow Goose population provides waterfowl hunters with many hunting opportunities. However, the number of participants in the spring harvest remains low, as does their hunting success rate. To stimulate interest, it will be necessary to develop tools to clear some of the obstacles that are limiting access to this resource. The main obstacle is that during their migration to Québec, the geese spend a large portion of their time on private land. Accordingly, we should:

- develop Québec-wide networking systems (e.g. via the Internet) to facilitate contact between hunters and landowners whose crops are being damaged by geese;
- identify the factors that are limiting hunting success and develop tools to overcome them;
- promote tools that build on existing structures to improve communication with regional waterfowl associations and hunters; and
- publish updated information on techniques for hunting Snow Geese in the spring and on the best time to hunt in each region of Québec in order to maximize hunting success.

Strategic directions

The various courses of action described above should be supported by specific measures that fall under four key strategic directions. Implementing these measures will make it much easier to achieve the objectives set out in the 2013–2018 Action Plan.

1. Increase scientific knowledge to optimize management of the Greater Snow Goose

1.1 Through knowledge acquisition

The behaviour of the geese constantly changes and adapts in response to environmental changes, both natural and human-made, and in response to the management measures that are implemented. Existing research activities and those allowing us to acquire new knowledge will support adaptive management of the resource. This could be done by:

1.1.1 maintaining the current scientific monitoring programs on the Greater Snow Goose, in particular the spring survey, the breeding monitoring and banding on Bylot Island, the annual fall productivity survey and the plant production monitoring in the tundra on Bylot Island;

1.1.2 resuming plant surveys in the bulrush marsh at the Cap Tourmente National Wildlife Area;

1.1.3 reviewing population size estimates from the spring survey using the new sampling protocol;

1.1.4 conducting a scientific assessment of the effect on the population of new management measures implemented in the U.S. in 2009;

1.1.5 creating a university research chair on the Greater Snow Goose; and

1.1.6 quantifying the effect of different hunting techniques, particularly stalking, on the success of hunting activities and flock movements.

1.2 Through analysis of information in existing databases

A large quantity of data available on different aspects of the Snow Goose is regularly (and sometimes routinely) compiled by a number of different stakeholders. Much of this information is currently spread out between different stakeholders, is not widely known about or is difficult to access; as a result, it is not being well used. Integrating these data with the scientific research and monitoring activities listed in Section 1.1 would allow us to get a better picture of the situation of the Greater Snow Goose in Québec and contribute to better management. This could be done by:

1.2.1 conducting a detailed inventory of all available data sources that may be connected with management of the Greater Snow Goose population and, where applicable, creating one or more easily accessible databases to establish links between different elements, thereby enabling better management;

1.2.2 tasking the strategic direction committee dedicated to increasing scientific knowledge (see foreword) with identifying areas where cross analysis is needed based on this detailed data inventory;

1.2.3 obtaining access to more detailed information from La Financière agricole du Québec, particularly for the specific geographical distribution of damage, while respecting privacy;

1.2.4 compiling a detailed list of the available data on hazing activities collected by the regional chapters of the Union des producteurs agricoles since the SGHM was introduced, and improving data collection techniques to promote the use and processing of these data;

1.2.5 documenting possible adaptations to farming practices that would help to reduce damage caused by geese;

1.2.6 having access to annually updated maps of the entire farmscape;

1.2.7 painting an economic picture of the Greater Snow Goose at the regional level across Québec in order to better quantify the costs and benefits of the bird's presence;

1.2.8 producing a third scientific report as a follow-up to the 1998 and 2007 reports to provide an updated assessment of all current and past Greater Snow Geese population management measures, and offering new recommendations as required; and

1.2.9 contributing to the North American Waterfowl Management Plan Committee's review of the objective for the target continental Greater Snow Goose population size, which is currently 500 000 birds (NAWMP 2012), to set an objective of 500 000 to 750 000 birds, taking into account the different variables that help establish a balance between the ecological and social parameters related to the geese's presence.

2. Promote the implementation of local integrated management mechanisms for the Greater Snow Goose

2.1 Through collaboration between different groups of stakeholders

Measures are being taken by different organizations, but communication between groups is not always easy. A better communication system would enable groups to work collaboratively and more effectively toward reducing crop damage. This could be done by:

2.1.1 developing networking systems to connect hunters and farmers across Québec, based on the model developed in Saguenay–Lac-Saint-Jean;

2.1.2 notifying hunters, by means of an alert, about birdwatching and hazing activities being carried out by the different chapters of the Union des producteurs agricoles;

2.1.3 developing a Québec-wide network of goose watchers and publishing their observations in real time—over the Internet, for example.

2.2 Through the involvement of regional stakeholders

Regional stakeholders are the most knowledgeable about the problems specific to their areas. Their collaboration and involvement are key to the effective management of the Snow Goose population. It is therefore essential that they be involved at the regional management level. This could be done by:

2.2.1 encouraging regional leaders to establish regional issue tables and to create favourable conditions for proposed measures; and

2.2.2 setting up an integrated damage prevention plan specific to regions facing a crop damage problem.

3. Educate and raise awareness among partners, local stakeholders and the public about the Greater Snow Goose problem and management activities

3.1 Through dissemination of information to affected stakeholders

Sharing information is a key factor in ensuring that the Greater Snow Goose issue is understood by all stakeholders, thereby encouraging their involvement. The measures put into action in all areas must be explained and shared to advance the objectives of the Action Plan. This could be done by:

3.1.1. maintaining the Greater Snow Goose Management Round Table, coordinated by Environment Canada, which meets once a year;

3.1.2. sharing conclusive results from the various measures under the Action Plan with other stakeholders as well as regional/national media; and

3.1.3. adapting these new management procedures to fit local/regional realities and receiving feedback on these measures.

3.2 Through a communications plan for the public

One consideration for management of the Greater Snow Goose is social acceptance of the tools used. It is therefore important to keep the public informed about the situation and the different measures being used to manage the population, as well as the objectives. This could be done by:

3.2.1 creating and publishing a list of locations and periods for harvest;

3.2.2 using marketing and promotional activities when introducing new management measures;

3.2.3 stimulating public interest in Snow Geese through various activities, including in schools; and

3.2.4 keeping an updated list of the best locations and periods for watching Snow Geese.

4. Encourage decision-makers from all organizations involved in managing the Greater Snow Goose population to adhere to the Action Plan and its implementation

4.1 To entice key stakeholders to commit to supporting the implementation of the Action Plan

The success of this kind of action plan relies on a commitment from the various organizations to move the issue forward to the extent of each organization's human or financial resources and mandate. Our goal is to increase interest in this Action Plan. This could be done by:

4.1.1 encouraging the directors of each organization involved to sign a declaration supporting the vision and strategic directions of the 2013–2018 Action Plan;

4.1.2 providing their organization's expertise to facilitate the implementation of regional integrated management programs;

4.1.3 maintaining coordination at the provincial level by Environment Canada's Canadian Wildlife Service; and

4.1.4 looking for innovative funding methods to help take concrete action at the local/regional level.

4.2 To find the necessary resources to implement the Action Plan

The migration of the Greater Snow Goose in southern Québec creates significant economic benefits (Groupe conseil Genivar Inc. 2005) but also significant losses in terms of crop damage. Better cost/benefit distribution between all stakeholders would help to increase social acceptance of the Snow Goose. This could be done by:

4.2.1 assessing the possibility of using some of the sales revenue from migratory bird hunting permits to set up a fund to supplement the shortfall in compensation provided to farmers;

4.2.2 exploring mechanisms through which birdwatchers and the tourism industry could contribute to the fund to supplement the shortfall in compensation provided to farmers;

4.2.3 exploring potential financial incentive options for farmers who participate in local/regional integrated management initiatives, i.e. in implementing other measures under the Action Plan; and

4.2.4 maintaining prevention and farmer compensation programs funded by relevant departments.

4.3 Through the implementation of appropriate regulations

The traditional fall hunting season and the spring conservation harvest are the main tools used by the Canadian Wildlife Service to manage the Snow Goose population (see Appendix IV). The eastern U.S. states now also have two different hunting periods: the fall hunting season and a special conservation hunting period (February to April – varies from state to state) to control the size of the Greater Snow Goose population. Although the population size has been relatively stable for the past several years, the geese adapt quickly to different management measures. As a result, it is important to be proactive and monitor the effectiveness of the special regulatory measures and modify the harvest regulations to achieve the target population size. This could be done by:

4.3.1 continuing to modify the hunting regulations until the target population size is reached;

4.3.2 adjusting regulations to suit the new realities of the Snow Goose population, as indicated by scientific research and monitoring; and

4.3.3 implementing flexible management mechanisms to swiftly react to changes in goose behaviours.

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Appendix I – Updated population size

Following a review of the sampling and analysis methodology used on the data from the 2010 spring population survey, some deficiencies were brought to light. Corrections were made from the 2010 survey on, and we have begun to review the estimates from certain years (lighter coloured bars in Figure 1). Despite an initial downward trend in the population size after the introduction of special conservation measures in Québec in 1998, the general trend over the past decade has been relative stability of the Greater Snow Goose population, at between 700 000 and 1 000 000 birds (Table 1).

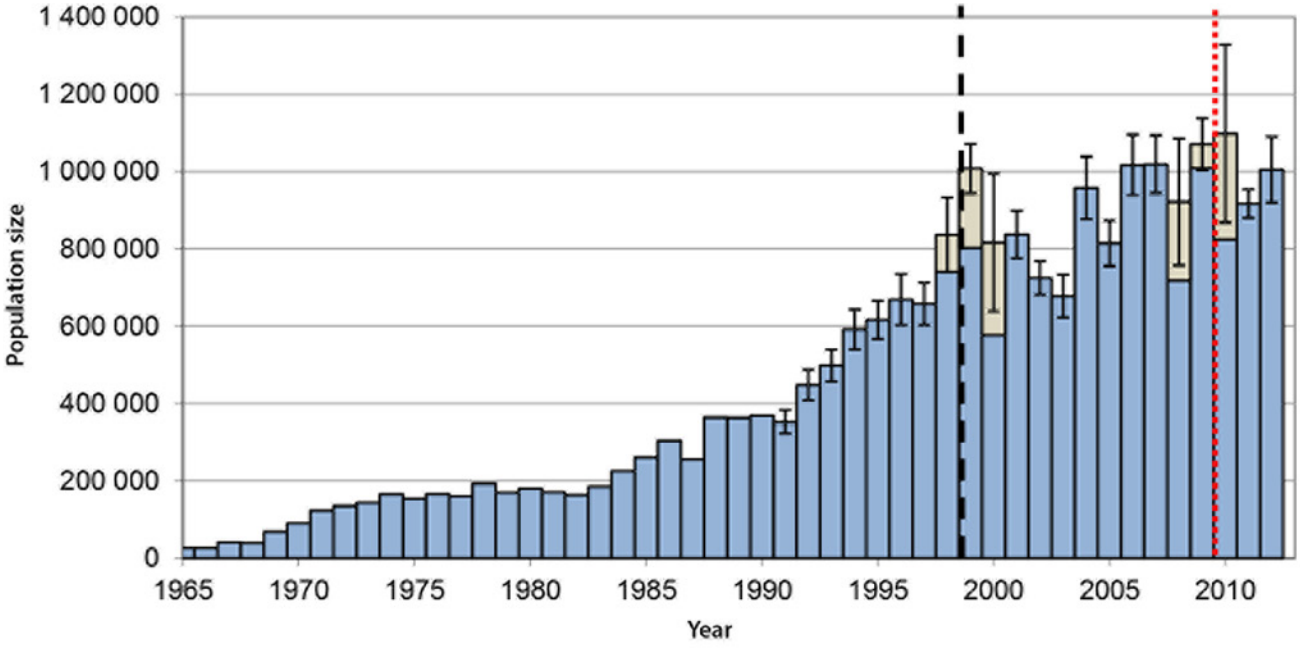

Figure 1. Estimate of the Greater Snow Goose population size from the spring survey conducted by the Canadian Wildlife Service, 1965–2012.

For 1998–2000 and 2007–2010, the lighter portion of the bars indicates a correction made based on a radio-tracking study. The error bars for those years are the confidence intervals of the total population, whereas the other confidence intervals represent the margin of error of the population estimate. The light blue bars are population estimates calculated according to the revised sampling methodology. The dotted black line indicates when special conservation measures were introduced in Québec, and the dotted red line indicates when such measures were introduced in the U.S.

Table 1: Estimate of the spring population and nesting success of the Greater Snow Goose, 1965-2012

Year	Estimated spring population[1]	Percentage of juvenile birds in autumn flight[2]		Brood size in fall[3]	
		Average	n	Average	n
1965	25 400				
1966	25 400				
1967	40 900				
1968	38 900				
1969	68 800				
1970	89 600				
1971	123 300				
1972	134 800				
1973	143 000	40.6	800	2.94	49
1974	165 000	6.4	7 282	2.19	119
1975	153 800	31.2	17 579	2.71	1 294
1976	165 600	12.6	20 847	2.46	419
1977	160 000	23.9	10 297	2.28	396
1978	192 600	17.9	9 679	2.34	309
1979	170 100	28.2	20 849	2.65	1 226
1980	180 000	35.3	12 120	2.76	651
1981	170 800	16.3	10 683	2.30	229
1982	163 000	25.1	9 577	2.48	661
1983	185 000	47.4	12 353	2.86	1 246
1984	225 400	30.4	39 781	2.63	2 434
1985	260 000	25.8	33 700	2.49	1 682
1986	303 500	2.3	22 998	1.89	74
1987	255 000	40.2	33 278	2.77	1 882
1988	363 800[4]	33.1	40 246	2.76	2 444
1989	363 200	31.1	29 191	2.59	2 014
1990	368 300	23.6	20 313	2.54	830
1991	352 600	38.3	15 102	2.69	1 247
1992	448 100	5.4	32 252	2.06	404
1993	498 400	47.8	24 163	2.75	2 743
1994	591 400	9.2	16 444	2.44	242
1995	616 600	16.6	19 519	2.47	665
1996	669 100	25.1	22 595	2.34	1 247
1997	657 500	36.8	17 586	2.69	1 222

Year	Estimated spring population[1]	Percentage of juvenile birds in autumn flight[2]		Brood size in fall[3]	
		Average	n	Average	n
1998	836 600[5]	33.1	17 982	2.52	1 440
1999	1 008 000[5]	2.1	20 394	2.09	91
2000	816 500[5]	22.7	20 468	2.54	1 302
2001	837 400	27.5	22 106	2.36	1 072
2002	725 000[6]	6.0	18 930	1.91	274
2003	678 000	27.0	15 900	2.36	1 092
2004	957 600	17.8	26 206	2.44	1 031
2005	814 600	20.7	29 022	2.38	1 470
2006	1 017 000	19.7	23 378	2.34	1 143
2007	1 019 000	20.6	25 463	2.28	1 371
2008	922 000[5,6]	40.0	32 020	2.62	3 188
2009	1 071 000[5,6]	10.6	28 969	2.08	753
2010	1 098 000[5,6]	19.6	27 030	2.25	1 533
2011	917 000[6]	28.0	31 719	2.42	2 291
2012	**1 005 000[6]**	12.2	25 822	2.19	834

1. Based on count from aerial photos.
2. Based on visual counts from the ground.
3. Broods with two parents.
4. No inventory was made – value derived from the population model published by Gauvin and Reed (1987).
5. The 1998 to 2000 and 2008 to 2010 estimates have been corrected for flocks of geese that were missed during the inventory based on radio-tracking data.
6. Estimates based on revised sampling methodology.

Appendix II – List of members (and their affiliation) of the Greater Snow Goose Management Round Table who participated in the workshop on January 25 and 26, 2012

Michel Baril	Fédération québécoise des chasseurs et pêcheurs
Daniel Bordage	Canadian Wildlife Service, Environment Canada
Isabelle Breune	Agriculture and Agri-Food Canada
Guylain Charron	Confédération de l'Union des producteurs agricoles
Carol Deschênes	Fédération québécoise des chasseurs et pêcheurs
Bernard Dubé	La Financière agricole du Québec
Marie-France Gagnon	Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec
Gilles Gauthier*	Université Laval
Benoit Gendreau*	Montmagny Regional County Municipality
Clément Gilbert	Fédération québécoise des chasseurs et pêcheurs
Jean-François Giroux*	Université du Québec à Montréal
Claude Grondin	Fondation de la faune du Québec
Jean-Sébastien Guénette	Regroupement QuébecOiseaux
Benoît Jobin	Canadian Wildlife Service, Environment Canada
François Lachance	Quebec Outfitters Federation
Josée Lefebvre*	Canadian Wildlife Service, Environment Canada
Katerine Montcalm	Fédération de l'Union des producteurs agricoles de la Côte-du-Sud
Bruno Nicole	Fédération de l'Union des producteurs agricoles de la Côte-du-Sud
France Papineau*	Conseil pour le développement de l'agriculture au Québec
Catherine Poussart	Ministère des Ressources naturelles et de la Faune du Québec
Sébastien Rioux	Fondation de la faune du Québec

* Member of the drafting committee

Appendix III – Updated information on damage caused by waterfowl

To understand the progression of crop damage caused by waterfowl since the implementation of this program, we have conducted a simple analysis of the compensation data from the waterfowl crop damage compensation program (which includes damage from Snow Geese, Canada Geese, Sandhill Cranes and ducks) provided by La Financière agricole du Québec. To find trends, we used the affected areas rather than compensation costs (the dollar amount varies over time and is based on the market).

A significant upward trend was noted between the total area of damaged farmland and the year ($F = 7.088$; $df = 1$ & 19; $p = 0.01539$). However, the "year" variable only explains 23% of the variability in the total area affected. It was also noted that there is no relationship between the Greater Snow Goose population size and the area of affected farmland ($F = 0.3426$; $p = 0.566$), but there is a significant connection between population size and year ($F = 14.2808$; $p = 0.0014$).

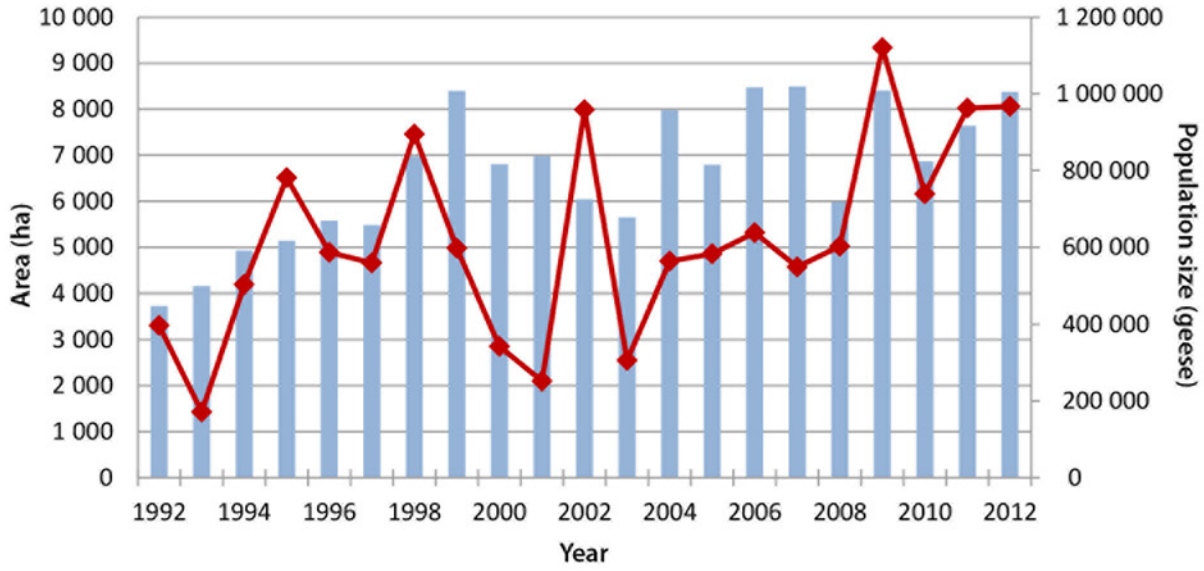

Figure 2: Total area of farmland that received compensation from La Financière agricole du Québec (curve), overlaid with Greater Snow Goose population size (vertical bars), 1992–2012. For 2012, the total area of affected land is provisional (data source: Direction de l'intégration de programmes, La Financière agricole du Québec).

Appendix IV – Updated Greater Snow Goose harvest levels

Harvest of juvenile birds varies greatly from year to year and is dependent on nesting conditions in the Arctic. However, harvest of adult birds has a direct impact on population size. Some trends have been observed based on the different hunting seasons studied (Figure 3).

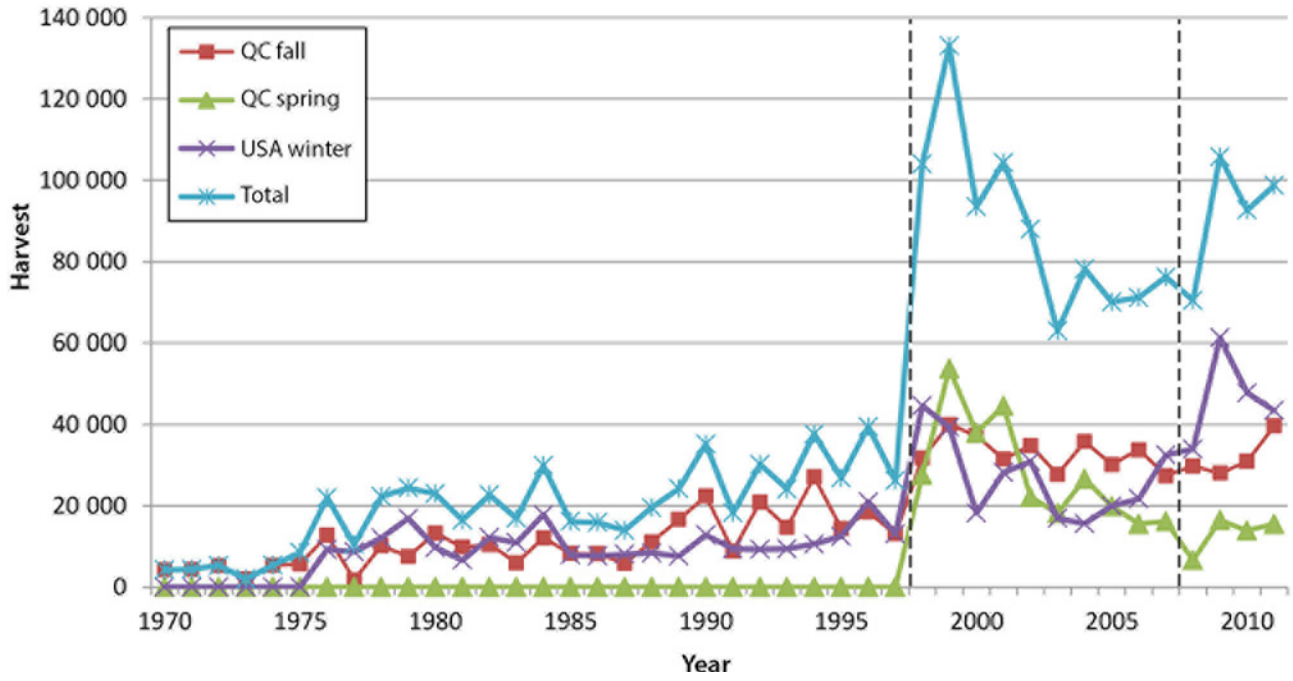

Figure 3: Estimate of the adult goose harvest during different hunting seasons in Québec and the United States between 1970 and 2011. Data are from the Canadian Wildlife Service and the Atlantic Flyway Council. The first black dotted line indicates when special conservation measures were introduced in Québec, and the second line indicates when such measures were introduced in the U.S.

There was an increase in the adult harvest in Québec during the regular fall season, after regulations were eased in the fall of 1998. This was followed by a slight decrease, and then by a period of stabilization in recent years. The spring conservation harvest in Québec was initially very successful for the first few years after it was introduced in 1998, but it has been in decline since then. There has been a gradual increase in the adult harvest in the U.S. since special conservation measures were introduced there in 2009. An estimated 60 000–140 000 Greater Snow Geese are harvested every year.

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Additional information can be obtained at:

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