

EHJV • PCHE

EASTERN
HABITAT JOINT
VENTURE



LE PLAN
CONJOINT DES
HABITATS DE L'EST

QUEBEC IMPLEMENTATION AND EVALUATION PLAN

2007 – 2012

28 August 2007

Letter of Transmittal

We are pleased to approve this document which describes implementation of the North American Waterfowl Management Plan in Québec. This plan reflects the broad interests of all parties to protect and improve the biodiversity of wetland and upland habitats throughout the province of Québec.

Approved by the members of the Québec Steering Committee on September 26th, 2008

Chairperson: Nicole Perreault
Chief, Service de la faune terrestre et de l'avifaune
Ministère des Ressources naturelles et de la Faune



Members :

Bernard Filion
Manager of Québec Operation
Ducks Unlimited Canada, Québec region

Patricia Houle
Regional Director
Environment Canada – Canadian Wildlife Service, Québec region

André Martin
President and chief executive officer
Fondation de la faune du Québec

Nathalie Zinger
Regional Vice-President
The Nature Conservancy of Canada, Québec region

Executive summary

The Eastern Habitat Joint Venture (EHJV) in Quebec is a partnership of federal, provincial and regional conservation organizations that is focused on the protection and conservation of wetland habitats for waterfowl. The joint venture was originally formed in 1989 as a regional partnership whose aim was the conservation of wetlands and waterfowl under the North American Waterfowl Management Plan (NAWMP). This new Implementation and Evaluation Plan is a revision of the original 1990-2004 Implementation Plan and it addresses the updates to NAWMP. This plan outlines changes in habitat and waterfowl populations that have occurred over the past 15 years, and gives a current status assessment for waterfowl and their associated habitats. The plan also presents waterfowl and habitats goals for the next 5-year implementation period. This document is intended as a blueprint for the conservation of valuable breeding, migration and wintering waterfowl habitat present in the EHJV in Quebec based on the best available information and the expert opinion of regional waterfowl biologists. This revision also provides a great deal of baseline information necessary for moving forward with a more rigorous approach for setting future habitat goals as additional information becomes available and documents information gaps that have to be addressed before additional progress can be made.

More importantly, this plan outlines the conservation programs that will be implemented to protect waterfowl habitat in Quebec. The programs will be a suite of Intensive and Extensive programs geared towards wetland conservation. A detailed description of each component within both conservation programs is presented. In addition, the success of the EHJV hinges on delivering the right conservation programs. To achieve the latter, this plan also includes an evaluation strategy that will allow the EHJV team to assess program efficacy and permit the refinement of programs on an ongoing basis.

This document is divided into different sections that:

- Describe important breeding, migration, and wintering habitats;
- Report on habitat and waterfowl changes over the past 15 years;
- Report on current status of waterfowl populations and habitats;
- Describe threats to waterfowl;
- Describe conservation programs and evaluation strategy;
- Present waterfowl and habitat goals;
- Describe how these programs can benefit other bird groups;
- Describe resource needs and funding sources;
- Describe governance processes and relationships;
- Describe communications and education.

Table of contents

Executive summary	2
Table of contents	3
List of Tables	4
List of Figures	4
List of Appendices	4
Acknowledgements	5
1. Introduction	6
General description of Quebec	8
2. Changes in habitat and waterfowl populations over the past 15 Years	14
3. Analysis and establishment of priority areas	21
3.1 Analysis of priority ecoregions in Quebec	21
4. Waterfowl status	25
4.1 Priority species	25
4.2 Habitat threats	30
4.3 Waterfowl population and habitat objectives	32
5. Conservation programs	40
5.1 Intensive programs	41
5.2 Extensive programs	44
5.3 Evaluation	45
6. Resource needs	52
7. Integration with other Bird Conservation Initiatives	53
8. Implementation processes and relationships	54
9. Communications and education	55

List of Tables		Page
Table 1	A detailed description of projected and accomplished habitat objectives for the EHJV, Quebec region from 1989 to 2004.	16
Table 2	Changes in wetland area along the St. Lawrence River between 1990 and 2002 (data from the Centre St-Laurent of Environment Canada).	17
Table 3	Examples of direct effects of EHJV activities on waterfowl performance measures.	19
Table 4	EHJV and provincial priority waterfowl species.	26
Table 5	Quebec waterfowl population baselines per BCR.	34
Table 6	Waterfowl breeding population objectives (indicated breeding pairs; IBP) for Quebec.	35
Table 7	Waterfowl staging and overwintering population objectives (no. of individuals) for Quebec.	36
Table 8	Quebec overall waterfowl population objectives per BCR.	37
Table 9	Projected habitat goals to be achieved through intensive and extensive conservation programs.	39
Table 10	Forecasted financial resources required to achieve EHJV waterfowl habitat goals 2007-2012.	52

List of Figures		Page
Figure 1	Bird conservation regions in Quebec.	10
Figure 2	Temporal trend of total breeding ducks (indicated pairs) in the Boreal forest of Quebec from 1990 to 2005.	18
Figure 3	Decision support matrix to determine priority ecoregions in Quebec.	22
Figure 4	Priority ecoregions in Quebec.	23
Figure 5	Priority landscapes in southern Quebec.	24
Figure 6	Priority wetlands in southern Quebec.	24
Figure 7	Conservation approach at different spatial scales.	40
Figure 8	Conceptual framework for the evaluation of the EHJV in the Quebec region.	47
Figure 9	Basic conceptual model for adaptive management.	51

List of Appendices

Appendix 1	Conservation planning for other bird groups under NABCI	56
------------	---	----

Acknowledgements

Several partners of the Quebec EHJV partnership provided valuable input during the preparation of this implementation and evaluation plan. Production of this plan (writing, design, and publication) was funded by the Canadian Wildlife Service of Environment Canada - Quebec region (CWS).

Valuable comments and contributions to overall plan development were provided by Raymond Sarrazin (CWS), Mark Gloutney (DUC), Bernard Fillion (DUC), Luc Bélanger (CWS), and the waterfowl biologists of the CWS – Quebec region. Jason Beaulieu (DUC) provided many of the maps for the plan, and Judith Kirby (DUC) provided insightful comments.

Raymond Sarrazin (CWS) provided overall direction and support for the plan on behalf of the Steering committee, and all of his input was greatly appreciated.

1. Introduction

North American Waterfowl Management Plan

The North American Waterfowl Management Plan (NAWMP, hereafter referred to as the Plan), is a long term conservation agreement that was signed in 1986 by Canada and the United States, and in 1994 by Mexico. The Plan is an innovative conservation initiative that was developed in response to declining continental waterfowl populations during the early 1980's. The main objective of NAWMP is to restore waterfowl populations to the levels that were present in the 1970's by protecting and restoring habitats that could ensure their survival and also benefit other wetland-dependent wildlife. In addition, the Plan shifted waterfowl management from site-specific habitat protection to a landscape-based waterfowl conservation approach. The Plan is a partnership between federal, state, and provincial governments and non profit organizations where all partners combine their resources to achieve the objectives of the Plan by funding conservation projects throughout North America. The implementation of the Plan was established through a series of joint ventures that address specific problems related to geographic locations or to species that deserved special attention due to serious population declines.

Funding for NAWMP has been through the North American Wetlands Conservation Act, a legislation that facilitates the transfer of U.S. funds (government and non-government) to Canada and Mexico to further support the conservation of wetland habitats.

Since its introduction in 1986, NAWMP has undergone 3 updates (1994, 1998, and 2004). In one of its updates, the Plan called for an all-bird conservation approach in its further implementation plans, and current implementation strategies are to include all birds into conservation programming.

North American Bird Conservation Initiative

The North American Bird Conservation Initiative (NABCI) was established in 1999 and endorsed by all three North American governments (Canada, U.S., and Mexico) as a means to ensure the protection, enhancement, and restoration of all of North America's native birds and their habitats. The main goal of NABCI is the long term conservation of the native North American bird populations, by reinforcing the efficiency of present and future activities, by improving effort coordination and by favoring and increased cooperation between the continent's countries and citizens. NABCI's vision is stated as follows:

NABCI aims to ensure that populations and habitats of North America's birds are protected, restored and enhanced through coordinated efforts at international, national, regional and local levels guided by sound science and effective management.

Eastern Habitat Joint venture

The Eastern Habitat Joint Venture (EHJV), one of 18 joint ventures initiated across North America, was established in November 1989 to address critical issues facing waterfowl populations of eastern Canada. The main objective of the EHJV is to protect

and restore wetlands in eastern Canada that produce the majority of waterfowl populations in the Atlantic flyway and also contribute to the Mississippi flyway. The EHJV focuses on habitat issues and its programs are geared towards maintaining, restoring, and enhancing the abundance and quality of wetlands and associated upland habitats in the region. These habitats provide the breeding, migration, and wintering requirements of a wide range of waterfowl and other wildlife species.

The original objective of the EHJV as outlined in the original Plan called primarily for the securement and protection of migration habitat, but it became clear that the greatest limitation to waterfowl populations in eastern Canada was the lack of quality and quantity of brood rearing habitat. This assumption was based on sound biological information and remains true today. The biological assumptions that drive the development of the programs in the current EHJV 5-year implementation and evaluation plan are the following:

1. Breeding habitat (including snag availability for cavity nesting species) and the quality and quantity of brood rearing habitat are the main factors limiting waterfowl recruitment and affecting other bird and wildlife species as well, in particular endangered species, in both agricultural and forest landscapes.
2. Staging and moulting habitat are under various anthropogenic pressures and need further protection and restoration to support increased populations of most waterfowl and wetland-related species.
3. Wintering habitat is critical to some local breeding populations, particularly Barrow's Goldeneye and Black Ducks, but the conservation issue is rarely related to natural habitat conditions.

The purpose of this Implementation and Evaluation Plan is to decide how habitat and waterfowl objectives will be achieved through the use of different conservation programs. The Implementation and Evaluation Plan is designed to be comprehensive and dynamic (adaptive management), and its purpose is to continue to promote broad support for wetland conservation.

In Quebec, the EHJV is a conservation partnership between Ducks Unlimited Canada - Quebec region, Ministère des Ressources naturelles et de la Faune, Canadian Wildlife Service – Quebec region, Nature Conservancy Canada – Quebec region, and Fondation de la faune du Québec. The objectives of the Eastern Habitat Joint Venture in Quebec are:

1. To promote large scale wetland conservation through the modification of provincial and municipal land use, agricultural, and forestry policies.
2. To protect, by securement and stewardship, residual wetlands and associated uplands currently subjected to high pressures resulting from urban, industrial, and agricultural development.

3. To restore and enhance the most severely degraded wetlands and also those having the greatest ecological potential.

General description of Quebec

Quebec stretches more than 1,950 km from north to south, and more than 1,500 km from east to west at certain latitudes. The province's total land area is 1,668,000 million km², of which 92% is crown land (mostly boreal forest habitat). The land is dominated by forests (940,000 km²) and fresh water (184,000 km²). The province has a high diversity of landscapes including seven terrestrial and two marine ecozones. There are three major ecological regions in the province of Quebec: the Canadian Shield, the Appalachians, and the St. Lawrence River Valley. The Canadian Shield is the largest physiographic region and is characterised by waters that are poorly buffered, weakly mineralised, and have little biological productivity. Other regions have more productive waters with high levels of organic matter, the St. Lawrence Plains being by far the most productive.

The remaining privately-owned lands (approximately 8%) are found in the southern part of the province and are used mainly for agriculture. The amount of land under cultivation was at its peak in Quebec during the middle of the 19th century, with more than 3 million hectares (ha) cultivated. In the 1940's there was a transition from local, family subsistence farming to more industrial farming practices that were oriented to regional and national markets. Over the last few decades, an increasingly intensive and prospering agriculture occurs in the south-west, and a more traditional mixed agriculture is found in other parts of the province. Today, close to 2,5 million ha of land is farmed in Quebec. The type of agriculture production varies greatly and is strongly influenced by local climatic and soil conditions.

Quebec borders two oceans and has over 8,000 km of coastline, 4,000 km of which are directly associated with the St. Lawrence River. Along these coastlines, there are over 900,000 ha of marshes, 800,000 ha of which are marshes with emergent or submerged vegetation located along the St. Lawrence River. The St. Lawrence River is the jewel in the crown of the Quebec landscape. On a world scale, the river ranks 17th in length, 13th in watershed area, and 15th in discharge volume. It is also fed by some 350 tributaries and contains more than 1,250 islands. Unfortunately, there are few estimates on the density of marshes for regions in the interior of the province. The highest densities of marshes are found in the James Bay Lowlands, ranking among the highest densities in the world.

A large part of Quebec's economy centres on the use of natural resources (agriculture, forestry, mining), making up 3.2% of the GDP. Since Quebec's landmass (with the exception of the taiga and tundra) originally was primarily forested, commercial forestry and deforestation for agricultural use in the southern

areas created conditions for a greater diversity and density of new waterfowl species, to the detriment however of indigenous populations such as the Black duck.

Another important characteristic of Quebec's landscape is the human occupation of the territory. The St. Lawrence River Valley has been central to Quebec's development since the start of European settlement for reasons that have changed little in 300 years. Quebec's population, estimated at 7.6 million in 2005, makes up 23.5% of Canada's total population. About 97% of its population lives within the St. Lawrence River's watershed, and two thirds of the population (69.5%) inhabit a 10-km strip of land on either side of the river. In fact, more than 50% of Quebec's population resides in only 0.7% of its territory, resulting in negative effects on the local waterfowl populations in these regions. Also, this part of the territory (St. Lawrence River area) is where we find the greatest number of privately-owned lands in Quebec.

The province of Quebec plays a key role in the conservation of North American waterfowl populations that are part of the Atlantic and, to a lesser extent, the Mississippi flyways. Quebec is important to waterfowl species on three levels. First, many wetlands and associated uplands are used as staging areas by Arctic breeding species during spring and fall migrations. It is estimated that over five million ducks and geese use wetland habitats during the fall migration. Second, approximately 1.2 million ducks and geese breed in the province. Lastly, a few hundred thousand aquatic birds choose to overwinter in Quebec.

The habitats where waterfowl are found are very diverse and include freshwater marshes, lakes, beaver ponds, rivers, bogs, and agricultural lands. Even though each species has its own specific habitat requirements, waterfowl breed from the southern St. Lawrence River valley to the Arctic tundra, and eastward from the Hudson Bay to the province's eastern shore. Although waterfowl are found throughout the province, certain specific sites are considered more critical because of the high numbers of aquatic birds that use these sites and the greater threats to habitat loss that we find in these areas. The latter high use sites are very important because their loss could have repercussions to waterfowl populations at the local, national, and international scales.

Quebec's vast landscape can be divided into six key program areas that represent the six Bird Conservation Regions (BCR) of the province. These BCR's are illustrated in Figure 1, and described in the text.

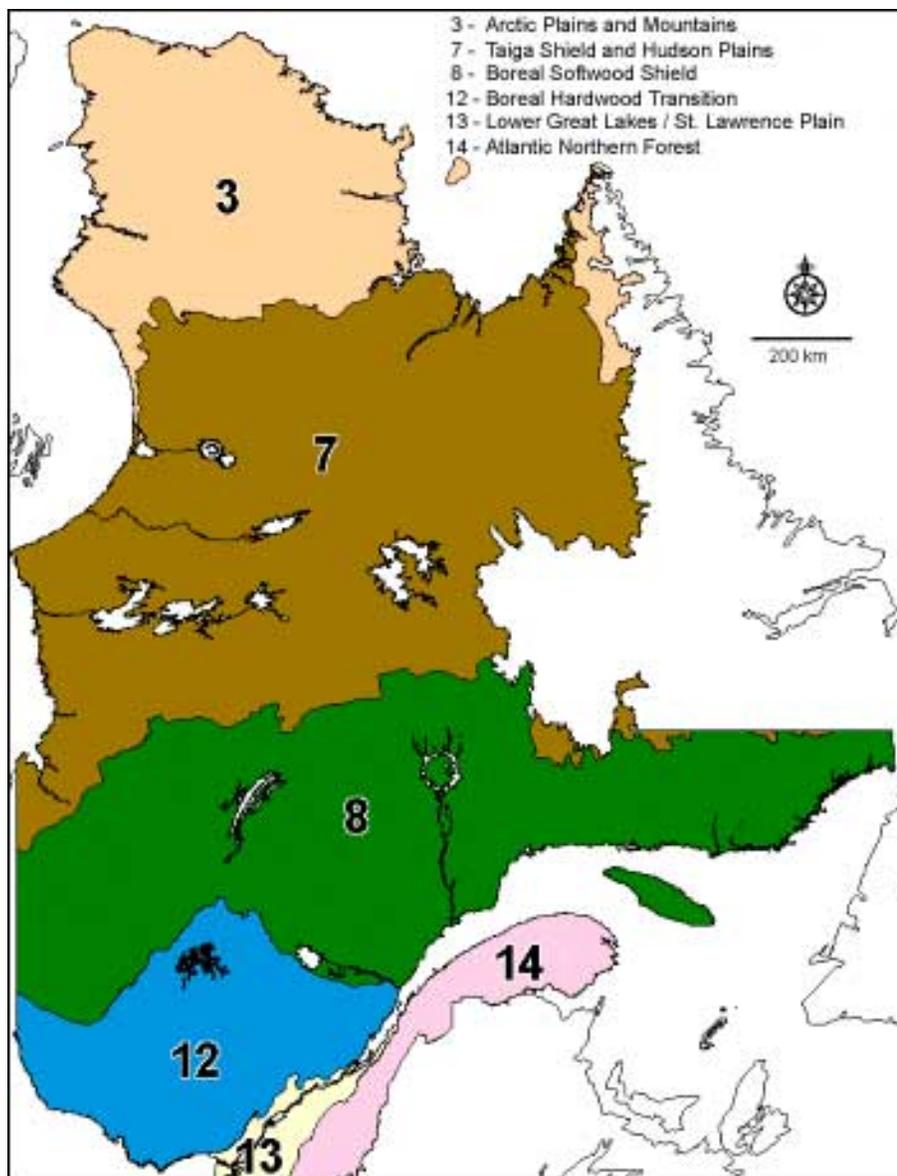


Figure 1. Bird conservation regions in Quebec.

BCR 3 (Arctic Plains and Mountains)

This BCR is located at the extreme north of Quebec. It covers 203,000 km² and represents 13.7% of the province's land area. This region includes low-lying coastal tundra. Because of thick and continuous permafrost, surface water dominates the landscape. Freezing and thawing form a patterned mosaic of polygonal ridges and ponds. Over 1.6 million ha of wetland area is found within this BCR in Quebec. Because of this wetness, waterfowl dominate the avian community. The most abundant breeding birds are the common eider and the Canada goose.

BCR 7 (Taiga Shield and Hudson Plains)

This BCR includes 553,437 km² of the Quebec landscape. This BCR includes the Hudson Plains and the James Bay lowlands, a very extensive area of wetlands that extends onto the Canadian Shield. The subarctic climate is characterized by relatively short, cool summers with prolonged periods of daylight and long, very cold winters. The poorly drained areas of the Hudson Plains support dense sedge-moss lichen cover, with open woodlands of black spruce and tamarack in better-drained sites. Coastal marshes and extensive tidal flats are present along the coastline. The Canadian Shield is characterized in upland sites and along rivers by aspen, mixed-wood forest of white spruce, balsam fir, trembling aspen, balsam poplar, and white birch. Further north, approaching the geographical limit of tree growth, stunted black spruce and jack pine dominate, accompanied by alder, willow and tamarack in the fens and bogs. Thousands of lakes and wetlands occur in glacially carved depressions, and peat-covered lowlands are commonly waterlogged for prolonged periods due to discontinuous and widespread permafrost. Close to 7.8 million ha of wetland area is found within this BCR in Quebec. The abundance of water provides an important habitat for breeding waterfowl. Representative waterfowl include Canada goose, Common eider, scoters, mergansers, Ring-necked duck, scaups, Green-winged teal, and Common goldeneye. The vast size of this wetland area results in a fall flight of more than 2 million waterfowl. The coasts of Hudson and James Bay also provide critical shorebird staging habitat, funneling millions of birds southwards during the fall migration.

BCR 8 (Boreal Softwood Shield)

In Quebec this BCR covers 461,000 km², which represents 31% of the total area of the province. It is a broad region comprised of seacoasts in the east and vast areas that are more than 80% forested by closed stands of conifers, largely white and black spruce, balsam fir and tamarack. Toward the south, broad leaf trees, such as white birch, trembling aspen and balsam poplar, are more widely distributed. The region is a broadly rolling mosaic of uplands and associated wetlands, dotted with numerous small to medium-sized lakes. Over 4.0 million ha of wetlands are found in this BCR in Quebec. The Abitibi-Temiscamingue ecoregion to the west is marked by lacustrine clay with high biological productivity located next to marine clay deposits of the James and Hudson Bays lowlands. Wetlands in Abitibi represent more than 25% of the surface area and the region has a high beaver population with more than 6 colonies/10 km². Pressures on these regions originate from human activity, namely agriculture, forestry operations, and mining exploitation.

The Quebec boreal forest generates a fall flight of more than 2.2 million waterfowl including Black duck, Common goldeneye, Ring-necked duck, Canada goose, and mergansers.

Ducks Unlimited is currently working with several partners to develop a greater collective understanding of the Quebec boreal ecosystem to enable the conservation of its tremendous ecological values and benefits to waterfowl and other wetland associated bird populations.

BCR 12 (Boreal Hardwood Transition)

This BCR covers 173,000 km², represents 12% of the province's total land base, and contains close to 1 million ha of wetland area. This region is characterized by coniferous and northern hardwood forests, nutrient-poor soils, and numerous clear lakes, bogs, and rivers.

Although breeding ducks are sparsely distributed throughout this BCR, stable water conditions allow for consistent reproductive success. Black ducks, Ring-necked ducks, mergansers, Common goldeneyes, Mallards, Green-winged teals, and Wood ducks are breeding species commonly found in this region. Threats to wetland habitat in this BCR include forestry, industrial and recreational activities. Because of the similarity in threats and habitat use, goals, assumptions and strategies for this BCR are the same as they are for BCR 8 – the Boreal Softwood Shield.

BCR 13 (Lower Great Lakes / St. Lawrence Plain)

The St. Lawrence Plain portion of the BCR is located in the province of Quebec. It covers 27,000 km² and represents only 1.8% of the total area of the province. However, 90% of the land base is in private ownership and this area supports 80% of the province's human population. The St. Lawrence lowlands have experienced the highest historic wetland losses, which continue today. Wetland losses are compounded by long-term gradual degradation of wetland functions. This region was originally covered with a mixture of oak-hickory, northern hardwood, and mixed-coniferous forests. Very little forest cover remains today due to agricultural conversion, forest harvesting, and urban expansion. This physiographic area is extremely important to stopover migrant waterfowl in eastern North America such as the Greater snow goose. It is also valuable as breeding habitat to Mallards, Black ducks, Green-winged teals, mergansers, and eiders. The fluvial and estuarine ecoregions of the St. Lawrence River possess extensive marsh complexes of high biological productivity as well as numerous islands where breeding duck densities reach colonial importance. For instance, eider duck colonies may carry 600 nests/acre.

BCR 14 (Atlantic Northern Forest)

This BCR covers 67,000 km² in Quebec, representing 4.5% of the total area of the province. The nutrient-poor soils support spruce-fir forests on more northerly and higher sites and northern hardwoods elsewhere. There are 115,693 ha of wetlands in this

region. Wetland habitat loss (quality and quantity) has occurred and there is continuing pressure from agriculture, forest exploitation as well as from numerous developments for resorts and outdoor recreation. Waterfowl breeding densities are typically low. Black ducks, Mallards, Ring-necked ducks, Green-winged teals, Common goldeneyes, and mergansers are the most common ducks found in this landscape.

2. Changes in habitat and waterfowl populations over the past 15 Years

Most of the activities of EHJV partners in Quebec over the past 15 years have been focused on the protection, enhancement, and restoration of wetland habitats along the St. Lawrence River valley because it was deemed that the most serious threats to habitat loss were located in this Key Program Area. The St. Lawrence River valley is a landscape composed mainly of agricultural lowlands that support a diverse waterfowl community by providing important breeding, staging (spring and fall), moulting and wintering habitats. Its geographic location, waterways and combination of gentle topography, fertile soils, warm growing season and abundant rainfall have made it one of the most intensely used and populated areas in Canada. It covers approximately 44,572 km² of mostly privately-owned land.

At one time, this area was covered by large tracts of contiguous forests, supporting more species of trees than any other region in Canada. In some areas of southern Quebec, less than 10% of the forest cover remains, and where it exists there are mixed-wood forests of sugar maple, yellow birch, eastern hemlock, and eastern white pine. A variety of tree species occupy drier areas (red pine, eastern white cedar, and red oak) and more humid areas (red maple, black ash, white spruce, tamarack, and eastern white cedar). The southwest portion of Quebec is intensively cultivated farmland (60%) with corn being the dominant crop. The central and eastern parts of the province show a more traditional agriculture (dairy and mixed farming). Urban development is extensive near Montreal and Quebec City. Total population in this part of the landscape reaches approximately 5,910,000 inhabitants.

Unlike other parts of the province of Quebec, some wetland mapping of the St. Lawrence River Valley has been done. The freshwater marshes of the river include those situated along its shores, as well as the vast stretches of submerged grass flats, archipelagos and numerous alluvial islands. Six island archipelagos, consisting of 224 islands ranging in size from 0,1 to 1,800 ha, are located in the fluvial sector of the river. Almost 38% of the cover on these islands consists of tall-grass meadows of reed canary-grass, while 14% is low-grass meadows and their plant composition depends mostly on past agricultural (pasture, cultivated, etc.) use of the land. These islands are surrounded by 3,000 ha of marshes with emergent and submerged vegetation, but there are more than 63,000 ha of marshes in the freshwater section of the river.

There are no historical records of the landscape that we can use to determine the amount of wetlands that have been lost before the implementation of the Eastern Habitat Joint Venture. However, major losses are known to have occurred in southern Quebec in areas where human activities have been the most intensive since colonisation. Initial losses of wetlands were due to the transformation of the land for agriculture, but recent losses are attributed to urban development, industrialisation, and the development of large transport networks. For example, over 4,000 ha of marshlands have been destroyed or heavily degraded along the St. Lawrence River over the past 50 years.

In the inland St. Lawrence Valley, wetland losses along the river's tributaries have probably exceeded this, given that more than 45,000 km of streams in the region have been altered and over 1 million ha of lands have been drained for agricultural purposes. Changing the course of waterways began early in the past century, but was most intensive from 1944 to 1965, with a total of 25,000 km of waterways being altered. From 1963 to 1991, 20,000 km of 13,180 waterways were altered. By the end of 1991, close to 325,000 km of agricultural drainage pipes had been installed draining over 586,000 hectares. These projects have cumulatively altered 80% of all waterways in the St. Lawrence Lowlands. Changes such as these have had a severe impact on the habitats and plant and animal communities that were traditionally found along the St. Lawrence River, including waterfowl.

It comes as no surprise, therefore, that recent habitat and land use mapping carried out by the Canadian Wildlife Service in southern Quebec shows that wetlands cover less than 10% of the St. Lawrence Valley, whereas marshes and bogs account for less than 1% of the total area. However, it should be noted that historically the St. Lawrence Lowlands probably did not include many large wetlands because the region consisted largely of deciduous forests. Indeed, the historically high density of small diversified riparian wetlands of the St. Lawrence Plain have been dramatically reduced by deforestation, alteration of waterways, and intensive ground drainage for agricultural purposes.

Habitat conservation in Quebec was ensured by a series of intensive and extensive programs. Habitats acquired through a combination of lease, easement, donation, or purchase comprised the majority of the intensive programs within the EHJV, whereas stewardship and changes in legislation on crown lands constituted the extensive programs. The original habitat objectives for the Quebec region that were set out in the 15-year EHJV implementation plan, as well as habitat accomplishments, are listed in Table 1.

Table 1. A detailed description of projected and accomplished habitat objectives for the EHJV, Quebec region from 1989 to 2004.

Program	Projected (hectares)	Accomplished (hectares)
INTENSIVE PROGRAMS		
Securement	25,088	13,100
Enhancement		
Mgmt. of existing impoundments	1,010	2,000
Beaver habitat mgmt.	6,060	N/A
Level ditching	768	340
Upland cover	4,040	4,523
Agricultural practices	8,080	2,165
Eider nest structures	1,500 structures	1,210 structures
Eider nesting cover	202	387
Inland nest structures	1,200 boxes	3,700 boxes
Restoration		
Exotic species	0	766
New impoundments	4,848	4,643
EXTENSIVE PROGRAMS		
Stewardship	32,320	3,173
Legislation on private lands	149,480	N/A
Legislation on crown lands	143,420	421,872
TOTAL	375,316	452,969

One area where we can link the impact of EHJV activities to improved landscape conditions from the 1970's is the wetland area along the St. Lawrence River. The available information that we currently have to assess habitat conditions/changes is a comparison of wetland area along the St. Lawrence River. Historical changes can be determined from information on wetland area modifications between the 1950's and the early 1980's. This assessment was based on a comparison of aerial photographs taken at these different times and shows that approximately 4,000 ha of wetlands were lost during this 30-year period. Most of this loss was due to urban and industrial development or to a transformation of wetlands into agricultural lands.

We also have more recent comparative data for landscape conditions along the St. Lawrence River between 1990 and 2002, and these encompass changes that may be in large part due to the work carried out by EHJV partners. Remote sensing was done along 1 km strips located on both shores of the St. Lawrence River system in 1990 and 2002 and the results are shown in Table 2. The latter show that a net gain was obtained during the first implementation period.

Table 2. Changes in wetland area along the St. Lawrence River between 1990 and 2002 (data from the Centre St-Laurent of Environment Canada).

Sector	1990-1991 (ha)	2000-2002 (ha)	Difference
Lac Saint-François	2508	2508	0
Beauharnois-Valleyfield	113	103	-10
Lac Saint-Louis	644	694	50
La Prairie bassin	0	2	2
Montréal-Longueuil	268	271	3
Varenes-Contrecoeur	860	941	81
Lac Saint-Pierre	16180	16102	-78
Fluvial estuary	2517	2999	482
Quebec-Levis	951	952	1
Middle estuary	3123	3278	155
Maritime estuary*	993	1166	173
Total	28157	29016	+ 859

*partial data

It is reasonable to believe that EHJV securement and enhancement actions along the St. Lawrence have significantly contributed to maintaining waterfowl habitats in several key areas along the river, namely the Lac St. Louis and the Îles de Varenes-Contrecoeur sectors. The most important waterfowl breeding sites have been secured in the St. Lawrence system, and without the intervention of the EHJV these habitats would certainly have been lost to urban, industrial, and agricultural development.

The 1989-2004 EHJV implementation plan also included waterfowl production objectives that were to be achieved within a 15-year time frame. The objectives were

set according to the Plan's overall objective of increasing continental waterfowl populations by 25% through protecting critical habitat.

The main difficulty in assessing the EHJV's direct contribution to waterfowl production is that we did not have detailed waterfowl survey protocols, or a good estimation of waterfowl population densities, in place before the implementation of the EHJV. Therefore, we do not have accurate population densities prior to the onset of the EHJV to which we can compare current estimates. However, over the 15-year time period a number of waterfowl surveys were conducted in the different KPA's and the results of these surveys allow us to look at how waterfowl populations have changed over the last 15 years. The best information that we currently have are from the Black duck surveys conducted in the Boreal forest. These surveys have been done annually since 1990 and therefore offer us the best opportunity to evaluate population trends during the past 15 years. The results of these surveys are shown in Figure 1, and they show that on the whole waterfowl populations in the Boreal forest have increased in the past 15 years. Although these surveys are for populations outside the St. Lawrence KPA, where most EHJV activities were located in Quebec, the trend is probably very similar in other landscapes in the province.

One conclusion that may be drawn from these results is that there is an urgent need to develop appropriate waterfowl surveys for most landscapes in the province that would allow us to better evaluate the link between habitat conservation and waterfowl populations.

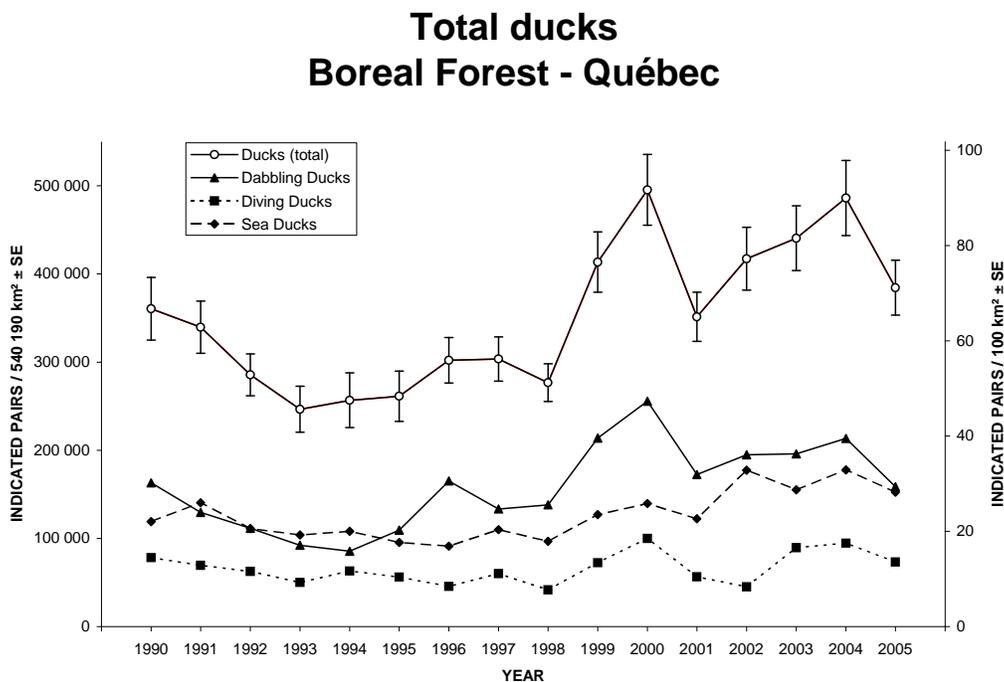


Figure 2. Temporal trend of total breeding ducks (indicated pairs) in the Boreal forest of Quebec from 1990 to 2005.

Although waterfowl surveys cannot inform us on the direct impact that EHJV activities have had on waterfowl production, we do have a few direct measures of the impacts of EHJV programs on waterfowl performance measures for the Quebec region. These performance measures were acquired in projects looking into the possible positive impacts of cover and impoundment management on breeding waterfowl.

Cover management: Vegetation cover was managed on a series of islands in the St. Lawrence river (Varenes and Berthier-Sorel island archipelagos). These islands were traditionally used by cattle as grazing pastures. The presence of cattle resulted in the loss of vegetative cover essential to waterfowl breeding, and also contributed to lowering reproductive success because of trampling of nests. Cover was managed by erecting fences along portions of the islands thereby preventing cattle to access these areas. The net results of these activities by EHJV partners was an increase in habitat use and reproductive success by nesting waterfowl using these islands 2 years after cover management was implemented (Table 3).

Management of impoundments: Spring staging habitat is critical to a large number of waterfowl species that migrate through the province of Quebec each year. These sites are used by ducks and geese as feeding areas and represent an important step for improving body condition which in turn may have an important impact on reproductive success. EHJV partners recognized the importance of these staging areas and implemented the management of existing impoundments to increase waterfowl use of these sites. The net result was more than a twofold increase in waterfowl use of managed impoundments (Table 3).

Table 3. Examples of direct effects of EHJV activities on waterfowl performance measures.

Technique assessed	Site	Performance measure					
		Total ducks		Nest density		Nest success	
		Before	After	Before	After	Before (%)	After (%)
Cover management	Îles de Varenes			118 nests	144 nests	33	69
Cover management	Îles Berthier-Sorel			0.34 nest/ha	0.39 nest/ha	22.9	32.3
Mgmt. of impoundments	Baie-du-Fèvre	1,111	2,606				

In addition to the above-mentioned changes in habitat and waterfowl populations along the St. Lawrence river, there have been other landscape-level changes that have occurred since the introduction of NAWMP. Most notably is the intensification of forestry. Timber harvesting has continued to increase over the last 20 years, probably in response to growing demands for lumber. The total harvest of timber in public forests (mostly the Boreal forest) went from 23.2 million cubic meters (Mm³) in 1986 to 31.3

Mm³ in 2003 (35% increase). This increase in the exploitation of the Boreal forest has certainly resulted in the loss of quality habitats for breeding ducks and other wildlife. In response to the increased pressure that the forest industry was placing on boreal habitats, the provincial government adopted a law on wildlife conservation that protects 45,673 km² of wildlife habitats on Crown lands.

3. Analysis and establishment of priority areas

The joint venture offers an opportunity among the different partners to coordinate planning and implementation of waterfowl conservation in the Quebec region. While acknowledging the mission and accomplishments of individual partners that make up the EHJV, the partners in Quebec recognize that, by coordinating planning and delivery among partners, the joint venture can focus limited resources on the highest conservation priorities and tie together individual conservation efforts. EHJV partners share a common responsibility for implementing continental, national and regional bird conservation plans in the Quebec region. Implementing these plans and providing effective bird conservation requires planning and implementation at various spatial scales, including flyway, region, BCR and project. The EHJV needs to provide an infrastructure that will support the planning and implementation at these scales and translation among these scales.

Important strides were taken to conserve wetlands during the first 15-year EHJV implementation plan. Indeed, the most important breeding sites along the St. Lawrence river were secured and have helped to maintain or increase wetland hectares and waterfowl numbers in the area. However, many more important breeding sites still need to be secured.

As in the previous 1989-2004 EHJV implementation plan, the conservation programs that will be delivered in this plan will consist of a series of Intensive and Extensive programs. Intensive programs will be those applied to specific sites within landscapes and will provide major benefits to wetland-dependent birds and other wildlife. Extensive programs will be developed to influence land use strategies and policies on a large spatial scale in order to favour the conservation of wetland habitats. Both programs will be designed to increase population sizes of breeding waterfowl by addressing limiting factors within the context of maintaining the integrity of wetland function. Specific conservation programs which may meet one or more of the objectives have been identified and are listed below.

Analysis of priority ecoregions in Quebec

Because of the large geographic area and the variety of wetland types found in Quebec, careful planning and coordination among federal, provincial, and local organizations will play a key role in the success of the conservation actions that need to be implemented.

One of the EHJV's partner, Ducks Unlimited – Quebec region, has developed decision support tools to help in determining priority conservation areas that will play a key role in waterfowl conservation. This planning tool uses a set of criteria to classify the 20 ecoregions in Quebec according to habitat values and pressures. This results in a classification matrix that highlights priority regions (Figure 3). The highest priority ecoregions are those having the highest habitat values and the highest pressures. For example, the St. Lawrence River ecoregion (no. 18) is characterized by high values and

pressures such that it has been designated as a priority concern for wetland conservation (Figure 4). The priority regions where most of the conservation actions will be focused are those listed in category A (Figure 4).

In addition to the support tool developed by Ducks Unlimited, Nature Conservancy Canada biologists determined important conservation sites using an ecoregional approach. They used available information on the biodiversity of different ecoregions and determined important sites in these regions based on these results. The information used came from the Quebec biodiversity database (CDPNQ) and Nature Serve in the United States.

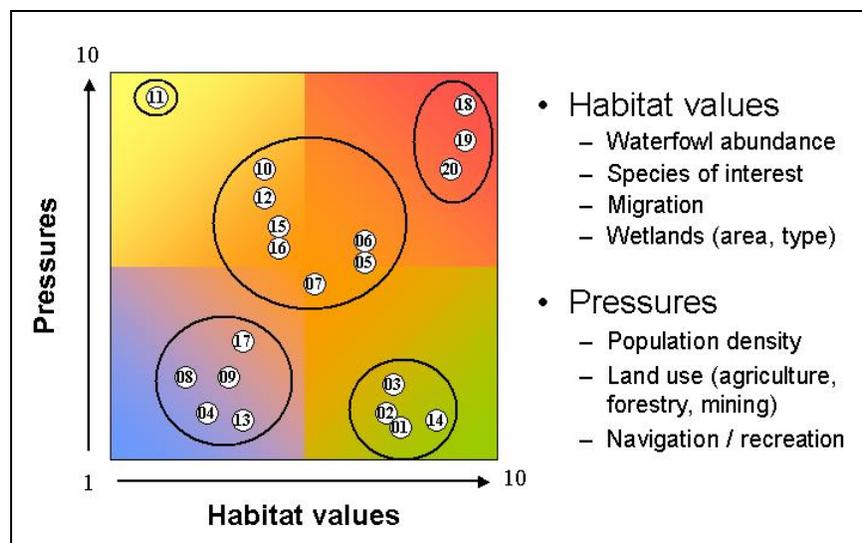


Figure 3. Decision support matrix to determine priority ecoregions in Quebec.

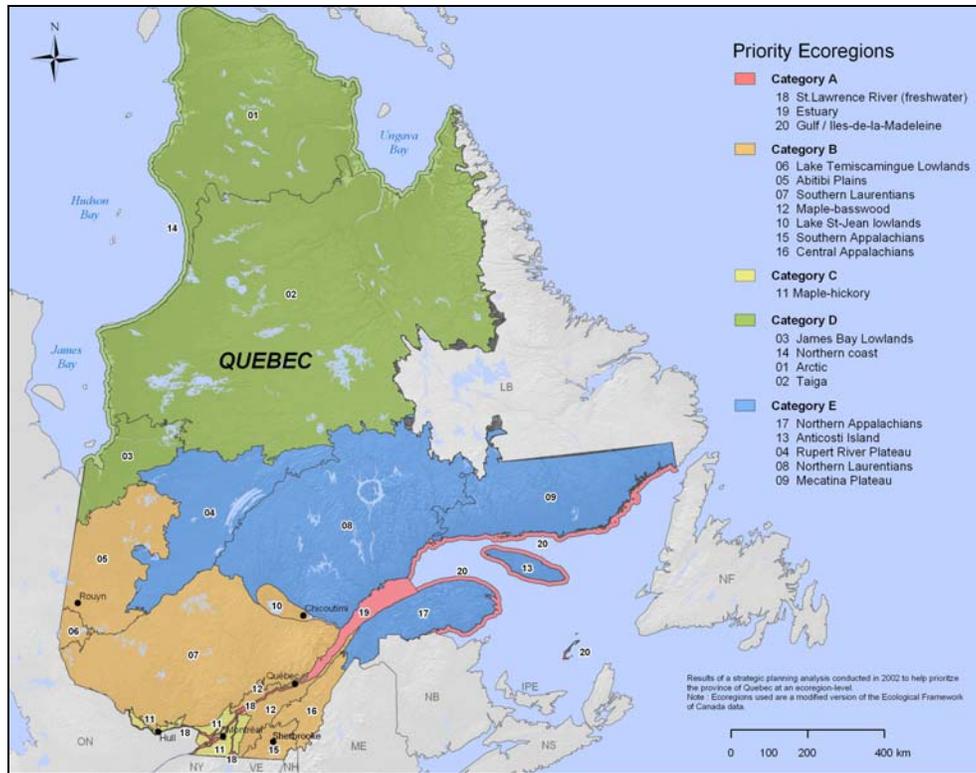


Figure 4. Priority ecoregions in Quebec.

In addition to determining priorities at the ecoregional scale, work is currently under way to determine priorities at both the regional and local landscape scales (Figures 5 and 6) using the decision support tools currently being developed.

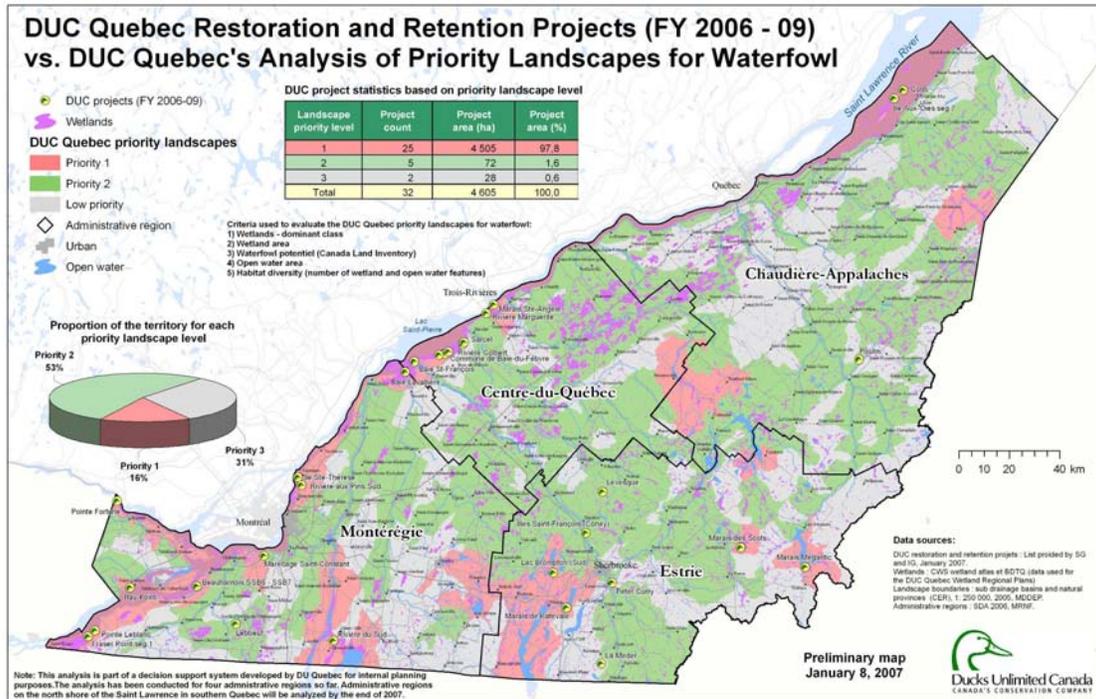


Figure 5. Priority landscapes in southern Quebec.

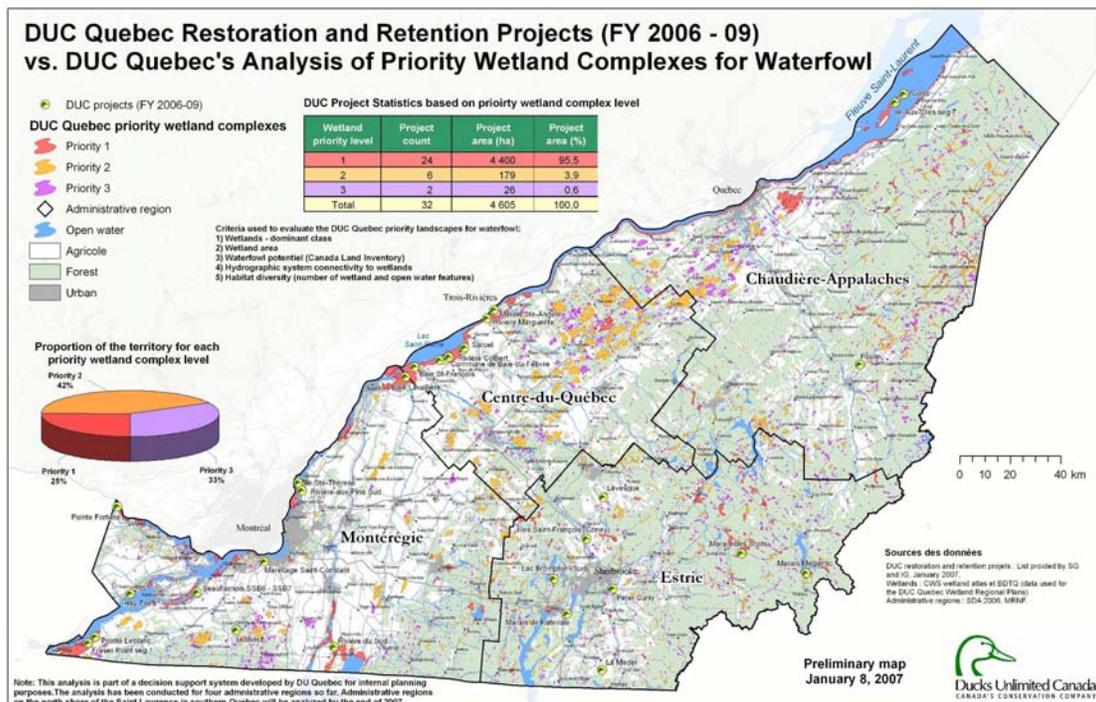


Figure 6. Priority wetlands in southern Quebec.

4. Waterfowl status

It is estimated that more than 8 million ducks, geese and swans stage in the province during their annual migration. Over 1,000,000 geese, and some 200,000 sea ducks, 150,000 divers and 125,000 dabblers are estimated to stage along the St. Lawrence River. Over 32 species of waterfowl are presumed to nest in the province, with an estimated breeding waterfowl population of over 1,2 million birds and an annual fall flight of approximately 10 million ducks and geese. Also, in spite of harsh winter conditions and near total ice coverage of wetlands, some 240,000 ducks, mostly Black ducks, Eiders and Goldeneyes, winter in Quebec each year mainly in the St. Lawrence Estuary and Gulf. These numbers of birds are expected to increase as a result of longer ice-free periods associated with climate change.

4.1 Priority species

The diversity of habitat types in the EHJV and its geographic location makes it an important region for many species of migratory waterfowl in terms of either breeding, migration and staging, or wintering habitat. The goal of this plan is to identify the highest priority waterfowl species in this region based on factors such as continental conservation concerns, the importance of our region to a species' life cycle and continental distribution, the population trend, and the threat level in our region. This plan is therefore aimed at those avian species for which our region has a responsibility to take the actions necessary to monitor, conserve, or restore populations to an acceptable level, and to provide, maintain, or manage the habitat that those populations would require. Many other native bird species, both common and rare, are not specifically mentioned in this plan because they are not considered as high a priority for conservation as the species that are listed in Table 4. The exclusion of these other species should not be interpreted as their somehow being less valuable. Rather, these other species either are considered to have robust or acceptable populations or trends, not requiring further conservation action, or we consider the EHJV to be so peripheral to their continental distribution that the species should not distract conservation attention from species that are a higher priority here.

EHJV priority waterfowl species were determined by EHJV scientists during a science forum held in July 2006. As mentioned previously, priority was based on such factors as continental importance of species, the importance of the EHJV region for waterfowl populations, current threats, and population trends. The priority listing for Quebec was determined through consultation with waterfowl biologists from EHJV partner organizations.

Table 4. EHJV and provincial priority waterfowl species.

Species	EHJV priority	Quebec priority
Ducks		
American black duck	High	High
Mallard	High	Low
Ring-necked duck	High	Moderate
Green-winged teal	High	Moderate
Blue-winged teal		Moderate
Wood duck		Moderate
Barrow's goldeneye	High	High
Harlequin duck	High	High
Long-tailed duck	High	Moderate
Common goldeneye		Moderate
Common eider (<i>dresseri</i>)	High	High
Common eider (<i>borealis</i>)		Moderate
Black scoter	High	High
Surf scoter		High
White-winged scoter		Moderate
Geese and swans		
CAGO - Atlantic (AP)	High	High
CAGO - Atlantic flyway resident	High	Low
CAGO - North Atlantic (NAP)	High	Low
Greater snow goose	High	High

Of all the nesting species found in Quebec, the **American black duck** (*Anas rubripes*) is one of the most representative in terms of distribution and abundance on the territory. Canada produces approximately 90% of all continental Black ducks, and Quebec is the principal reproductive area for nearly 50% of these birds. However, since 1955 black duck populations have been declining at the regional and/or continental scale. Most black ducks in Quebec breed in the boreal forest (BCR 8 and 12) where there is an abundance of breeding habitat. Current waterfowl surveys estimate that there are approximately 164,500 breeding pairs. Although habitat availability in the boreal forest does not seem limiting, the limiting factor seems to be duckling survival, although harvest rate may also play an important role in the population dynamics of this species. In the southern Quebec landscape, another possible limiting factor is agricultural practices, most notably a shift from dairy farms to cash crops (corn) which favour mallards over black ducks. All conservation programs targeted a better management of the boreal forest will benefit the Black duck.

Considered a scarce breeder in Quebec at the turn of the 20th century, the **Mallard** (*Anas platyrhynchos*) is now very common in the southern part of the province. Mallards

nest in a variety of habitats, and are widely distributed throughout the St. Lawrence lowlands. Mallards are also common in agricultural areas throughout the province, and in the boreal forest. Current surveys estimate that there are 46,800 breeding pairs in Quebec and that population size is increasing. No special conservation programs have been proposed to target mallard populations.

The **Ring-necked duck** (*Aythya collaris*) is a species that has a widespread distribution throughout the boreal forest (BCR's 8 and 12). Current waterfowl surveys show an estimated population of 79,400 breeding pairs, and the objective is to maintain current population size. This goal will be achieved mainly through policy influence programs that target forestry practices and push for a provincial wetland policy.

The **Green-winged teal** (*Anas crecca*) has a widespread distribution in Quebec, and is found in BCR,s 8, 12 13, and 14. Although it breeds in Quebec, it is easiest to observe during the spring and fall migrations when it stages along the St. Lawrence River. Current waterfowl surveys estimate 39,400 breeding pairs across the surveyed portion of the province representing a stable breeding population.

The **Blue-winged teal** (*Anas discors*) has experienced population declines in Quebec in the past decades. An intensification in agricultural practices is thought to be responsible for the decline of this species. There are no current population baselines for blue-winged teals, and its provincial priority status is moderate. No special conservation actions are planned for this species.

The **Wood duck** (*Aix sponsa*) is a fairly common breeder in southern Quebec. Because the species is associated with mature deciduous stands, it becomes progressively less abundant towards the northern part of the province and at higher elevation where conifers tend to dominate forests stands. There are an estimated 6,400 breeding pairs in Quebec, and the population objective is set at 7,000 pairs. Because nesting cavities are paramount to breeding wood ducks, continued support for nest box programs and other conservation programs that secure and restore forested wetlands and protect snags will be important for this waterfowl species.

The **Barrow's goldeneye** (*Bucephala islandica*), eastern Canada population, is currently listed as a species of special concern by COSEWIC. As such, much attention is given to acquiring basic ecological information regarding this species' life cycle. We estimate that approximately 2,500 individuals overwinter in Quebec, and the long term objective would be to increase this number to 3,500 overwintering individuals. An important limiting factor is the availability of nesting cavities to nesting birds. Influence of forestry practices in the province that protect snags will surely benefit this cavity nesting bird.

The **Harlequin duck** (*Histrionicus histrionicus*) is a small sea duck that breeds on fast flowing rivers and streams, and overwinters along the coast. It is designated as a species of special concern by COSEWIC. Current estimates indicate that approximately 1,800 individuals overwinter in eastern Canada. A management plan has been prepared

for this species and there are no specific conservation action planned by the EHJV partners in Quebec.

The **Long-tailed duck** (*Clangula hyemalis*) breeds along the Hudson and James Bay coast of Quebec and overwinter along the eastern coast of Quebec. There are insufficient data to determine a population baseline for this species. Additional survey data would address this information gap. Oil spills are of concern, particularly where the birds occur in large concentrations. Winter surveys would be helpful in determining distribution and population trends in the St. Lawrence estuary and Gulf. There are no EHJV conservation actions that target this species.

The **Common goldeneye** (*Bucephala clangula*) is a common duck in the boreal forest (BCR 8 and 12). The availability of nest cavities is thought to be the most important factor limiting populations of common goldeneyes. There are approximately 65,400 breeding pairs according to current surveys. Because they rely on tree cavities for nesting, they are at risk from deforestation by logging, particularly near riparian areas. Loss of mature forests is one of the most important factors affecting common goldeneyes. Conservation programs that deal with forestry practices and affect the protection of wetland habitat and cavity nesting sites in the boreal forest landscape will benefit this species.

The **Common eider** (*Somateria mollissima*) is a sea duck typical of northern seacoasts. The subspecies *dresseri* nests on islands in the St. Lawrence estuary and in the Gulf of St. Lawrence. This duck is exploited as a game bird and as subsistence food (aboriginal hunting and egg gathering) and is the only duck that produces commercially harvestable eiderdown. Common eiders are well suited to northern environments. There are an estimated 42,000 pairs that breed on islands of the St. Lawrence estuary and Gulf. The subspecies *dresseri* is very abundant in the Gulf of St. Lawrence during the winter months and accounts for 30% of all the eiders wintering on the Atlantic coast.

The eastern population of **Black scoters** (*Melanitta nigra americana*) breeds primarily in northern Quebec and western Labrador. The black scoter is one of North America's least-studied sea ducks, and little is known about the factors that determine habitat preferences for breeding, molting, staging, and wintering areas. There are currently no surveys that do an adequate job of estimating population size or trend for black scoters, and further studies would be needed to gain a better understanding of basic population dynamics and ecology for this species.

The **Surf scoter** (*Melanitta perspicillata*) is a sea duck that breeds in the boreal forest and northern regions of Quebec. Little information is available on population size and further data would be required on the general ecology of this species in the province. No conservation programs are planned for this species.

The **White-winged scoter** (*Melanitta fusca*) in eastern Canada nests on freshwater and brackish lakes in the boreal forest along the James Bay coast and overwinters along the Atlantic coast. Relatively little is known about their life history and ecology or the links

among their breeding, wintering, and molting distributions. There are very few data available to accurately estimate population size. No conservation programs are planned for this species.

Three populations of **Canada geese** (*Branta canadensis*) breed in Quebec. The largest population is the Atlantic Population (AP) of Canada geese. Waterfowl surveys estimate that there are 160,000 breeding pairs Quebec, and that most breed in the northern part of the province (BCR 3 and 7). The other two populations, North Atlantic (NAP) and Atlantic flyway residents, are much less numerous. Because most geese breed in the northern regions of the province, no conservation actions have been planned specifically for this species.

The **Greater snow goose** (*Chen caerulescens atlantica*) population that stages along the St. Lawrence River and adjacent farmlands during the spring and fall migrations has shown the most spectacular waterfowl population growth rate in Quebec's history. Indeed, the spring population of Greater snow geese has increased from less than 50,000 birds in the late 1960's to approximately 1 million individuals at the end of the 1990's. The greater snow goose population was so large that staging geese were exerting tremendous pressure on their staging grounds. In light of this tremendous increase in population size, special conservation measures (spring harvest) were adopted to reduce population size, and the latter intervention resulted in the stabilization of the population at approximately 800,000 individuals for a few years. The population size has since increased to over 1 million individuals. The goal is to reduce the population to a target of 500,000 to 750,000 staging individuals.

Staging and Wintering Waterfowl

The number of birds staging and wintering in Quebec is related to continental and local breeding population size, habitat conditions and food availability as well as weather. Waterfowl are associated with the Atlantic and Mississippi flyways. Milder winters provide longer ice-free periods that are resulting in increased wintering populations as well as potentially increasing the residency time of waterfowl during migration.

The availability of high-energy food resources from agricultural activities is a key factor for staging waterfowl such as Black Ducks, Mallards and Snow and Canada Geese. Access to aquatic food resources is important for species like Ring-necked ducks and Green-winged teal. Wetland drainage within the agricultural landscape has likely degraded habitat conditions for staging waterfowl. However, given the mobility of most species and the proximity of agricultural areas to coastal environments, this degradation is likely buffered to some degree by the availability of coastal and estuarine habitats. These coastal and estuarine habitats are also important to migrating sea ducks such as common eiders, black scoters and long-tailed ducks.

Staging and wintering contributions from Quebec may be as important as breeding contributions to continental waterfowl populations. This statement is supported by the

diversity of species and the migration numbers. Estimates of fall flights are 8 million waterfowl. However, these estimates are conservative as they under represent sea ducks. We lack information on waterfowl use days for most species. We assume that residency times of field feeding waterfowl are relatively long.

The abundance and accessibility of quality foods and adequate energy are considered limiting factors for many migrating and wintering waterfowl. However, the availability of waste grain and legumes from agricultural activities is assumed to meet the energetic needs of most key staging waterfowl.

Late winter and spring nutrition and survival may limit some species, particularly Black Ducks, Scaup, scoters, eiders, Snow and Canada geese. There are no regional studies comparing food availability and quality for either agricultural or coastal landscapes.

For field feeding waterfowl we assume that the interspersed fresh water wetlands and coastal habitats is sufficient to meet their needs. We assume the same for diving ducks as well, but are less certain about this assumption.

For sea ducks and coastal waterfowl we assume that the current mix of habitat and food resources is sufficient to meet their needs. Anthropogenic factors however, may be influencing access to these resources.

4.2 Habitat threats

Although much effort has been put into conserving habitats for waterfowl and other wetland-associated wildlife, the reality is that threats, both old and new, still present important challenges to waterfowl conservation biologists. These threats not only affect waterfowl and other wildlife species using these habitats, but some even threaten basic ecosystem functions and could seriously impact water quality by negatively influencing wetland habitats. Threats facing waterfowl can be grouped into general categories that include habitat loss, fragmentation, and degradation, and environmental contaminants. These landscape level threats can negatively impact reproductive success of nesting ducks by reducing duckling survival, and nesting success is particularly at risk in BCR 13 where threats are greatest.

The continued intensification of agriculture and urban sprawl (residential, commercial, and industrial development) along the St. Lawrence floodplain will increase the draining and degradation of residual wetlands in rural and suburban areas. These small wetlands serve important functions not only to wildlife and biodiversity in general, but they also are important in terms of ensuring water quality and in managing fluctuating water levels downstream. In the past years severe flooding has occurred in different areas of the province and many agree that better management and conservation of wetland ecosystems could have limited the amount of flooding in certain areas. As

global warming increases, the number of annual flooding events will probably increase and it is important that this be considered in wetland conservation discussions and urban planning.

Habitat loss, fragmentation, and degradation represent the greatest threats to waterfowl species in Quebec. Although we suspect wetland losses have decreased over the past 15 years, the loss of remaining wetlands remains a major concern. An estimated 4 000 hectares of wetlands were lost in southern Quebec prior to the onset of the EHJV, and much work needs to be done to protect the remaining wetlands.

The intensification of agriculture along watercourses presents a major threat to waterfowl because it can bring about the loss of forest habitats, fragmentation of the landscape, and an increase in the use of pesticides. Although some of these represent direct threats to waterfowl populations (loss and fragmentation of habitats), the use of pesticides may result in an indirect effect through the reduction of breeding success (fewer eggs, lower brood survival, etc.). Another threat, mainly to Black ducks, is the switch from traditional forms of agriculture (dairy farming; in which black ducks thrive) to cash crops (better for mallards). Although some of these changes may be detrimental to certain duck species, they can benefit other species at the same time. New monitoring programs will need to be developed to look into this issue while existing monitoring programs should continue (for example the Eastern Lowlands Initiative).

A regional habitat threat facing several species of waterfowl that breed in Quebec is a reduction in the availability of natural cavities. The intensification of forestry and mining activities in riparian areas on crown (boreal forest) and private (Appalachian forest) lands in the past decade has had a negative impact on the availability of habitat in the boreal forest. This is mainly the result of changes in silvicultural practices that favour shorter rotation (interval between harvests) and the removal of snags due to safety concerns. The end results are younger forests that contain fewer trees of the size and age class necessary to have naturally occurring nest cavities (old and decaying trees). If current forestry practices are not modified to leave old trees standing then many wildlife species will be negatively affected by the loss of cavity trees. Although nest boxes are an effective management tool to counter the loss of natural cavities, their installation and maintenance in areas of low human population is expansive and labour intensive making this management option unlikely to completely offset the natural loss of cavities in many areas of the boreal forest.

Environmental contaminants continue to represent a serious threat to wildlife populations. Waterfowl face numerous sources of contamination including municipal waste water treatment facilities, atmospheric deposition in lakes and rivers, agricultural runoff, and industrial production facilities. Waterfowl must contend with numerous toxic compounds such as DDE, PCB's, mercury, lead, and a plethora of pesticides and herbicides. In addition to direct mortality at lethal doses, contaminants have also been

shown to depress an individual's survival and reproductive rates, as well as cause birth defects that lower recruitment rates or reduce future cohorts' reproductive rates.

Waterfowl in the wild are susceptible to numerous pathogens that result in an unknown number of mortalities every year, but may result in large die-offs under certain conditions. For example, waterfowl are at risk to pathogens that cause avian botulism (*Clostridium botulinum*) and avian cholera (*Pasteurella multocida*). As waterfowl become more concentrated as a result of habitat loss and degradation, this may increase the risk that local populations become more susceptible to major die-offs these pathogens can cause. This is particularly relevant in several densely populated eider nesting colonies where significant die-offs have occurred in the past.

It has been suggested that long term climate change could potentially have an influence on the population ecology of birds. The main impacts of these changes should influence mostly northern ecosystems and species that breed at these latitudes. However, northern breeding species that would benefit from better conditions on their breeding grounds (more food, less harsh weather conditions), and thus increase their reproductive success, could put even more grazing pressure on staging habitats in the south because of the potential large increase in the number of individuals migrating through the southern staging areas (ex.: overabundant Arctic geese populations).

4.3 Waterfowl population and habitat objectives

Population objectives

Theoretically, the basis for a habitat conservation plan for migratory waterfowl should be quantitative population objectives and an estimate of the habitat necessary to sustain desired population levels. However, in most cases population sizes, densities, and distribution of species of interest are unknown or poorly estimated, as is our knowledge of how populations are affected by various management scenarios, and how those relationships differ over space and time. Because waterfowl populations are dynamic over time, and fluctuate temporally with annual changes in environmental conditions, existing monitoring programs may track waterfowl population trends imprecisely. Further, whether or not habitat in a given region is limiting to the population of interest may not be known, or it may be known not to be.

Setting population and habitat objectives can be controversial. At best, setting and using population or habitat objectives is a challenge, which should be viewed as an ongoing exercise requiring refinement, research into underlying assumptions, and improvement over time. At worst, setting population-based habitat objectives is viewed as a fundamentally flawed concept that would be too costly to do properly for many species

and scales. Nevertheless, there is often a desire to go ahead and set population objectives with whatever information is currently available, in order to provide:

1. a baseline or starting point for habitat conservation planning (i.e., a specific goal or target);
2. a marketing tool to communicate conservation needs concretely with politicians and policymakers, who may be less willing to fund something that is undefined;
3. performance indicators for evaluation.

Selecting a population objective is the critical first step, as habitat objectives are largely determined from the latter. Habitat objectives are meant to relate directly to population objectives, yet our current understanding of the relationship between population response and habitat conditions is lacking. These objectives are a first step towards deciding which species' populations are currently robust, which populations are in need of restoration, and to what level, and which populations are overabundant and should be reduced by management actions.

Therefore, quantitative estimates of breeding waterfowl populations were developed using the most accurate information that captured the breeding and non-breeding conservation needs of individual species at the scale of the joint venture in Quebec (Table 5). The population objectives were set for a 10-year horizon with the intent of assessing our progress towards these goals after the first 5 years following the implementation of this plan. The most up-to-date waterfowl baseline population estimates are presented in Table 5, and these estimates are also broken down into the different BCR's. The latter values are estimates of current numbers of waterfowl present in the province. From these, population objectives were determined for the breeding season (Table 6), and for overwintering and staging waterfowl (Table 7). The overall picture including current population baselines and population objectives to reach within ten years is presented in Table 8.

Table 5. Quebec waterfowl population baselines per BCR.

Species	Population baseline	BCR 3	BCR 7	BCR 8	BCR 12	BCR 13	BCR 14
Ducks							
American black duck	164,500 pairs			85,500	59,000	8,000	12,000
Mallard	46,800 pairs			17,800	8,000	11,000	10,000
Ring-necked duck	79,400 pairs			41,000	27,700	1,200	9,500
Green-winged teal	39,400 pairs			21,000	9,100	3,700	5,600
Blue-winged teal	N/A			N/A	N/A	N/A	N/A
Wood duck	6,400 pairs			1,200	3,400	1,000	800
Barrow's goldeneye	2,500 ind.			0	0	0	2,500
Harlequin duck	N/A			N/A	N/A	N/A	N/A
Long-tailed duck	N/A			N/A	N/A	N/A	N/A
Common goldeneye	65,400 pairs			38,000	25,200	200	2,000
Common eider (<i>dresseri</i>)	42,000 pairs			10,000	0	0	32,000
Common eider (<i>borealis</i>)	90,000 ind.			90,000	0	0	0
Black scoter	N/A			N/A	N/A	N/A	N/A
Surf scoter	N/A			N/A	N/A	N/A	N/A
White-winged scoter	N/A			N/A	N/A	N/A	N/A
Geese and swans							
CAGO - Atlantic (AP)	160,000 pairs	137,000		23,000			
CAGO - Atlantic flyway resident	2,500 pairs					2,500	
CAGO - North Atlantic (NAP)	9,000 pairs			9,000			
Greater snow goose	1,000,000 ind. ¹						

¹ It is impossible to determine the proportion of geese within each BCR during spring staging. This value is determined from surveys done in a single day across the province. Also, the number of geese within each BCR changes rapidly (daily) during staging.

Table 6. Waterfowl breeding population objectives (indicated breeding pairs; IBP) for Quebec.

Species	EHJV conservation needs				
	EHJV Priority	Quebec Priority	Population baseline (IBP)	Population objective (IBP)	Population gap
Ducks					
American black duck	High	High	164,500	171,500	7,000
Mallard	High	Low	46,800	52,800	6,000
Ring-necked duck	High	Moderate	79,400	80,900	1,500
Barrow's goldeneye	High	High	N/A	N/A	
Green-winged teal	High	Moderate	39,400	41,400	2,000
Blue-winged teal ¹		Moderate	N/A	N/A	
Common goldeneye ¹		Moderate	65,400	65,400	0
Wood duck ¹		Moderate	6,400	7,000	600
Harlequin duck	High	High	N/A	N/A	
Common eider (<i>dresseri</i>)	High	High	42,000	60,000 ²	18,000
Common eider (<i>borealis</i>) ¹		Moderate	N/A	N/A	
Geese and swans					
CAGO - Atlantic (AP)	High	High	160,000	150,000	-10,000
CAGO - Atlantic flyway resident	High	Low	2,500	0	-2,500
CAGO - North Atlantic (NAP)	High	Low	9,000	9,000	0

¹ Provincial priority species² Population objective taken from the Common eider management plan

Table 7. Waterfowl staging and overwintering population objectives (no. of individuals) for Quebec.

Species	EHJV conservation needs				
	EHJV Priority	Quebec Priority	Population baseline	Population objective	Seasonal relevance ²
Ducks					
Long-tailed duck	High	Moderate	N/A	N/A	W
Barrow's goldeneye	High	High	2,500	3,500	W
Common eider (<i>borealis</i>) ¹		Moderate	90,000	100,000	W
Black scoter	High	High	N/A	N/A	S
Surf scoter ¹		High	N/A	N/A	S
White-winged scoter ¹		Moderate	N/A	N/A	S
Geese and swans					
Greater snow goose	High	High	1,000,000	500,000 – 750,000 ³	S

¹ Provincial priority species²Overwintering: W; Staging: S³Population objective taken from the Greater snow goose integrated management action plan

Table 8. Quebec overall waterfowl population objectives per BCR.

Species	EHJV conservation needs						Seasonal relevance
	Population baseline	Population objective	BCR 8	BCR 12	BCR 13	BCR 14	
Ducks							
American black duck	164,500 pairs	171,500 pairs	93,500	64,500	9,000	13,000	B
Mallard	46,800 pairs	52,800 pairs	19,000	8,500	12,000	10,500	B
Ring-necked duck	79,400 pairs	80,900 pairs	41,500	28,000	1,000	9,500	B
Green-winged teal	39,400 pairs	41,400 pairs	21,500	9,000	4,000	5,500	B
Blue-winged teal	N/A	N/A	N/A	N/A	N/A	N/A	
Wood duck	6,400 pairs	7,000 pairs	1,500	3,500	1,000	1,000	B
Barrow's goldeneye	2,500 ind.	3,500 ind.	0	0	0	3,500	W
Harlequin duck	N/A	N/A	N/A	N/A	N/A	N/A	
Long-tailed duck	N/A	N/A	N/A	N/A	N/A	N/A	
Common goldeneye	65,000 pairs	65,000 pairs	38,000	25,000	200	0	B
Common eider (<i>dresseri</i>)	42,000 pairs	60,000 pairs	N/A	N/A	N/A	N/A	B
Common eider (<i>borealis</i>)	90,000 ind.	100,000 ind.	90,000	0	0	10,000	W
Black scoter	N/A	N/A	N/A	N/A	N/A	N/A	
Surf scoter	N/A	N/A	N/A	N/A	N/A	N/A	
White-winged scoter	N/A	N/A	N/A	N/A	N/A	N/A	
Geese and swans							
CAGO - Atlantic (AP)	160,000 pairs	150,000 pairs	N/A	N/A	0	0	B
CAGO - Atlantic flyway resident	2,500 pairs	0	0	0	0	0	B
CAGO - North Atlantic (NAP)	9,000 pairs	9,000 pairs	9,000	0	0	0	B
Greater snow goose	1,000,000 ind.	500,000 – 750,000 ind.	N/A	N/A	N/A	N/A	S

Habitat objectives

The goal of the EHJV partnership is to restore breeding waterfowl populations to the relatively high levels observed during past decades and to improve the nutritional condition of migrating and wintering waterfowl thereby increasing their individual survival and reproductive potential. Habitat objectives are linked to desired population goals for a group of key waterfowl species and these objectives are assumed to reflect and accommodate the needs of other waterfowl and wetland-dependant species within Quebec. Habitat objectives will be refined and adjusted as new biological and environmental information is gathered and integrated into a model-based decision process.

Overall habitat goals for 2007-2012 are presented in Table 9. These goals were derived from the best information currently available. We determined an estimate of the number of hectares of wetlands and associated uplands that needed to be secured, enhanced, managed or influenced to ensure waterfowl conservation. These estimates were based on an assessment of waterfowl habitat needs in the different BCR's.

However, as described previously, we cannot currently assert that these habitat goals will necessarily produce more individual ducks and geese. However, as the EHJV moves forward and gathers more information, our desire is to develop a more biologically driven approach to estimating population-based habitat goals based on a better understanding of the waterfowl-habitat relationship.

A complete description of these habitat objectives and the conservation programs that will be implemented are discussed in the following section.

Table 9. Projected habitat goals to be achieved through intensive and extensive conservation programs.

Program	Projected (hectares)	Delivery agency ¹
INTENSIVE PROGRAMS		
Securement		
Acquisition	7,500	DUC, MRNF, NCC
Conservation easements	350	NCC
Conservation agreements	12,100	DUC
Total	19,950	
Habitat Enhancement		
Habitat restoration	2,300	DUC, MRNF
Wood duck nesting boxes	500 boxes	DUC
Lure crop	N/A	CWS
Total	2,300	
Habitat management	17,500	DUC, NCC
EXTENSIVE PROGRAMS		
Stewardship		
influence	132,700	DUC, NCC, FFQ
Government policy	30,279,735	DUC

¹DUC: Ducks Unlimited Canada – Quebec region

NCC: Nature Conservancy Canada – Quebec region

FFQ: Fondation de la faune du Quebec

MRNF: Ministère des Ressources naturelles et de la Faune du Quebec

CWS: Canadian Wildlife Service – Quebec region

5. Conservation programs

The implementation of this conservation plan at three different spatial scales will require the use of different conservation tools that are adapted to those scales. This integrated approach is summarized in Figure 6. Government policy influence actions have the possibility of affecting wetland conservation on a provincial level spatial scale. The second level of conservation programs involving stewardship target the regional spatial scale. Securement, enhancement, and management activities will be implemented at the local spatial scale. The latter activities are the most costly to implement but are crucial to protecting important wetlands.

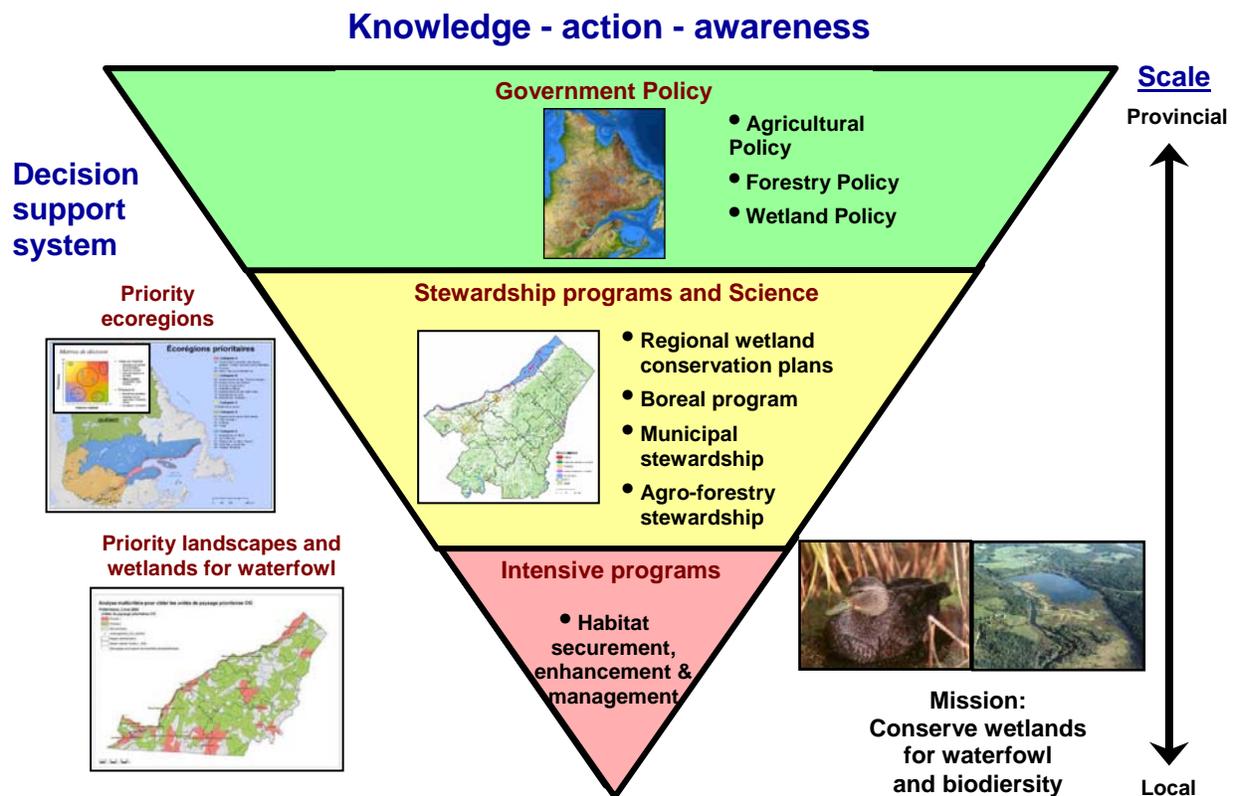


Figure 7. Conservation approach at different spatial scales.

The following sections describe the different conservation actions that will be implemented in the next five years. This description goes from the local to the provincial spatial scales.

5.1 Intensive programs

Intensive wetland conservation programs will consist of securement, enhancement, and management programs. The priorities for these programs will be determined according to local needs and the urgency to protect threatened wetlands based on GIS analysis of priority landscapes and wetlands.

Most intensive conservation actions will be focused on priority habitats within Bird Conservation Region (BCR) 13. As stated previously, this area is critical to breeding and staging waterfowl, and this BCR is where we find the greatest threats to wetland loss and degradation (urban sprawl, intensive agriculture, etc.), and the largest areas of privately-owned land in the province. In the past, more than 80% of conservation investments have occurred within this area. We will certainly secure more critical wetland habitats in this BCR because of the continued and emerging threats to wetlands. Sites to be secured will be identified by EHJV partners and the priority will be based according to several factors such as threats to wetland function, benefits to waterfowl and other wetland-associated species, ecological goods and services, and land area.

Securement

Protecting and securing wetlands in Quebec involves a diversity of approaches. In areas with a high risk of habitat loss, such as along the St. Lawrence River and in key areas of the agricultural landscape, conservation actions must include direct acquisition of critical habitats to ensure the long-term integrity of the landscape. These direct securement activities work in concert with other conservation efforts that provide short-term or less direct conservation measures.

Clearly, there is a need for strategic investment in these activities as costs are relatively high compared to other securement approaches. As such, a screening process has been developed that assesses wetlands on the basis of the risk of loss, value to waterfowl, and cost of acquiring the habitat. There are a number of options available to obtain long-term securement and these include fee-simple acquisition, land donation, conservation easements, voluntary nature reserves, and conservation agreements. Some of these securement activities are defined below:

1. Fee title acquisition: Acquisition of lands to be owned by a conservation agency or organization and managed for wildlife conservation in perpetuity. This technique offers the highest level of security but is also the highest in cost. The objective is to secure title to 9,960 hectares of critical waterfowl habitat.
2. Conservation easements: Conservation easements with private landowners and local government will be used to acquire legal interests to conserve and manage important wetlands and associated uplands and limit development while allowing some use by the landowner consistent with the easement conditions. The easements may be particularly effective in working landscapes including working

forests and farms where the use of the land is consistent with wildlife habitat conservation. Easements will generally be held by federal, provincial or regional conservation organization with the resources to monitor and enforce the easement conditions. The goal is to secure 500 hectares through easements.

3. Conservation agreements: Conservation agreements are 10-year minimum securement agreements between landowners and sponsoring agencies, which may not be registered on land title. This agreement entitles the landowner to maintain all property rights and can assume responsibility for maintaining projects, although the sponsoring agency typically assumes full management responsibility to ensure optimal project performance. These no-cost agreements contain restrictions against future uses of the land, for the purpose of wildlife habitat management.

The prioritization exercise that Ducks Unlimited Canada carried out pointed to a focus on protection and consolidation of critical waterfowl habitats along the St. Lawrence and Ottawa rivers, as well as key wetlands surrounding Brompton and Megantic lakes in the agricultural areas of southern Quebec. These key sites have been targeted for acquisition by DUC in their protection and securement program, and the objective for Ducks Unlimited is to secure 14,350 ha of critical waterfowl habitat. An additional 4,850 hectares will be secured by Nature Conservancy of Canada, and 750 ha by the province of Quebec.

Enhancement

Wetland enhancement is one of the key solutions to increasing waterfowl populations for key species as it improves the abundance and productivity of brood rearing habitat. Enhancement programs will be applied to wetlands having great potential for waterfowl populations but that currently are submitted to natural or human-induced constraints (intermittent flooding, agriculture, forestry, etc.) that limit their use by wildlife. It is assumed that duckling survival is the key limiting factor for our key species, therefore enhancement directly increases duckling survival. It should also increase the number of pairs settling in an area. These two factors increase the carrying capacity of the landscape and increase waterfowl populations.

Enhancement through wetland restoration includes actions to restore habitat features that have been lost or degraded and thus create new waterfowl habitats that serve as ecological equivalents to lost habitats.

Wetland restoration programs involve restoring large degraded wetlands primarily along the productive St. Lawrence system and within agricultural areas using a variety of restoration techniques (i.e. water control structures and dykes). The resulting habitat is typically open marsh in a hemi-marsh state. These wetlands are important to all priority waterfowl species in terms of increasing duckling survival. These enhanced habitats can

also benefit other wetland-dependent wildlife and improve the ecological goods and services provided by the wetland. These restoration techniques are critical in highly developed areas such as the St. Lawrence coastal zone and agricultural landscapes.

Past projects, such as installing nest structures and upland cover management to improve nesting success which is a key limiting factor for cavity nesting species, eiders, and perhaps blue-winged teal have been a success. We plan on pursuing some of the same programs that were initiated in the 1990-2004 EHJV Implementation plan. A new program that we would like to develop addresses the potential impact that overabundant Greater snow goose and other rapidly increasing waterfowl populations may have on agricultural lands. Geese and ducks that migrate through the province and stopover at different migratory halts often feed in adjacent corn fields. These large flocks of geese and ducks may, in the long term, exert heavy grazing pressure on these agricultural lands and there is growing concern from the agricultural community that these impacts may be on the rise. A lure crop program, similar to the one implemented in the Prairie Habitat Joint Venture, would be set up to attract waterfowl away from cash crops and thus lessen their impact on these lands. These lure crops could also lessen the impact of grazing on tidal wetlands (bullrush marshes, for example), as these are important for many staging waterfowl along the St. Lawrence.

The other enhancement program that we will continue is the installation of wood duck nesting boxes. There are currently approximately 3,500 boxes installed throughout the province, and the program calls for an additional 500 boxes over the next five-year period. This program has met with great success and hinges on community involvement. Current estimates indicate that approximately 45% of nesting boxes are exclusively used by waterfowl during the breeding season and it is estimated that an average of 1,500 new ducks are produced annually.

Habitat enhancement activities by partners will result in 2,300 ha of restored wetlands over the next five-year period. The waterfowl response to these restored wetlands will accumulate as the program is deployed across the landscape.

Currently, there are no waterfowl productivity models that relate the additional brood production to waterfowl population response as a result of habitat restoration. The development of waterfowl-habitat relationship models is a key component of this implementation plan and the latter will help in assessing population response to conservation actions.

Management

Over the past 15 years different EHJV partners have either secured or enhanced wetlands in order to increase waterfowl habitat. The continued success of these habitats necessitates the management of infrastructure that were originally put into place.

Intensive management generally requires repeated efforts to attain and sustain habitat conditions that meet the needs of waterfowl species. These actions improve habitat conditions for waterfowl beyond what would occur in the absence of management, and are suited to areas where the overall carrying capacity of the landscape has been reduced.

There are a total of 17,500 ha of managed wetlands in Quebec that support approximately 17,500 breeding pairs of ducks (1 breeding pair/hectare). Significant inventories of intensively managed projects in Quebec are ageing. One of the consequences of this ageing, aside from the decline in the condition of the infrastructure, is a decline in the productivity of wetlands as they move increasingly away from a hemi-marsh state. These outcomes can be reversed or minimized through intensive management activities. The management activities can range from low cost measures such as water level manipulation when the vegetative community is rooted, to the high cost of physically removing dense vegetation mats. These activities are expected to return waterfowl productivity back to levels expected in the early phases of the management project.

Investment in management activities will be concentrated on wetlands along the St. Lawrence River.

5.2 Extensive programs

As stated above, a key focus of the EHJV program in Quebec will be to maintain current habitat conditions at the landscape level. This will involve investments in Extensive programs that are aimed at influencing wetland conservation. These activities will consist of trying to influence provincial policies and programs that may currently exert pressures on wildlife habitats, and in promoting wetland and water strategies, policies, and programs. The types of actions expected in this program will allow for the protection of larger areas than in the intensive programs, and at a much lower cost. Extensive programs are critical to maintaining the current habitat quality that is sustaining our waterfowl populations.

Government influence

The conservation of large areas of wetland and associated upland habitats will be possible through changes in certain policies, norms, practices, and regulations. The major thrust of this program will be to continue working towards influencing the provincial government to adopt a no net loss wetland conservation policy, and to influence forestry and agricultural practices through the approval of Best Management Practices (BMP). More specifically, this policy influence will affect waterfowl habitats in the boreal forest (BCR 8 and 12) as well as in the St. Lawrence River valley (BCR 13).

It is important that the Quebec government adopts a wetland conservation policy. This policy would set a vision and overarching guidelines for the long term conservation of wetland habitats and associated uplands. Although this legislation has been discussed

for a number of years, continued efforts will be deployed to ensure that it is adopted. The objective is to protect more than 14 million hectares of wetland habitats.

Current and past agricultural practices are a major cause of the degradation of wetland habitats. Our goal is to influence agricultural practices to ensure the protection of wetland habitats in the agricultural landscape, and woodlot framing on private land through adopting BMPs and recognizing the landowners contribution to protecting ecological goods and services of natural areas.

The boreal forest covers approximately 77% of Quebec's landscape. It is mainly public lands that are managed by the provincial government. Human activities in the boreal forest are geared towards the utilization of natural resources (forestry, hydro-electricity), and this exploitation has resulted in the loss of many hectares of wetland habitats that were key to the breeding of many duck species. Our goal is to influence the forestry industry and the government to adopt new environmental guidelines (BMPs) to better protect wetland habitats. The objective is to protect 15 660 000 hectares of wetlands, including riparian wetlands.

Stewardship

Stewardship activities will be either extension of influence. Extension activities will target land-use management organizations and private landowners to raise their awareness about the importance and benefits of wetlands to society. Ducks Unlimited Canada will assist regional municipalities with their planning and land use strategies through the development of their Regional Conservation Plans. In addition, EHJV partner activities will also help private landowners in understanding the importance of their involvement in wetland and upland habitat stewardship and implement Best Management Practices (BMPs). Extension will target many land-use sectors: municipal (regional and local scales), agricultural, forestry, private woodlot, and boreal crown land. A key element to the extension activities will continue to be the development of awareness tools such as wetland maps, reports and factsheets, and public education.

Influence activities will include Environment Canada's Habitat Stewardship Program which assists in the conservation of important wildlife habitats. Another influence activity will be the implementation of the Regional Conservation Plans and to promote wetland conservation actions by regional planners.

Because some of the most threatened wetland habitats are located in BCR 13, and that most of this land is privately-owned, continued efforts will be deployed to obtain the voluntary collaboration of landowners in conserving wetland habitats. One program that has had good success in the past, and will continue in this plan, is the voluntary stewardship of wetlands in privately-owned woodlots.

5.3 Evaluation

The overall success of EHJV programs depend on proper development and implementation so that they provide positive benefits to waterfowl conservation. The main objectives of the evaluation program will be to assess whether the implemented conservation programs do in fact provide for better conservation of waterfowl populations and their habitats, and also to validate underlying biological assumptions that were used to estimate supplemental waterfowl production. We will also conduct cost-benefit analyses for individual conservation strategies to assess their efficacy.

The three main questions that need to be posed are the following:

- Is the Joint Venture meeting its stated objectives?
- Is the Joint Venture employing the best techniques and implementing the most effective programs?
- Are changes needed in the Joint Venture's approach?

The evaluation program will be developed to answer the three questions listed above, and to assess the overall success of the Joint Venture. The results of the ongoing evaluation process will allow us to feed these results back into the management and implementation of our programs in such a way as to adapt our approach to integrate these new findings into subsequent actions. This adaptive management approach will be used in the development and refinement of our conservation programs.

In keeping with the theme of the most recent NAWMP update (*Strengthening the Biological Foundation*), we will develop a research program aimed at gaining a better understanding of the relationship between waterfowl populations and their habitats. One of the shortcomings of the previous EHJV plan (and in many other bird conservation plans) was a missing link between habitat objectives and species population objectives - the hallmark of a strong planning process. For example, how do birds benefit (reproduction, recruitment, etc.) from the direct conservation actions of the EHJV? Without this link, the joint venture could reach habitat conservation goals without seeing improvements in bird populations. To the extent possible, these linkages are made in this implementation planning update. We believe that gaining a better insight regarding the link between waterfowl species and habitat needs and uses is a very important component to developing long term solutions for waterfowl conservation, and our actions need to be framed within this conceptual framework. This will only be possible through carefully planned long term projects aimed at examining these relationships. The ultimate goal is to develop an explicit waterfowl habitat model that will provide insights into expected waterfowl responses to changes in landscape conditions.

Our proposed evaluation program will allow the assessment of the efficacy of EHJV programs at different spatial scales. The different scales and their associated evaluation components are shown in Figure 8, and a description for each component follows.

a) Tracking habitat goals

This represents the coarsest spatial scale (tracking) and represents an evaluation at the regional (provincial) scale. This level will allow us to determine how many hectares of wetlands have been affected through our conservation programs. All habitats conserved through either Intensive or Extensive programs will be registered in the National Tracking System database administered by Ducks Unlimited Canada. This habitat database allows for a very good accounting of habitat accomplishments and allows us to track our progress toward habitat objectives.

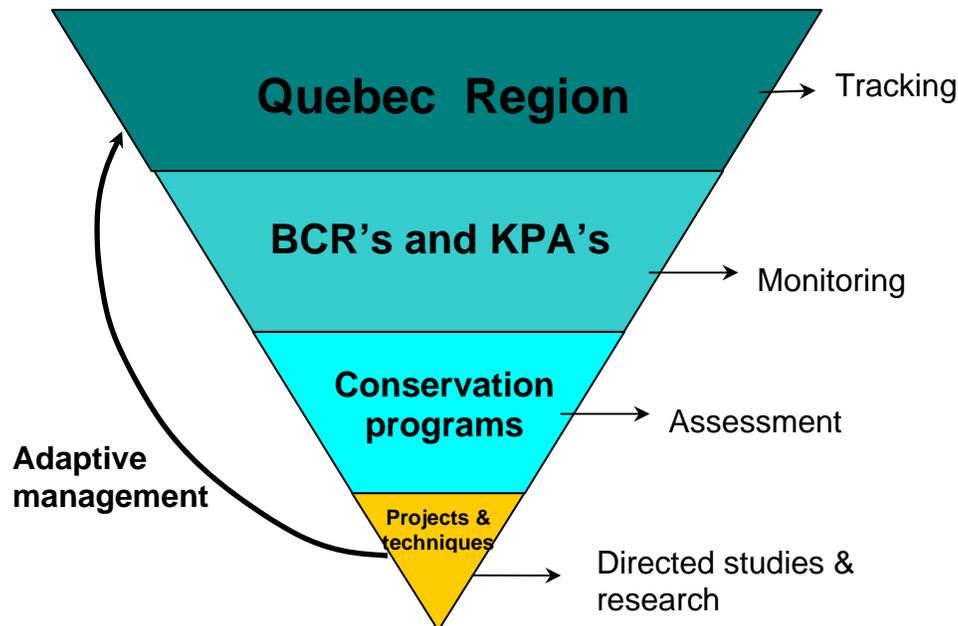


Figure 8. Conceptual framework for the evaluation of the EHJV in the Quebec region.

b) Monitoring habitat and waterfowl changes

The second level at which we will assess the success of EHJV programs is at the BCR (KPA) spatial scale. An evaluation at this level will allow us to monitor the impacts of EHJV programs on waterfowl populations and overall land use. This evaluation will be possible through the use of different waterfowl and habitat monitoring programs. There are a number of monitoring programs that we can use to monitor changes in both habitats and waterfowl populations, and the following is a list of those we intend to use:

Monitoring changes in habitat:

- National Wetland Inventory: BCR 8, 12, 13 and 14, and other wetland mapping using photo interpretation

- 10-year survey of St. Lawrence wetlands and shore habitats (St. Lawrence Centre; CSL): BCR 13 and 14
- 10-year survey of changes in the availability and configuration of wetland habitats along the St. Lawrence river (using the 1 km² breeding pairs survey quadrats): BCR 13
- Current status of the boreal forest (forest cover maps): BCR 8 and 12
- Changes in land use in the boreal forest (ecotourism, forestry activities): BCR 8 and 12

Monitoring changes in breeding waterfowl populations:

- Indicator: Trends in the estimated breeding population size, annual breeding pair density and recruitment (fledging success)
 - CWS – USFWS Eastern waterfowl annual integrated survey program – BCR 8-12-13-14
 - CWS Banding program – BCR13-14
 - Fledging success for BCR 8-12 (BDJV isotope study)

Monitoring changes in staging/moulting waterfowl populations:

- Indicator: Changes in waterfowl abundance and distribution along the St. Lawrence River and its tributaries
 - CWS fall and spring surveys - BCR13
 - CWS Greater snow goose annual spring surveys - BCR 13 and 14
 - MRNFQ 5-yr Waterfowl concentration areas surveys - BCR 13 and 14
 - Sea Duck Joint Venture monitoring programs - BCR 14

Monitoring changes in non-waterfowl wetland-related species:

- Provincial Bird Checklist (EPOQ) – BCR 13 and 14
- Marsh Monitoring Program – BCR 13
- Species at risk annual survey – BCR 13 and 14
- MRNFQ – 5-yr heron colony surveys
- CWS – 5-yr seabird nesting colonies surveys
- PRISM (waterbirds)

c) Program assessment

The assessment of the effectiveness of conservation programs will be done through studies that will evaluate the efficacy of individual techniques or groups of techniques to meet the desired outcome within the overall implementation plan. An example of such an assessment would be the development of a general monitoring protocol for waterfowl populations in paired control/treatment blocks that represent the range of landscapes in the areas of concern (target areas), where treatments blocks would be those where

EHJV conservation efforts would have been applied. This approach would allow for the evaluation of the efficacy of the technique in producing additional waterfowl.

d) Directed studies and research

Directed studies and research projects are small scale, short-term studies of problems or issues with implications for waterfowl in the EHJV. We will develop a research program that will address important knowledge gaps for which information is needed. Current research priorities are the following: 1) the linkage between habitat and waterfowl population biology, 2) the effects of specific waterfowl management practices on non-waterfowl species and overall biodiversity, 3) general waterfowl biology, and 4) the impact of exotic species.

The following is a preliminary list of possible directed studies: (under review)

- Study of the relationship between habitat characteristics and Black duck population biology (jointly with BDJV and DUC's boreal forest research program)
- Identify the relationship between seasonal species distribution and habitat characteristics (species habitat needs)
- Ecological integrity of St. Lawrence river bullrush marshes and their carrying capacity for Greater snow geese (jointly with AGJV)
- Contribution of EHJV protection and stewardship programs to the conservation of other wetland bird species, in particular, species at risk, and mutual benefits for both programs (EHJV/SAR – Habitat Stewardship Program)
- Monitoring the impacts of geese on *zoostera* beds in the James Bay and the St. Lawrence estuary (jointly with AGJV)

e) Adaptive management

Adaptive management describes an iterative process designed to improve the rate of learning about the management of complex systems. The process incorporates an explicit acknowledgement of uncertainties and knowledge gaps about the response of the system to management actions. Reducing these uncertainties (i.e. learning) becomes one objective of management. Adaptive management is a process by which we use cyclic planning, implementation, and evaluation to improve on management decisions and performance. This approach uses current assessment and results of ongoing programs and feeds them back into the planning and implementing phases to further refine the overall delivery of programs.

While there are several approaches, the following are key attributes of an adaptive management approach:

1. Decision makers, scientists, and other stakeholders work together and seek to enhance the understanding of the system that they manage.
2. Identification of: **indicators** (i.e. quantitative measures of the state or dynamics of the system that are relevant in the analysis of trade-offs among management alternatives), **actions** (management activities or policies that will affect the system) and **ecological processes** that link actions to changes in the indicators.
3. Explicit predictions of outcomes of potential management actions on a suite of indicators, using simulation models or other projection tools. Exploration of trade-offs among alternative approaches.
4. Identification of key uncertainties and knowledge gaps. These are prioritised based on how reducing these uncertainties will help in the trade-off analysis. I.e. if we knew X, would it help us to choose among management alternatives A and B?
5. Adaptive management typically involves experiments implemented at an operational scale (management), designed to test hypotheses or qualitative relationships between management actions and changes in indicators.
6. Monitoring of indicators.
7. Evaluation of observed and predicted changes, diagnosis of reasons for differences, and assessment whether newly acquired knowledge justifies modification of the management plan, e.g. based on new projections of the consequences of proposed actions with new relationships between actions and indicators. Other reasons for changes in plans include new objectives of stakeholders.

Although there are detailed models available, the basic adaptive management model consists of four steps and is illustrated in figure 9.

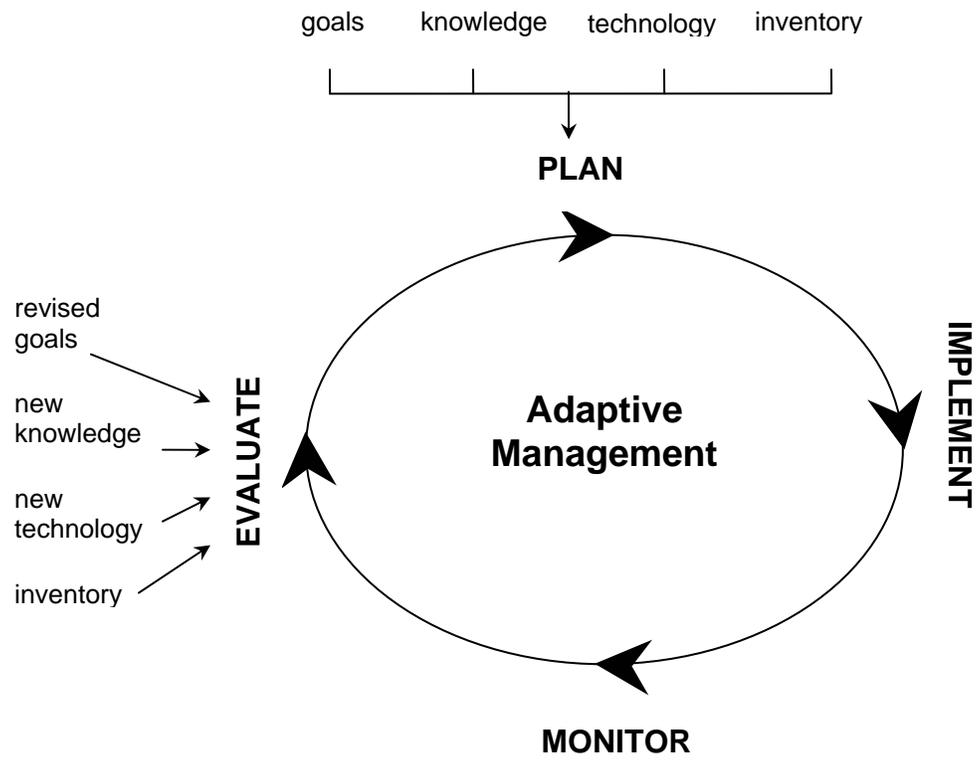


Figure 9. Basic conceptual model for adaptive management.

6. Resource needs

To achieve the conservation objectives presented in this implementation and evaluation plan will require an investment of \$9,772,600 per year. Approximately 4% will be used for planning and coordination, 13% will be allocated to evaluation and research programs, 1% will be invested in communications and education, and the remainder of the funds will be dedicated to the implementation of the different intensive and extensive conservation programs (Table 10).

Table 10. Forecasted financial resources required to achieve 2007-2012 EHJV waterfowl habitat goals.

Program/activity	Land area (hectares)	Projected cost	Delivery agency
1. Habitat securement			
a) Acquisition			
Fee-simple purchase	7,500	\$25,000,000	DUC, MRNF, NCC
Land donation			
TOTAL ACQUISITION	7,500	\$25,000,000	DUC, MRNF, NCC
b) Other than acquisitions			
Conservation easement	350	\$1,000,000	NCC
Conservation agreements	12,100	\$300,000	DUC
TOTAL OTHER THAN ACQUISITION	12,450	\$1,300,000	DUC, NCC
TOTAL SECUREMENT	19,950	\$26,300,000	DUC, MRNF, NCC
2. Habitat enhancement			
Habitat restoration	2,300	\$6,550,000	DUC, MRNF
Wood duck nesting boxes	500 boxes	\$125,000	DUC
Lure crops	N/A	\$150,000	CWS
TOTAL ENHANCEMENT	2,300	\$6,825,000	DUC, MRNF, CWS
3. Habitat management	17,500	\$3,750,000	DUC, NCC
4. Stewardship			
a) Extension	9,700	\$1,675,000	DUC, NCC
b) Influence	123,000	\$1,000,000	DUC, FFQ, CWS
TOTAL STEWARDSHIP		\$2,675,000	DUC, NCC, FFQ, CWS
5. Communications and education	N/A	\$600,000	ALL
6. Coordination	N/A	\$1,938,000	ALL
7. Evaluation	N/A	\$6,525,000	CWS, DUC, MRNF, NCC
8. Government influence	30,279,735	\$250,000	DUC
TOTAL	*	\$48,863,000	

* Note that acres are not additive; enhanced and managed hectares are hectares that have been previously secured.

7. Integration with other Bird Conservation Initiatives

All-bird planning is an iterative process to determine how landscapes can support desired population levels of all birds as prescribed by national and international bird conservation plans under NABCI. In the past, most conservation initiatives delivered messages that improved populations for a single species or group of species without consideration of impacts on other birds. This can be inefficient, especially in times of shrinking budgets for wildlife conservation. Furthermore, wildlife planners have been unable to tell wildlife managers and decision-makers how much habitat is enough, or often send mixed messages depending on the species.

NAWMP recommended that an “all bird conservation” strategy should be used in planning activities in one of its Updates, and care was taken during the planning stages of this implementation plan to consider and integrate, whenever possible, the science needs and conservation priorities for all bird groups. Habitat conservation for all bird species would require an important increase in overall funding, and new partners will be solicited.

In Quebec, conservation plans are currently available for shorebirds and waterbirds, and a landbird conservation strategy is also available. The Quebec region has also been involved in conservation planning at the BCR level through its participation in the development of conservation plans for BCRs 13 and 14. These plans contain a listing of priority species and important bird habitats in Quebec, and these were selected based on biologically-based criteria. Much of the conservation planning currently being developed will use a scientifically driven ecosystem-based approach, and will consider the priority species and habitats identified in the BCR plans.

The conservation programs proposed in this implementation plan should not only have positive repercussions to waterfowl, but should be beneficial to overall wetland and associated upland biological diversity. For example, shorebirds, songbirds, reptiles and amphibians, insects, semi-aquatic mammals, and fishes that depend on wetlands for their entire life or only during certain periods of their life cycle should benefit from the conservation actions of the EHJV.

Appendix 1 outlines a summary of the different science needs and conservation priorities proposed for the conservation of shorebirds, waterbirds, and landbirds as described in the different bird conservation plans currently available for the Quebec region.

8. Implementation processes and relationships

There are two committees that operate within the Quebec EHJV partnership: the Steering Committee and the Technical Committee. The Steering Committee provides overall direction to the partnership, establishes goals and objectives, and oversees the other committees that exist within the EHJV in Quebec. The Steering Committee also coordinates the development of conservation programs, governs the implementation of programs, liaises with the EHJV Management Board and evaluates program delivery.

The Technical Committee is responsible for providing guidance to the Steering Committee on scientific and technical matters. It provides sound scientific advice and guidance, including setting research, monitoring and evaluation priorities, and is responsible for implementing plans, the evaluation process, and making recommendations on adaptive management techniques. It acts as a forum for discussion and integration of biological planning and evaluation at multiple spatial scales, facilitates technical information exchange and reporting, and helps to identify and communicate results of research, monitoring, and assessment to academia and NAWMP/NABCI partners. It reports on the status of biological foundations, evaluation results and implications for future conservation activities.

Each partner agency plays a significant role in the implementation of the EHJV programs in Quebec and contributes to the collective objectives and goals of the partnership.

9. Communications and education

A communication program will be approved and implemented on an annual basis by the Quebec EHJV partners to generate public awareness of and support for NAWMP's goals and objectives. It will also serve to inform stakeholders of partner's accomplishments in Quebec, and to motivate organizations, governments, and politicians to support the protection and enhancement of wetland and upland habitats and to thus attain an all-bird conservation strategy.

Various communication and education actions will be implemented such as:

- annual progress report
- Quebec EHJV website update
- Press conferences and releases
- Scientific publications and technical reports
- Wetland education programs

Appendix 1: Conservation planning for other bird pillars under NABCI

The following actions and science needs were extracted from the **Quebec Waterbird Conservation Plan**, the **Quebec Shorebird Conservation Plan**, and the **Quebec Landbird Conservation Strategy**.

WATERBIRD SCIENCE NEEDS AND CONSERVATION ACTIONS

Monitoring and research needs for waterbird conservation in Quebec

1. Population monitoring

The objective of a bird population monitoring program, no matter which bird group it addresses, is to gather detailed information on distribution, population abundance and trends as well as data on reproduction (hatching success, flight success, net productivity) which will enable the prediction of long term population levels or population goals. Only with long term monitoring and the use of efficient methodologies within a reasonable time frame, will we be able to know if a species is increasing or declining. We have noticed that for certain species, particularly the grebes and the rails, no reliable data exists to determine their population trends on a regional or continental scale because the monitoring systems addressing these species do not exist in Quebec.

1.1 Seabird population monitoring

The survey results for seabirds nesting in Quebec are compiled in the seabird data bank (BIOMQ) which essentially contains data on distribution according to a geographic information system (GIS), abundance, survey methods, survey chronology and other references. A CWS biologist has the responsibility to maintain the BIOMQ as well as its diffusion to biologists, university researchers and the public. The BIOMQ also helps in responding to specific demands for impact assessment in marine habitats and for academic or practical research projects. Part of this bank is also available on the internet. The population monitoring that presently exist are under-financed and do not respect the pre-established time intervals. It is equally impossible to implement other studies which would be necessary to fully understand the problematics related to seabirds especially in northern regions.

Seabird monitoring in Migratory Bird Sanctuaries of the North Shore of the Gulf of St. Lawrence since 1925 (BCR 8)

This monitoring program is unique in North America and lead to the measurement of the efficiency of the network of Migratory Bird Sanctuaries of BCR 8. This study is also part of the National Seabird Program of CWS established in 1971. It has reported on the population dynamics of 16 seabird species. It is also used to measure the health status of the St. Lawrence marine ecosystem when research projects are specific to certain species and can be conducted jointly. Seabirds play a central role at different levels of the food chain and they are sensitive to natural and anthropogenic modifications of the marine

ecosystems. In this context, this seabird monitoring study has also been integrated to the monitoring section of St. Lawrence Action Plan Phase III (SLAP-III) to help judge the health of the St. Lawrence. The actual program must be solidified because a chronic lack of resources in 1998-99 forced the responsible biologist to split the survey over a two year period instead of carrying it out yearly as it had always been done since 1925, and to abandon long term research projects which would allow survey results to be interpreted through an ecosystemic approach. Such modifications decrease our capacity to objectively and scientifically interpret what goes on in the marine environment. In addition, survey techniques for certain species, especially in the more populated sanctuaries, need to be revised and developed to improve our capacity to detect statistically significant changes. To this survey, it would be equally appropriate to incorporate the survey on seabird colonies on the North East of Anticosti Island where there are Black-legged Kittiwake, Black Guillemot and Great Cormorant colonies of national importance but have never been the object of regular monitoring. These colonies are part of BCR 8 just as are the North Shore MBS.

Seabird monitoring in the Mingan Archipelago National Park Reserve of Canada and the Forillon National Park of Canada (BCR 8 and 14)

These monitoring programs are carried out by teams of technicians and biologists from Parks Canada in order to better understand the seabird trends within the parks' limits. The time span varies according to the species, but is usually three years. The results from these surveys are recorded in the BIOMQ and consolidate our knowledge on seabirds of BCR 8 and 14.

Seabird monitoring in the St. Lawrence Estuary, the Gaspé Peninsula and the Magdalen Islands (BCR 14)

These large geographic entities are part of BCR 14. The seabird colonies of BCR 14 have been surveyed according to a more or less regular time interval due to a lack of resources. We need to establish a 5-year survey interval for each of these geographic regions and survey seabird nesting in the most important colonies of this BCR (see the important sites of BCR 14 in section 2.0) (last partial survey, St. Lawrence Estuary: 2001, expected: 2006; last survey, Gaspé Peninsula: 2002, expected: 2008; last partial survey, Magdalen Islands: 2000; expected 2007).

Monitoring of the Northern Gannet population in the Gulf of St. Lawrence (BCR 14)

This survey is part of CWS National Seabird Program established in 1971 and recurs every 5 years. Since there are only 6 colonies across Canada, three of which are in Quebec, all colonies are surveyed during the same season jointly by the Quebec and Atlantic regions. This species is also used as an indicator species of the St. Lawrence marine ecosystem's health status in the monitoring phase of the SLAP-III. Data on productivity and contamination of the Northern Gannet of Bonaventure Island area also recorded. Until now, this monitoring program has respected the five year time span since 1967. The research

division, on the other hand, would need to be supported by additional resources (see research section).

Monitoring of Thick-billed Murre colonies (BCR 3)

Even if certain Thick-billed Murre colonies are geo-politically situated in Nunavut, seabird populations biologists from the Quebec region have had, in the past, the monitoring responsibility of two Thick-billed Murre colonies of Akpatok Island and still have that responsibility within the framework of the National Seabird Program of CWS. All the islands along the coasts of Ungava Bay and Hudson Strait (included in the Nouveau- Quebec) are visited by Inuits from Nunavik who harvest wildlife. The Makivik Corporation is their spokesperson on wildlife matters and it is with this corporation that CWS, Quebec region, collaborates to conduct surveys in this BCR (e.g. Common Eider survey in Ungava Bay in 1980 and 2000). In 1981, 1982 and 1987, a series of control colonies were established at the North and South colonies of Akpatok Island to detect population trends, but have not been re-examined since. These two colonies represent one of the largest, if not the largest, Thick-billed Murre concentration in the world. Update surveys are needed at Akpatok Island as well as at Digges Island and Cape Wolstenholme colonies situated on the continent at the northern point of the Ungava Peninsula. This last colony has never been surveyed according to the unified method of type I or II whereas on Digges Island, CWS operated a research station for several years and established a monitoring protocol according to the unified method (last survey at Akpatok Island, South colony: 1982; North colony: 1983; expected: to be determined).

Monitoring seabird populations of the coastal zones of James Bay and Hudson Bay (BCR 7 and 3)

This portion of the Quebec territory includes the coastal zones of BCR 7 and 3. In 1985, the Makivik Corporation, in collaboration with CWS, Quebec region, set the basis of a colonial bird population monitoring program within the framework of the Common Eider population monitoring of Northern Quebec, for the following species: Herring Gull, Great Black-backed Gull, Glaucous Gull and the Arctic Tern. Several other waterbird species were not surveyed, but should be included in future monitoring. For example, it would be important to know the population status of the Arctic Tern (inland colonies), the Black Guillemot and the unidentified Jaegers of BCR 7 and 3 (last survey: 1985, expected: to be determined).

Population monitoring of the Ring-billed Gull

This survey is carried out every three years within the framework of the monitoring of overabundant species. Due to the numerous complaints concerning the invasion of gulls in urban areas, CWS, Quebec region, follows the evolution of Ring-billed Gull populations in BCRs 13 and 14 because of their close links to urban environments. This survey is very important to support and justify gull control when necessary.

Population monitoring of the Double-crested Cormorant

This species is protected under provincial government legislation. In the last couple of years, an increase in the North American Double-crested Cormorant population has raised questions among Lake Saint-Pierre commercial and sport fishermen concerning a possible competition for resources. An increase in the Double-crested Cormorant population in the St. Lawrence Estuary has also affected the nesting habitat of other colonial bird species which justified population control for this species in the late 80s and early 90s. To support and justify these controls, The Quebec Ministry of Natural Resources and Wildlife (MRNF) wants to maintain a survey for this species in BCR 13 and 14.

1.2 Monitoring of waterbirds other than seabirds

There are currently few monitoring programs covering waterbird species other than seabirds. As opposed to seabirds, which usually nest in colonies, several waterbird species are found in isolated pairs. Very low densities require survey techniques which are adapted to scattered distributions. We must therefore plan on several years of development and practice to implement monitoring systems for these species. Even if certain monitoring programs already exist for particular species, resources to maintain them and improve their contents are deficient.

Monitoring Great Blue Heron colonies in Quebec (BCR 12, 13, 14)

In connection with the Conservation Law of the Quebec government and its regulation on wildlife habitats, MRNF conducts surveys for all heron colonies on the entire Quebec territory every five years. This survey is also a monitoring element within the framework of SLAP (Monitoring program of SLAP-III) and is carried out jointly with contaminant monitoring directed by CWS.

Canadian Lake Loon Survey

The Canadian Lake Loon Survey is supervised by Bird Studies Canada. This monitoring program is carried out by volunteers who send their observations to Bird Studies Canada. The authorities of La Mauricie National Park of Canada also have a monitoring program on the Common Loon which began in 1987.

Monitoring waterbirds associated with wetlands

The Marsh Monitoring Program (MMP) is a bi-national program (Canada and United States) for which the Canadian portion is supervised by Bird Studies Canada. It would be appropriate to link a future survey program on waterbirds associated with Quebec wetlands with the MMP via a Bird Studies Canada coordinator. The sites to be surveyed could consist of the existing National Wildlife Reserves in BCR 13 and 14 as well as certain provincial and federal parks in the BCRs situated farther north. Exceptional environments should also be surveyed, such as Rupert Bay for example, where we find an important population of Yellow Rail which is a species at risk.

2. Research on waterbirds

Fundamental studies on several aspects of waterbird ecology are required to explain and interpret population trends. Data collection of demographic parameters such as productivity and juvenile and adult survival rate is essential to understand population dynamics. Knowledge based on scientific research must be part of our arsenal to make decisions and take action for waterbird population management. Research is intimately linked to population surveys in such a way that it is more accurate and appropriate to talk about «integrated research».

2.1 Research on seabirds and other waterbird species

Population demography

Demographic parameters such as reproductive success and adult and juvenile survival rate are essential information to understand population dynamics. Seabird populations are sensitive to variations in adult survival rates. Obtaining reliable data on survival rates is difficult because it requires the use of banding recapture techniques over several years (10 to 15 years). In Quebec, estimations exist only for the Razorbill of the Sainte- Marie Islands (adult survival rate = 0.90). An empirical method based on reproductive success and the evolution of the Northern Gannet population of Bonaventure Island has also permitted the estimation of an adult survival rate for this species (0.92). Due to the Razorbill's importance in BCRs 8 and 14 in Quebec, we insist on the importance of continuing the Razorbill project in the Sainte-Marie Islands (this project was abandoned in 1997 for financial reasons) and the establishment of control colonies on the islands in the St. Lawrence Estuary to carry out the same type of research. The Northern Gannet of Bonaventure Island should also be the object of long term research on adult and juvenile survival rates. Because of a 40% decline in the Atlantic Puffin population in several sanctuaries of the North Shore, this species should also be the object of a similar study in the Sainte-Marie Islands and Brador Bay sanctuaries. From a logistic point of view, studies on Razorbill and Atlantic Puffin demography can be carried out jointly since these two species use the same nesting sites.

Seabirds as bio-indicators of the St. Lawrence marine ecosystem

Seabird population fluctuations can be correlated to natural stresses (climate change, large scale oceanographic disruptions [e.g. North Atlantic Oscillation; NAO]) and anthropogenic stresses (e.g. oil or chemical spills, contaminants, interaction with fisheries) in the St. Lawrence marine ecosystem. A series of quantifiable parameters such as activity budget, productivity (hatching success, flight success, net productivity), juvenile growth and diet (composition, quality and quantity) can be correlated together and interpreted on the basis of abundance or rarity and quality of food resources. Seven species of seabirds (Northern Gannet, Double-crested Cormorant, Herring Gull, Black-legged Kittiwake, Common Tern, Common Murre and Razorbill) have already been selected in BCRs 8 and 14 to establish an environmental monitoring network. Several scientific publications have been written within this monitoring

framework. The objective of these research projects was to obtain basic data to start and maintain a St. Lawrence marine environment monitoring program using an ecosystemic approach. University participation in these projects is essential and a financial participation is expected through SLAP-IV.

Development of survey techniques for alcids in the sanctuaries of the North Shore, Bonaventure Island, and the islands of the St. Lawrence Estuary

There is an urgent need to establish study plots to improve our survey network in order to obtain more precisions on population estimates particularly for alcids (Common Murre, Razorbill, Atlantic Puffin and Black Guillemot). Due to the lack of resources, surveys have been conducted within a short time frame and with very approximate methods, therefore reducing the precision of the results significantly.

Recovery of Common Tern colonies in the Gaspé Peninsula and Magdalen Islands

The Common Tern populations of the Gaspé region have declined considerably over the past ten years. Gull control techniques are being experimented to restore the Common Tern colony of Sandy Beach in the Gaspé region as well as in the Magdalen Islands, where Red Fox predation and gull invasion in areas favourable for the Common, Arctic and Roseate Tern (an endangered species) are factors which prevent their respective populations from increasing. Parallel to these measures taken to restore these populations, there should be long term research on tern reproductive success and survival rates. These studies would enable us to measure the effectiveness of the interactions carried out in the colonies.

Impacts of water level on the reproductive success of the Black Tern in the fluvial section of the St. Lawrence and extension of this research project to grebes and rails

The Black Tern reproduces in wetlands and was once proposed as a species at risk in Canada. A drastic population decline has been noted in Ontario and we believe the same is true in Quebec. Spring and summer water level conditions appear to be a determining factor in the nesting success of Black Terns along the St. Lawrence (BCR 13). The water level range that represents the optimum conditions for reproductive success of this species should be determined. It would also be appropriate to examine water level impacts on other groups of species (grebes and rails) with similar nesting habits.

3. Conservation actions

Recovery of Common Tern colonies of the Gaspé Peninsula and the Magdalen Islands

In BCR 14, we find several favourable habitats for the establishment of large tern colonies. In the Gaspé region, there is presently a project to restore the Common

Tern at Sandy Beach (Gaspé Bay) which requires varied management techniques such as predator elimination either by trapping or electric fence installation (Red Fox) or the installation of enclosures made of monofilament treillis which prevents gulls from establishing in habitats favourable for tern nesting. There are other sites in the Gaspé region which should be managed to restore Common Tern colonies which were once thriving such as the Carleton Beach Ridge and the Saint-Omer MBS. At the Magdalen Islands, the colonies of Paquet Island, Îlot du Chenal, Baie du Portage Island (Havre-aux-Basques) and the 2nd islet of Point-aux-Loups should also be the object of management for tern colony recovery. Let us mention that three species nest at the Magdalen Islands: the Common Tern, the Arctic Tern and the Roseate Tern, a species at risk.

Predator control on the islands of the St. Lawrence Estuary, and in the sanctuaries of the North Shore and Brion Island (Magdalen Islands)

Predation by the Red Fox is a recurrent problem on islands of the St. Lawrence Estuary (BCR 14) like the Long Pèlerin, the Petit Pèlerin, the Gros Pèlerin, the Gros Pot and the Pot du Phare where the majority of Razorbills of the St. Lawrence Estuary are found. The Société Duvetnor Ltée has made efforts to eliminate them until now, but without substantial and sustained help, we cannot guarantee control efficiency. On the North Shore (BCR 8), the predation problem is particularly important in the following three sanctuaries: Baie des Loups, Sainte-Marie Islands and Brador Bay. Efforts are currently under way to control the Red Fox at the Sainte-Marie Islands, which is not the case for the other two sanctuaries. At Brion Island, a Provincial Ecological Reserve, Red Fox control would allow the recovery of the Leach's Storm-Petrel colony and would most certainly be favourable for the Atlantic Puffin.

Increase the surveillance in the Migratory Bird Sanctuaries on the North Shore

Waterbird poaching is particularly important in remote regions. This is especially true on the North Shore (BCR 8). In several locations, harvesting seabird eggs and increased motorboat use close to Migratory Bird Sanctuaries left without surveillance, are still common activities. From the late 80s until 1997, a substantial increase in surveillance had positive results on reproductive success and on seabird population increases in this region. Unfortunately, a slack in surveillance since 1997 seems to correspond to a recent population decline observed inside and outside the Migratory Bird Sanctuaries. We will have to increase and maintain the surveillance efforts of the North Shore sanctuaries if we want to maintain and increase seabird populations in BCR 8.

Update the recovery plan for the Caspian Tern

Since the Île à la Brume MBS (BCR 8) is the only place where the Caspian Tern nests in Quebec, we feel the urgency to prepare a recovery plan for this species which clearly shows signs of decline. A revision of the Caspian Tern situation in Quebec has already been made in 1997, but didn't follow through since it was

not retained by the COSEWIC as a species at risk. In our opinion, this decision was based on an arbitrary reason since scientific data clearly shows the precarious status of the Caspian Tern on the North Shore. Not to mention that this species' distribution in Eastern Canada is very restricted and could constitute a distinct population from the Caspian Tern of Western Canada which shows no sign of decline.

SHOREBIRD SCIENCE AND CONSERVATION NEEDS

Monitoring and research needs for shorebirds conservation in Quebec

In this section, we present the research and conservation needs of shorebirds in Quebec. There are three key components to this section: i) population monitoring, ii) research, and iii) habitat management. The needs discussed here reflect the conservation priorities that have been developed for each shorebird species which occur regularly in Quebec (see Section II Quebec Shorebird Species Status & Action Sheets).

1. Population Monitoring

One of the goals of population monitoring of shorebirds in Quebec is to assess the use of all known staging areas, present and past, and to evaluate the importance (or potential importance) of each site for breeding or migrating shorebirds and to recommend appropriate actions that may secure the site. A second goal is to identify and survey potential breeding or staging areas for which there are currently little or no data, in order to assess their importance and use by shorebirds. In addition to the goals mentioned above, monitoring programme(s) can be used to obtain a wide range of information for a species, including its distribution, migration routes, abundance (rare vs common), and population trends. Any long-term management of a species would not be possible without such information. Monitoring programmes can also be used in determining, for particular species, the importance of a region (or province) in a national or international perspective (e.g., percent of Canadian/global population breeding or migrating in Quebec). Finally, monitoring is essential to evaluate any changes in populations that may occur in response to human activities (especially at a community level) and environmental changes, and to assess the effectiveness of any action plans or protective measures that have been implemented. It must be emphasized that data from any monitoring programme(s) would compliment checklist data submitted annually by birders and entered into the ÉPOQ databank. Therefore, birdwatchers and bird clubs must be encouraged to continue submitting and processing all checklists with shorebird sightings from all regions of the province and all times of the year.

1.1 Proposed Shorebird Monitoring Programmes for Quebec

Migrating Shorebirds

Initially, prior to implementing an active monitoring programme for migrating shorebirds in Quebec, we propose establishing at CWS-Quebec Region a centralized computer databank that will contain all shorebird sightings, both new and old (e.g., data from the 1987-91 surveys and ÉPOQ data from 1976 up to now), and in a format that will allow computation of population estimates and trends as well as being able to be used in Geographical Information Systems (GIS) mapping software. Because of the large number of shorebird species migrating through Quebec, the large area of the province that they migrate through, the wide range of habitats they utilise on migration, and the differences in the timing of migration for different species, no single programme would ever be sufficient to monitor all species. We therefore propose that a number of monitoring programmes be implemented:

➤ **Quebec Shorebird Survey (QSS)**

Re-establish the annual MSS-based surveys in Quebec for both spring and fall migrations. A Quebec Shorebird Survey should be designed to work with and compliment birders' checklists that are submitted each year and entered into ÉPOQ. We propose two phases in the implementation of a QSS:

1. Extensive survey

For the initial three years, the QSS should be conducted by CWS and be extensive in both effort (personnel and time) and coverage throughout the St. Lawrence corridor (including Ottawa River, Lake Saint-Jean, the Îles-de-la-Madeleine). This information must be collected apart from ÉPOQ checklists. This will enable a direct comparison of QSS extensive survey data collected on each species (such as estimates of number of birds, flock sizes, migration routes, and timing) to be made with ÉPOQ data from the same three years in order to determine not only the accuracy of ÉPOQ data but, equally important, to determine where ÉPOQ data is insufficient or inadequate (specific sites and periods of time). Since a species' migration route or use of staging areas may change over time, we recommend an extensive survey be conducted every 10-15 years.

2. Annual survey

This survey (starting in year 4) will be smaller in scale than the initial extensive survey and will target and focus only on sites, species (or even group of species), or time periods for which the extensive survey had shown ÉPOQ data to be insufficient or inadequate.

➤ **Shorebird checklist programme**

This programme would encourage birdwatchers to continue to fill out and submit daily checklists (perhaps involve birders in a standardised monitoring of specific sites) and have them entered into the ÉPOQ database. Checklists with sightings of shorebirds would be submitted directly to the Association québécoise des groupes d'ornithologues (AQGO) and/or the CWS. (Currently, checklists can be submitted via the Internet at www.oiseauxqc.org/feuilles/chkan.html). Such data

would complement QSS data and be used in determining population estimates and trends (as was done for this Plan). Each year's compilations and results could be published online at the CWS-Quebec Region web site and/or in a Quebec ornithological publication.

➤ ***Species-specific programme***

This programme would target a species for which it was shown that the QSS and the ÉPOQ data are inadequate, possibly because the species is rare (e.g., Willet) or endangered (e.g., Piping Plover), has a very limited distribution, or migrates through the province outside the regular survey period or in a habitat not usually surveyed. For endangered species, a programme could be conducted in collaboration with the Endangered Species Programme for that species.

➤ ***Region-specific programme (northern Quebec)***

This programme would target regions which the QSS can not cover or for which it was inadequate. One such area is northern Quebec, specifically the taiga and tundra regions (from James Bay north to Ungava Bay). A monitoring programme in this region would include two steps. First, potentially important sites (habitat) would be identified and evaluated using aerial photographs or remote sensing (Landsat TM Imagery). Second, breeding and staging areas that have been identified would be visited and ground surveys conducted to determine the actual use of the area by shorebirds. Such programme could be undertaken in partnership between Environment Canada and Hydro-Quebec, or it could be implemented under the framework of PRISM, the Canada-US shorebird monitoring programme, or Environment Canada's *Northern Ecosystem Initiative*. The second step could also be done in collaboration with other projects or researchers working in the north.

➤ ***Linking with national and international programmes***

Collaborate with other regions in national or international programmes designed to monitor a particular species (or group of species). An example of an existing programme is the International Piping Plover Census conducted every five years on the plover's breeding and overwintering grounds.

➤ ***Aerial surveys***

An aerial survey would cover the entire coastline (north and south shores) of the St. Lawrence River corridor, and be repeated every two weeks from mid-July to early November (covering the peak migration for most shorebird species), for a total of 8 surveys. These surveys could be conducted once every five years, and would identify for each species any changes in the location of sites used for staging and the timing of migration. This information is needed in order to adjust the annual QSS to ensure that it targets and focuses on the proper regions and species.

➤ ***Replicate previous surveys (Îles-de-la-Madeleine)***

Beginning in 1969, shorebirds were studied for seven consecutive years on the Îles-de-la-Madeleine. From 1969 to 1972, fall migrating shorebirds were captured, weighed, measured, and banded at sites all across the archipelago, and from 1973 to 1976, a comprehensive breeding census was conducted annually. These two extensive studies provide an excellent baseline to monitor migrating and breeding shorebirds on these islands. However, since these studies were carried out 30 years ago, a repeat of both studies would be very valuable in identifying long-term changes in shorebird use (species and numbers) of this important Quebec archipelago.

Breeding Shorebirds

Breeding shorebirds require a separate monitoring programme from the QSS. Because of habitats and the accessibility to breeding grounds which vary according to the different species, a single programme for all breeding species will not work. We propose that the following different programmes be implemented:

➤ ***Program for Regional and International Shorebird Monitoring (PRISM)***

This programme was formerly known as the North American Shorebird Assessment and Monitoring Program. One of its objectives is to estimate population size and trend of North American shorebird populations. An important component of the programme is to survey breeding shorebird populations in the arctic, i.e., Alaska, Northwest Territories, Nunavut, and the Ungava Peninsula of northern Quebec. A survey protocol has been developed for these areas. It is based on the double-sampling technique, and has two levels of effort: i) a large continental effort that occurs at 20 year intervals, and ii) a selection of good shorebird sites that are surveyed at 10 year intervals. In addition to the surveys, a number of sites will be chosen where checklist survey cards are filled out annually by volunteer birdwatchers. Surveys have been conducted in Nunavut (2001-2005) and in northern Quebec in 2002. Future surveys in the other regions of Arctic Canada, including Quebec, are planned for 2007 and beyond.

➤ ***Breeding Bird Survey (BBS)***

These annual point-count surveys record all species of birds heard or seen in a 3-minute interval at specific sites along the survey routes. However, for most shorebird species the BBS is unsuitable as a monitoring programme because the habitat the birds nest in is often inaccessible or because of the bird's behaviour during the breeding season (i.e., the species is quiet or reclusive). In Quebec BBS data exists for Killdeer, Greater Yellowlegs, Spotted Sandpiper, Upland Sandpiper, Wilson's Snipe, and American Woodcock. Prior to relying on BBS data for any species, however, a thorough evaluation should be done.

➤ ***Boreal forest road-side survey***

Using the network of roads in the James Bay region, an off-road survey technique developed in Alaska for boreal-nesting shorebirds (Lee Tibbitts, Alaska

Biological Science Center) and tested in 2000 for Lesser Yellowlegs near Yellowknife, Northwest Territories, by the CWS could be used in this province. Such a survey might also be proven useful for censusing breeding Greater Yellowlegs, Solitary Sandpipers, and Wilson's Snipe. The use of song playback (taped calls) should be assessed as a potential way of improving survey efficiency for territorial species.

➤ ***Species-specific programme***

Currently, there are two extensive species-specific monitoring programmes in Quebec, one for the Piping Plover and one for the American Woodcock. We propose similar species-specific monitoring programmes be implemented (because of logistics, perhaps only once every five years) for species that are rare or have a very restricted breeding distribution in the province, such as the Willet, Marbled Godwit, Upland Sandpiper, and Wilson's Phalarope, or for a discrete population of a species that elsewhere in the province may be common (e.g., the discrete populations of Least Sandpiper and Greater Yellowlegs on the Îles-de-la-Madeleine). Usually such species (or discrete populations) are inadequately monitored by large-scale surveys, thus the need for smaller but species-specific surveys.

➤ ***Collaborative programmes***

The monitoring of breeding shorebirds could also be done collaboratively with monitoring programmes for other bird groups, for example, the annual Black Duck Joint Venture (BDJV) survey for breeding waterfowl in central Quebec. The BDJV mandate could possibly be expanded to include counting shorebirds. Similarly, because of the high logistical costs involved with studies or surveys in central and northern Quebec, monitoring or research studies for species breeding in this part of the province could be carried out in collaboration with other agencies (such as Hydro-Quebec) or researchers (CWS personnel studying tundra-nesting Canada Geese or Common Eiders, for example) working in the region.

Wintering Shorebirds

Only two shorebird species regularly winter in Quebec: the Purple Sandpiper and Wilson's Snipe. The former winters on gravel beaches and rocky shores along the St. Lawrence while the latter winters in the interior along small streams and wet habitats that do not freeze over. Wintering sites for both species are dispersed and may change from year to year, depending on local winter conditions. A collaborative monitoring programme by biologists and local bird club members should be adequate for the Wilson's Snipe, but for the Purple Sandpiper, aerial survey(s) of wintering sites which are often inaccessible by ground, may be required.

2. Research

In Quebec, with the exception of field studies on flight energetics and foraging behaviour, little research has been done on any other aspects of shorebird

ecology. Although research is not required equally for all species, it is needed for a species or a habitat of concern to provide baseline data from which conservation or management decisions can be taken. Research is essential to assess the importance of changes in population size, productivity, or survival by determining the factors causing or affecting these parameters. Consequently, research priority for shorebirds in Quebec should be given to the following areas:

- Determine turnover rates of shorebird species migrating through the St. Lawrence River corridor, using colour-marking, mark-recapture, and/or radio telemetry techniques. It must also be determined if rates vary among regions and if there are flock movements among different staging sites. This information is required to determine the accuracy and precision of the population estimates calculated using ÉPOQ data. **(HIGH priority)**
- Determine if there are sex or age differences in the timing of migration of different species and in routes or staging areas used (banding programme and genetic sexing for most species). **(HIGH priority)**
- Investigate the significant downward occurrence trends, based on the ÉPOQ checklist data for fall migration, for the Semipalmated Plover, Killdeer, Spotted Sandpiper, Ruddy Turnstone, Red Knot, Sanderling, Semipalmated Sandpiper, Purple Sandpiper, Wilson's Snipe, and Red-necked Phalarope. **(HIGH priority)**
- Assess threats to important staging areas (in particular mudflats and other coastal habitats used for feeding and resting) in the St. Lawrence River corridor and along James Bay (urban development, agriculture, forestry, industry, recreation, hydro-electric projects) and their potential effects on use of these areas by shorebirds (i.e., a proactive long-term approach vs a short-term reactionary approach). **(HIGH priority)**
- Continue the ongoing Recovery Team programme for the Piping Plover, Quebec's only shorebird species classified as *endangered*; the programme includes monitoring of population size and reproductive success as well as protection measures for breeding birds and breeding habitat. **(HIGH priority)**
- Assess the effects of anthropogenic changes on shorebird populations during migration, such as disturbances at staging areas as a result of recreational activities like sailing, wind surfing, and use of all-terrain vehicles (ATVs) on beaches.
- Assess the potential impacts of potential long-term environmental changes, such as global-warming (climate change) or increasing toxin levels in the food-chain.

- Determine the habitat requirements, productivity, and survival rates of species associated with agricultural areas (specifically Killdeer and Upland Sandpiper).
- Examine how changing and expanding agricultural practices affect breeding shorebirds, in particular:
 - Upland Sandpiper – Loss of breeding habitat due to the abandonment of marginal farmland on which shrubs and trees subsequently grow.
 - Wilson's Phalarope – Encroachment of farms (cropland and pastures) onto wetland meadows used for nesting. (**HIGH priority**)
- Examine the effects of habitat fragmentation on the productivity and survival of breeding shorebirds in southern Quebec; species most affected are Killdeer, Spotted Sandpiper, Upland Sandpiper, Wilson's Snipe, and American Woodcock.
- Examine the factors affecting productivity and survival (including nesting and fledgling success, natal philopatry, survival rates, modeling of population dynamics) of all migrant breeders, including those species with isolated populations.
- Assess the population status of the *griseus* subspecies of the Short-billed Dowitcher, which nests only in northern Quebec and Labrador, making it of high jurisdictional importance. (**HIGH priority**)
- Determine the winter distribution, habitat requirements, population size, and the survival rate of the Purple Sandpiper in Quebec. (**HIGH priority**)
- Assess the present status and management of harvested shorebird species, i.e., Wilson's Snipe and American Woodcock.
- Determine the numbers of shorebirds accidentally shot by waterfowl hunters in Quebec (for example, in 1999, 12 shorebird wings other than Wilson's Snipe and American Woodcock were submitted to the CWS for the National Harvest Survey).
- Determine the efficiency and accuracy of song playback (taped calls) for monitoring boreal breeding species.
- Determine the effect of the time of day and the time of the breeding period on survey efficiency.

- Assess the impact of the proposed opening of the Havre aux Basques lagoon on the Îles-de-la-Madeleine.

3. Habitat Management

There is a wide variety of shorebird habitats in Quebec, both for breeding in the summer as well as for staging (foraging and roosting) during spring and fall migrations. Management of any of these habitats must take into consideration competing human land use interests, which in southern Quebec are dominated by agriculture, manufacturing industries, urban developments, maritime ship traffic, and tourism-recreational activities. In central Quebec, competing human activities include forestry and hydro-electric projects while the northern sectors of the province are impacted by mineral exploration and extraction as well as First Nation fishing and hunting activities. Habitat protection or management measures will vary depending on: i) the type of habitat involved, ii) whether the habitat is rare or abundant and widespread, iii) the importance of the habitat in question in the life-cycle of a species or group of species, and iv) any competing human land use activities. Protection can require government legislation or new land use policies, or it can involve stewardship programmes which ensures that human use is compatible with the needs of shorebirds.

In Quebec, the priorities for habitat management should be to:

- Identify, map, and quantify the habitats, including those in protected areas (such as Migratory Bird Sanctuaries), used by shorebirds either for breeding or as staging (feeding or resting) areas during migration.
- Identify habitats under immediate threats or stresses, the nature of the threats (e.g., habitat alteration or loss, windmill farms, oil spills), and recommend mitigating or protective measures.
- Rank (prioritise) all habitats in terms of their importance for a species (or group of species) as well as for the priorities for which protective measures, research, or management are needed.
- Formally protect important breeding or staging areas through inclusion in parks (or Migratory Bird Sanctuaries, reserves, etc) or through designation under programmes such as Western Hemisphere Shorebird Reserve Network or Important Bird Areas.
- Integrate staging and breeding sites with priority sites of landbirds, waterbirds, and waterfowl, as well as potential marine protected sites.

QUEBEC'S LANDBIRD CONSERVATION STRATEGY

Goal

With its Five-year Action Plan for the implementation of NABCI in Quebec, the Canadian Wildlife Service, Quebec Region, supports and values the protection of all birds and all habitats in Quebec. The goal of this Strategy fits in this context: to maintain the diversity and abundance of Quebec's landbirds.

Strategic Orientations

The Canadian Wildlife Service, Quebec region, has defined four strategic orientations for the conservation of landbirds in Quebec: 1) monitoring; 2) research; 3) conservation; and 4) education and awareness. These strategic orientations are in accordance with NABCI's vision for the protection of all birds and all habitats in Quebec.

This Strategy does not pretend to cover every issue and challenges, but it is a mean to start discussions on landbird conservation to establish action, conservation and management plans in collaboration with numerous partners. These future plans will identify the conservation measures specific to each BCR. Moreover, they will prioritize species, habitats, and geographic areas in a hierarchical manner. They will also identify short-term and long-term action items. Finally, they will seek to maintain an equilibrium between a reactionary approach (based on urgency, i.e. abundance, threats, distribution, etc.) and a proactive approach (based on other criteria, i.e. economic, level of knowledge, possibilities of partnership, importance of species, etc.). The identified actions under each strategic orientation are thus examples and will be refined and modified with the involvement of the different partners.

1. Monitoring

It is essential to fill the knowledge gaps on Quebec's landbirds by adequate monitoring programs. Proper knowledge of changes in distribution, abundance, demography and habitats is necessary to identify efficient conservation actions and measure their efficiency.

Action 1a: Identify species and geographic areas that require additional knowledge.

In Quebec, our knowledge of bird distribution, trends and habitat uses in boreal and northern regions is deficient because the majority of monitoring programs take place in the southern regions. We have also less information on the extent and localization of migration corridors, staging and wintering areas than on breeding areas. Therefore, efforts must be allocated to fill these gaps.

Action 1b: Improve or expand existing surveys, or develop new surveys, to address priority gaps in species or geographic coverage.

It is important to review existing monitoring programs to improve their global coverage in terms of habitats and species monitored and taking into account needs, costs, logistic feasibility, human resources availability (professional and amateur birdwatchers), etc. For example, the review of actual monitoring programs and the establishment of new programs should consider species which

are not covered by inventories, such as diurnal raptors and some nocturnal birds as well as landbirds using wetlands. Furthermore, for some species, the monitoring level should include more than trends, i.e. abundance, reproductive success and survival rates.

It would be important to promote the use of checklists across the whole province (BCRs 14, 12, 8, 7, 3) in order to increase the coverage of the EPOQ database, managed by the *Association québécoise des groupes d'ornithologues* (AQGO).

Likewise, the Breeding Bird Survey (BBS), coordinated by CWS in Canada, should be expanded to better cover the boreal forest (BCRs 14, 8, 7). BBS is one of the rare tools providing a large scale overview of population trends for several landbirds. The presence of recently built forestry roads offers an opportunity to improve coverage in this region.

The Christmas Bird Count (CBC), coordinated by Bird Studies Canada, is a useful tool to follow population trends of winter bird residents in Quebec. A greater participation of birdwatchers in the northern regions (BCRs 14, 12, 8, 7, 3) would help us obtain a better idea of bird distribution in winter.

The potential of migration monitoring stations as a tool to follow landbird populations of the boreal forest and the northern regions should be fully evaluated in order to be recognized. The Canadian Migration Monitoring Network has been developed to detect bird population trends from poorly accessible regions. Some bird population trends are solely based on the interpretation of these data. In Quebec, the only station is located near Tadoussac. Other sites should be developed to monitor a greater number of species. Updating the Atlas of the Breeding Birds of Southern Quebec should also be considered and evaluated.

Landbirds are good indicators of the health of our ecosystems; on the one hand, their mobility allows them to react quickly to environmental changes and, on the other hand, they can easily be observed. Monitoring of the structure (species composition, richness and abundance) of bird communities across time and space would document changes in ecosystems (BCRs 13, 14, 12, 8, 7, 3). Such monitoring would facilitate the modeling of the impact of climate changes on bird communities.

Moreover, the establishment of a monitoring program for species whose optimal habitat is limited could help orient the actions to maintain viable populations (BCRs 13, 14, 8, 7). As some habitats are affected by the homogenization of forest stands, it would be important to monitor these habitats temporally and spatially. In fact, because bird conservation measures usually concentrate on habitat management rather than population management, we should also evaluate the possibility to follow habitats within the framework of existing bird monitoring programs.

Action 1c: Encourage research on monitoring to ensure continued improvement in sampling design, data collection protocols, analysis procedures, etc.

Methodological improvements of monitoring programs would help reduce many biases and thus facilitate comparisons among different programs, and between years. For example, it would be interesting to develop new precise methods to follow landbird populations through time, especially in remote and northern regions (BCRs 14, 12, 8, 7, 3). In fact, population monitoring throughout the vastness of the boreal forest poses important logistical and financial constraints. The use of geomatics (geographic information system, airborne and spaceborne imagery) combined with efficient statistical and modeling methods would be useful to design optimal sampling schemes. Methods based on volunteer participation need to be carefully evaluated as to the soundness of the data collected, i.e. as to their potential and limitations.

Moreover, the coordination of monitoring programs would ensure efficient use of human and financial resources, sharing of knowledge and would facilitate understanding of population dynamics throughout the annual life cycle.

Action 1d: Train and encourage volunteers to participate in monitoring surveys.

Monitoring programs are strongly volunteer-driven in populated areas. Thus a particular attention should be given to data collection and analysis and to adequate training of volunteers. Likewise, forestry partners interested in undertaking voluntary wildlife monitoring programs should be provided with supervision or expertise to improve the quality of the information collected in the field. Incentives are thus necessary to encourage participation to monitoring programs. Participation possibilities must be announced and recognized. The use of different technologies, such as the Internet, to promote participation and training is fundamental, particularly to establish a network of observers in remote regions such as northern Quebec. Moreover, in regions where it is impossible to involve enough volunteers, automated listening stations could be developed as an inventory tool.

Action 1e: Ensure that monitoring results are available and used for research and conservation.

Original databases, including metadata, should be made available to everyone to maximize use of the data. Moreover, the regular compiling, interpretation and reporting of monitoring data would help maintain volunteer interest as well as encourage use of the data by scientists and managers.

Finally, it is important to mention that partnerships with people in the field lead towards concrete research, conservation and management actions. Although monitoring programs cannot occasionally identify the causes of the detected changes, they serve important function in identifying some research priorities.

2. Research

Scientific research allows the understanding of many issues concerning the conservation of landbirds by looking at, for example, bird species biology, habitat dynamics, different potential threats to survival, etc. A greater understanding of the complete life cycle of landbirds certainly leads to better management of their populations. Research is essential to identify the causes of the trends observed by the monitoring programs in order to put in place adequate conservation measures. Well documented research projects can also be used in an irregular or even regular monitoring framework when the research is replicated in the future.

Action 2a: Study landbird population status in regard to national conservation priorities (BCRs 14, 13, 12, 8, 7, 3).

At the continental and national level, many landbird species have been identified as priority species. We need to identify the size of breeding populations in Quebec, the importance of the preferred habitats (in terms of extent and distribution), the wintering areas and the migratory corridors used. Understanding the ecology of these species is essential to evaluate the impacts of natural resource development projects and to propose mitigation measures.

Action 2b: Determine the needs, in terms of essential habitats, to maintain bird populations, especially in the St. Lawrence valley and in the boreal forest (BCRs 13, 14, 12, 8, 7, 3).

Conservation actions are often based on habitat management. It is necessary to understand the critical components of habitats to ensure bird reproduction and survival. The loss of hardwood stands in the St. Lawrence valley has reached a level at which certain species could possibly express difficulties to survive. The elimination of stumps in many remaining woodlots is also a threat to bird reproductive success. Moreover, our knowledge of habitats, especially in the boreal forest, is even more limited.

Briefly, understanding the ecological processes governing these habitats and the requirements specific to each species is fundamental to adequately manage the diversity of this vast territory. Because species often use more than one habitat throughout their life cycle and that habitat quality varies between years, it is important to document the role of each habitat for a given species and this over several years.

Action 2c: Study the specific and cumulative impacts of the different anthropogenic development activities on bird populations (BCRs 14, 8, 7).

There is an obvious need to understand the impacts of human activities on landbirds. In Quebec, the intensity, frequency and severity of these activities vary considerably from one region to another. It is important to take advantage of this diversity to distinguish anthropogenic threats from natural disturbances on landbird reproductive success. Also, the impact of climate changes is still relatively unknown. The presence of pristine boreal forests constitutes a great

opportunity to evaluate the changes susceptible of affecting wildlife. The impact of climate changes could also be significant in different parts of the province due to an increase of degree-days which could modify the agricultural landscape as well as the northern and forest landscapes.

3. Conservation

Information obtained from monitoring and scientific programs will lead to the development of conservation actions which will identify, protect, and manage the habitats essential for the maintenance of viable landbird populations in Quebec. Action plans developed with partners will identify needed actions and regroup them according to: priority species, priority regions, habitats and issues. We enumerate here only a few of the possible actions to ensure the protection of landbirds in Quebec.

Action 3a: Support policies and processes which favour the sustainable use of natural resources (BCRs 13, 14, 12, 8, 7, 3).

Because of their diversity, their population dynamics and their mobility, birds do not always respond perfectly to traditional conservation actions. A community approach must be superposed to more classic species approaches.

Conservation efforts must be directed at several scales (i.e. regional, landscape and local) to ensure that sufficient habitats are adequately distributed in the breeding area to meet bird community needs. The landscape approach requires a planning methodology which favours the sustainable development of resources. Within this context, CWS-Qc could influence land planning to better respond to birds' needs, for example, by encouraging competent authorities to modify or adopt laws, regulations, policies and practices beneficial to bird populations and which support the objectives of the action and conservation plans.

In the same manner, environmental impact assessments for land development projects offer an opportunity to intervene in land management in favour of bird conservation, particularly during the establishment of conservation measures to minimize impacts on birds and their habitats.

Action 3b: Participate in existing conservation efforts and initiate new partnerships for the conservation of landbirds.

Extended partnerships favor the synergy of bird conservation activities by sharing of knowledge and enhancing collaboration opportunities. It is important to encourage existing partnerships efforts and initiate new ones if necessary. Moreover, it would be equally important to watch for new funding opportunities at the international, national and regional levels from which landbird conservation could benefit.

4. Education and awareness

Even if the education of individuals and organizations is inherent to the partnerships for bird conservation, it must be sustained and promoted. However,

education is often based on scientific knowledge that is not accessible to the majority of the population. We must correct this difficulty to access information because it generates myths and misconceptions which are often translated into non appropriate bird conservation actions.

The conservation of landbirds in Quebec depends also on the involvement and aptitudes of those interested. The success of the Strategy thus depends on a number of elements ranging from general public outreach to the active commitment of distinct partners (e.g. financially). Outreach must therefore join and involve a large spectrum of stakeholders and actions.

Action 4a: Establish a communication program for the conservation of landbirds (BCRs 13, 14, 12, 8, 7, 3).

There exist many different potential outreach tools for the general public, land management stakeholders and wildlife partners to increase awareness on the importance of the conservation of landbirds and their habitats in Quebec. According to the audience, it is possible to publish articles in general science magazines and in scientific journals, to diffuse information during events, to make presentation in schools, to produce diverse outreach documents such as posters, information leaflets, Internet pages, etc. The conservation and action plans will detail the elements of the communication program. For example, the monitoring programs initiated by Environment Canada's Biosphere and EMAN (Ecological Monitoring and Assessment Network) involving local people could be developed in order to include the monitoring of birds.