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Status of Quebec Waterfowl Populations, 2009

Christine Lepage and Daniel Bordage (Editors)

Quebec Region

Canadian Wildlife Service
Technical Report Series Number 525

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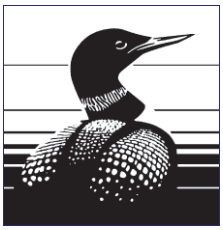

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STATUS OF QUEBEC WATERFOWL POPULATIONS, 2009

Christine Lepage and Daniel Bordage (Editors)[1]

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Abstract

Status of Quebec Waterfowl Populations, 2009 is intended to provide an up-to-date picture of the status of waterfowl species in Quebec. This publication has for each of the 37 species annually present (as a breeder, a migrant or a winterer) in the province a text that provides an overview of seasonal occurrence, an assessment of provincial and continental population trends, a description of conservation issues, and the importance of the role played by Quebec in its conservation.

The Anserini tribe (geese) includes six species that are observed regularly in Quebec. However, the only common breeder is the Canada Goose, which is also an abundant migrant. During migration, while the Snow Goose (Greater subspecies) and Brant pass in large numbers, the Greater White-fronted Goose, Ross's Goose, Snow Goose (Lesser subspecies) and Cackling Goose are more observed in small numbers.

The tribe Cygnini (swans) is represented by two species that breed in Quebec, but only the Tundra Swan is a regular breeder. The Mute Swan, despite an extraordinary breeding record, is mainly observed irregularly and in small numbers.

The tribe Anatini (dabbling ducks) includes nine species that are regular breeders in Quebec. While most of the species in this tribe are originally Prairie natives (Gadwall, American Wigeon, Mallard, Blue-winged Teal, Northern Shoveler and Northern Pintail), the American Black Duck, Wood Duck and Green-winged Teal are intimately linked to forest habitats. The American Black Duck breeds exclusively in northeastern North America.

The Aythyini tribe (diving ducks) is composed of five species regularly observed in Quebec. Mostly associated with the Prairies, the Canvasback (migrant only) and Redhead are present only in small numbers in the province. While the Greater Scaup and Lesser Scaup breed mainly in the northern half of Quebec, the Ring-necked Duck has a fairly continuous and uniform distribution in Quebec, and is therefore present in large numbers.

The tribe Mergini (sea ducks) is represented by 13 species that breed regularly in Quebec, with a number of them present even in winter. This is a highly variable group generally associated with marine environments during a sizeable portion of their annual cycle. The Surf Scoter, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser and Common Merganser prefer the boreal forest. The King Eider, Harlequin Duck, White-winged Scoter, Black Scoter, Long-tailed Duck and Red-breasted Merganser inhabit primarily the taiga or tundra, and the Common Eider breeds in colonies in island and coastal environments. Two species of Mergini are considered of special concern on the List of Wildlife Species at Risk in Canada: Harlequin Duck (Eastern Population) and Barrow's Goldeneye (Eastern Population).

Lastly, the tribe Oxyurini (stiff-tailed ducks) includes only one species breeding in Quebec, the Ruddy Duck.

The waterfowl species for which Quebec has an important responsibility—based on the Quebec proportion of breeding or migrant numbers compared to North American numbers—are the following: Snow Goose (Greater subspecies), Brant (Atlantic Population), Canada Goose (Atlantic and North Atlantic populations), American Black Duck, Common Eider (*dresseri* and *borealis* subspecies), Harlequin Duck (Eastern Population), Black Scoter, Barrow's Goldeneye (Eastern Population), Hooded Merganser, Common Merganser and Red-breasted Merganser.

Résumé

L'*État des populations de sauvagine du Québec, 2009* entend faire le point sur la situation des espèces de sauvagine au Québec. À cette fin, chacune des 37 espèces présentes annuellement (comme nicheur, migrateur ou hivernant) dans la province fait l'objet d'un texte qui dresse le bilan de sa présence saisonnière, met en perspective la tendance de sa population aux échelles continentale et québécoise, décrit ses enjeux de conservation et souligne l'importance du rôle du Québec envers cette espèce.

La tribu des *Anserini* (oies) compte six espèces observées de façon régulière au Québec. La Bernache du Canada est toutefois la seule espèce qui y niche couramment, en plus d'être un migrateur abondant. Au moment des migrations, tandis que l'Oie des neiges (Grande sous-espèce) et la Bernache cravant passent en grand nombre, l'Oie rieuse, l'Oie de Ross, l'Oie des neiges (Petite sous-espèce) et la Bernache de Hutchins sont plutôt observées en petit nombre.

La tribu des *Cygnini* (cygnes) compte deux espèces nicheuses au Québec, mais seul le Cygne siffleur y est un nicheur régulier. Le Cygne tuberculé, malgré une mention de nidification exceptionnelle, est surtout observé de façon marginale et irrégulière.

La tribu des *Anatini* (canards barboteurs) compte neuf espèces qui nichent régulièrement au Québec. Alors que la plupart des espèces de cette tribu sont davantage originaires des Prairies (Canard chipeau, Canard d'Amérique, Canard colvert, Sarcelle à ailes bleues, Canard souchet et Canard pilet), le Canard noir, le Canard branchu et la Sarcelle d'hiver sont intimement liés au milieu forestier. Le Canard noir niche exclusivement dans le nord-est de l'Amérique du Nord.

La tribu des *Aythyini* (canards plongeurs d'eau douce) compte cinq espèces observées régulièrement au Québec. Surtout associés aux Prairies de l'Ouest, le Fuligule à dos blanc (migrateur seulement) et le Fuligule à tête rouge sont donc plutôt présents marginalement dans la province. Tandis que le Fuligule milouinan et le Petit Fuligule nichent davantage dans la moitié septentrionale, le Fuligule à collier a une répartition assez uniforme au Québec et présente, par conséquent, des effectifs très nombreux.

La tribu des *Mergini* (canards de mer) compte treize espèces qui nichent régulièrement au Québec; plusieurs y hivernent également. Il s'agit d'un groupe très varié, caractérisé par une utilisation du milieu marin durant une bonne partie du cycle annuel. La Macreuse à front blanc, le Petit Garrot, le Garrot à œil d'or, le Garrot d'Islande, le Harle couronné et le Grand Harle préfèrent nicher dans la forêt boréale. L'Eider à tête grise, l'Arlequin plongeur, la Macreuse brune, la Macreuse à bec jaune, le Harelde kakawi et le Harle huppé fréquentent plutôt la taïga ou la toundra, et l'Eider à duvet niche en colonie en milieu insulaire et côtier. Deux espèces de *Mergini* ont le statut « préoccupant » sur la *Liste des oiseaux en péril au Canada* : l'Arlequin plongeur (Population de l'Est) et le Garrot d'Islande (Population de l'Est).

Enfin, la tribu des *Oxyurini* (canards à queue dressée) compte une seule espèce au Québec, nicheuse de surcroît, l'Érismature rousse.

Les espèces de sauvagine pour lesquelles le Québec a une responsabilité importante – fondée sur la proportion d'effectifs nicheurs ou migrateurs québécois par rapport aux effectifs nord-américains – sont les suivantes : Oie des neiges (Grande sous-espèce), Bernache cravant (Population de l'Atlantique), Bernache du Canada (Populations de l'Atlantique et de l'Atlantique Nord), Canard noir, Eider à duvet (sous-espèces *dresseri* et *borealis*), Arlequin plongeur (Population de l'Est), Macreuse à bec jaune, Garrot d'Islande (Population de l'Est), Harle couronné, Grand Harle et Harle huppé.

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Foreword

Waterfowl have fascinated people throughout the ages. Who has not rejoiced to see flocks of geese and ducks in the thousands winging across the Quebec skies towards their breeding grounds further north, a harbinger of the much-anticipated season of spring? At this time of year, our waterfowl are clad in their brightest plumage and it is the perfect time to observe ducks and geese on their staging grounds, where they pause to replenish their energy reserves after flying hundreds of kilometres without stopping. Although not all waterfowl have the Wood Duck's magnificent garb, their other attributes provide ample compensation for observers. How can you not be fascinated by the spectacular courtship displays of the Common Goldeneye, in which the drake attempts to win the hen's favours by adeptly whipping his head backward to his tail while simultaneously levitating his breast out of the water? What better way is there to wake up on a spring morning than to hear the honking of Canada Geese high over your house, even in the middle of the city? From the window, you can spot the flock's characteristic inverted "V" formation, with the angle of the "V" pointing due north towards the birds' breeding grounds. Quebec is the final destination for many species of waterfowl, which settle down and raise their young during our all-too-brief summer. At this time, you can observe a Mallard hen and her brood hurriedly crossing a country road in single file or, in the St. Lawrence estuary, enjoy the spectacle of Common Eider crèches, with a few hens watching carefully over the multitude of ducklings, which slip under the water and then pop up as if they were inflated with helium or were pieces of cork. In fall, the ducklings are now grown and, overhead, birds that nested at more northerly latitudes are migrating back to their wintering grounds, a sign that winter is on its way farther north. At this time, birdwatchers are joined by waterfowl hunters, who use all their experience and skill to draw in the wily birds, particularly the adults, who are agile flyers and well seasoned in the ways of hunters. Then winter settles in, a time when waterfowl numbers are generally at their lowest. However, the calm is relative in the world of waterfowl since Quebec is a southern vacation destination for some very hardy species. Then, the throngs of waterfowl return, as they do every spring, and the cycle of life begins again. One of the primary mandates of Environment Canada's Canadian Wildlife Service is to ensure the continuation of this life cycle. How many birds return from the south? Was it a good year for breeding? Are hunters killing too many birds? Are some species in trouble? Do birds have enough suitable habitat? Do our development projects have an impact on waterfowl? Is pollution within levels that can be tolerated by waterfowl? These are some of the questions that we hope to begin to answer in this document.

Table of contents

List of figures

List of tables

1. Introduction

The North American Bird Conservation Initiative (NABCI) is an international effort to conserve all bird species. Under NABCI, the goal is to formulate continent-wide bird conservation plans for each of four groups of birds: waterbirds (other than waterfowl), waterfowl, shorebirds and landbirds. Subsequently, action plans are to be devised for each bird conservation region (BCR; see Figures 1a and 1b), taking account of priority bird species. In each BCR, species are ranked by priority according to various factors, in particular: (1) percentage of the continental population present in the BCR; (2) total population of the species; (3) the species' status, particularly population trends; and (4) conservation issues associated with the species. To develop effective and objective conservation plans, these parameters must be documented as accurately as possible.

In Quebec, a considerable amount of information on waterfowl is available, thanks to well-organized monitoring efforts and applied research programs often dating back a number of years, as well as other sources. The interest in waterfowl and the collection and dissemination of information on this bird group is due in large part to the North American Waterfowl Management Plan (NAWMP), a large-scale initiative that was signed in 1986 by Canada and the United States, joined officially by Mexico in 1994 (North American Waterfowl Management Plan 2004). Owing to NAWMP, waterfowl specialists are a step ahead of specialists in the other three groups in continent-wide conservation efforts. Under NAWMP, a number of joint habitat ventures cover most of North America; however, these conservation efforts have admittedly targeted the middle part of the continent, particularly the U.S. Great Plains and Canadian Prairies. Furthermore, although the 1994 and 1998 updates to NAWMP included a dozen habitat joint ventures, until 1998, there were only two species joint ventures: the Arctic Goose Joint Venture (AGJV) and the Black Duck Joint Venture (BDJV) (North American Waterfowl Management Plan 1994; North American Waterfowl Management Plan 1998). The third species joint venture (Sea Duck Joint Venture, or SDJV) was not established until 1998. The latest NAWMP update in 2004 could easily give the impression that all waterfowl species are already adequately covered in Quebec. This is not the case, however, since for example only one species of dabbling duck in Quebec, the American Black Duck, is directly covered under NAWMP, through the BDJV.

At the provincial scale, the Quebec Waterbird Management Plan (Canadian Wildlife Service and Ministère du Loisir, de la Chasse et de la Pêche 1986) is, to our knowledge, the closest antecedent to *Status of Quebec Waterfowl Populations, 2009*. The section on the status of waterfowl populations in the Waterbird Management Plan was modelled in large part on a management plan formulated eight years earlier (Reed 1978). The 1986 management plan provided results by region in six regions of Quebec—which were quite a bit different from the bird conservation regions—and species were often grouped together for certain analyses (the scoters, for example). The situation of waterfowl and our current knowledge have obviously changed a great deal in the last 25 years. Consequently, *Status of Quebec Waterfowl Populations, 2009* is not an updated version of these previous documents but rather a new conservation tool based on recent information on waterfowl populations in the province.

The objective of the *Status of Quebec Waterfowl Populations, 2009* is to describe the status of waterfowl populations in Quebec at the bird population scale, with reference to

the NABCI BCRs. This scale is the one generally used by the Canadian Wildlife Service (CWS) and NAWMP. In addition, to help supplement NAWMP and NABCI efforts, this document attempts to identify the species with the highest conservation priority, the key sites used by these birds, and management and conservation measures that could have a positive effect on these species. Therefore, *Status of Quebec Waterfowl Populations, 2009* will serve as a cornerstone of the *Quebec Waterfowl Management Plan, 2011.* The *Quebec Waterfowl Management Plan, 2011* is specifically intended to determine priority species at the scale of the individual bird conservation regions and identify relevant conservation issues, in order to ensure the conservation of waterfowl in Quebec.

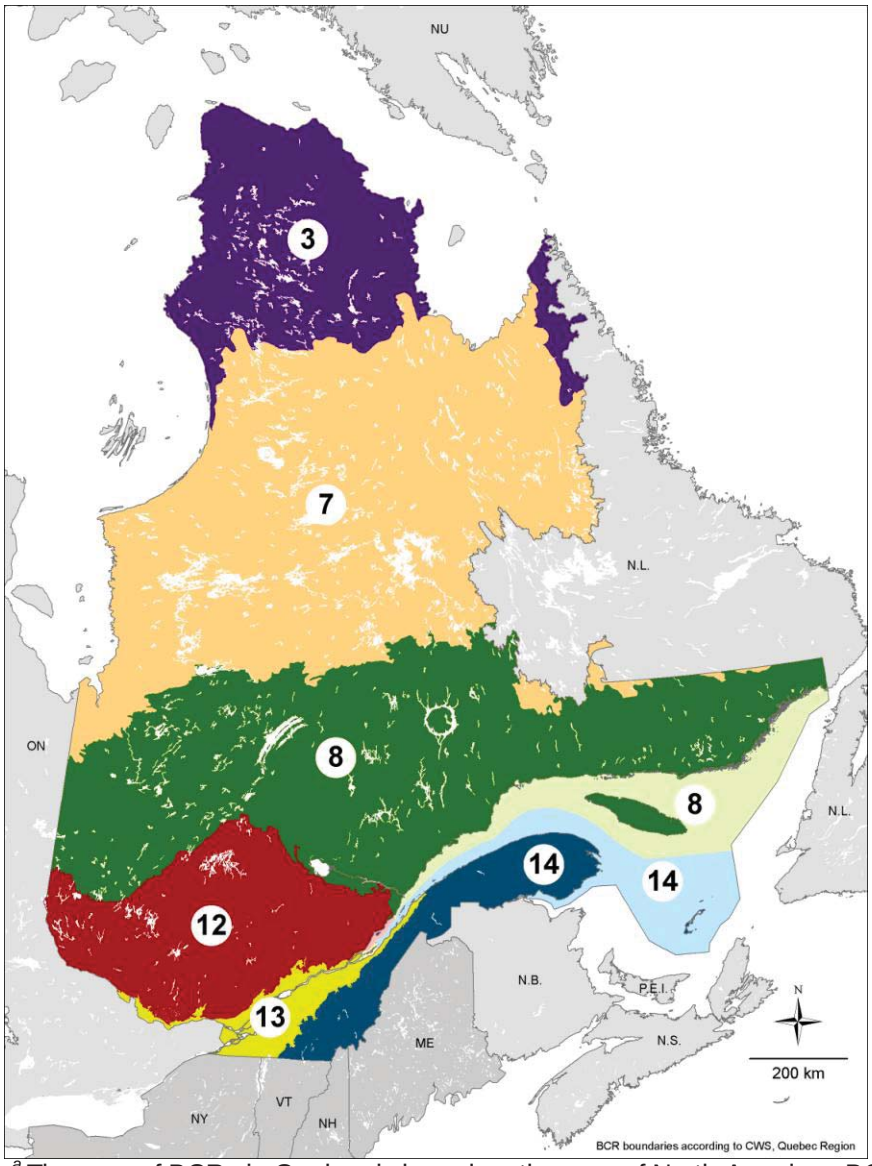
2. Methodology

2.1 Study area

This document covers the entire province of Quebec: a total of 1,645,706 km^2 for the purposes of this study, representing the combined area of the six BCRs in Quebec. Therefore, this area is slightly smaller than the official number published by Quebec's statistics bureau (Institut de la statistique du Québec 2009; 1,667,441 km^2), but 100,000 km^2 greater than the number provided by Statistics Canada (1,542,056 km^2; www.statca.gc.ca). In northern Quebec, it does not include the various islands in James Bay and Hudson Bay such as the Belcher Islands, which belong to Nunavut. The Makivik Corporation recently reached an agreement-in-principle on the recognition of the ancestral rights of the Nunavut Inuit over the islands off the coast and it will be interesting to follow the progress of this issue in the future.

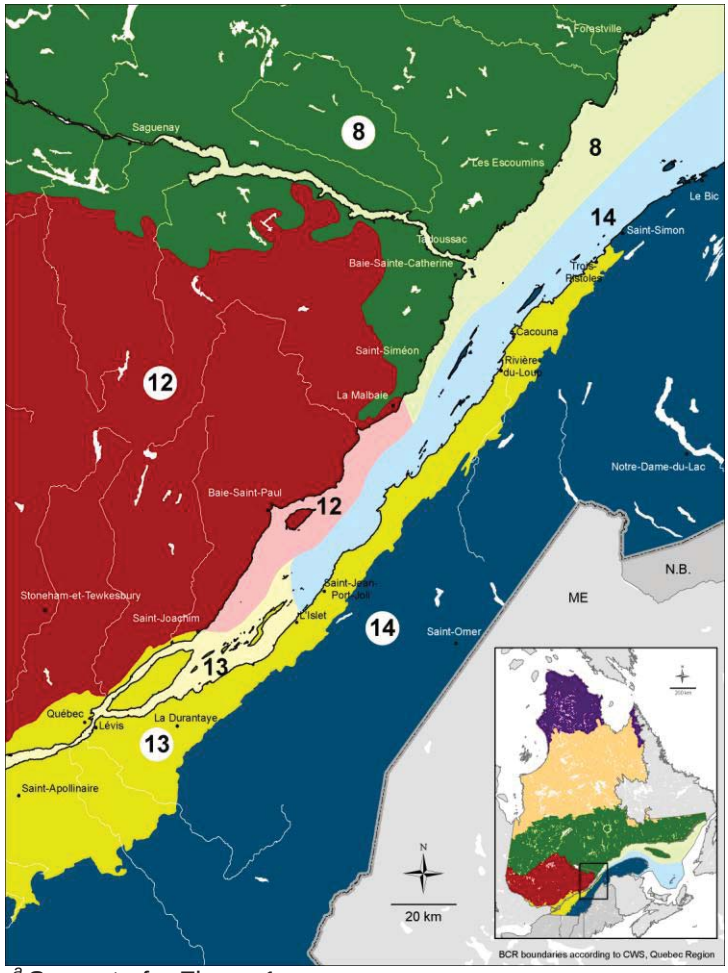
As we mentioned in the introduction, this document makes frequent reference to various BCRs as defined by NABCI. This division of North America under the initiative is based on ecological characteristics; Quebec makes up part of six BCRs (Figure 1a), which are listed in Appendix 8.1.

Figure 1a. Bird Conservation Regions (BCRs) in Quebec (adapted from NABCI's map of BCRs in North America[a])



[a] The map of BCRs in Quebec is based on the map of North American BCRs developed by the NABCI partners and supported by the Commission for Environmental Cooperation. The specific requirements of this document (scale, boundaries and area) have been taken into account in this adaptation (by Martine Benoit, CWS-Quebec Region), which provides a better fit between the BCRs and Canada's terrestrial ecozones (Ecological Stratification Working Group 1995). In addition, the delineation of aquatic environments reflects their landscape characteristics and use by birds (based on CWS-Quebec Region expertise).

Figure 1b. BCRs (8, 12, 13 and 14) in the upper estuary (adapted from NABCI's map of North American BCRs[a])



[a] See note for Figure 1a.

This document also refers to Quebec's administrative regions (see map in Appendix 8.2).

2.2 Target species

Selecting the species of waterfowl to be covered in this document was more difficult than it would appear at first glance. First, we had to agree on the actual definition of the term "waterfowl" and, secondly, decide if we will concern ourselves with all species of waterfowl observed in Quebec or only those that breed or are observed regularly here. Thirdly, several species of waterfowl are managed by populations, like the Canada Goose, or subspecies, like the Common Eider. Lastly, from a taxonomic point of view, differentiating between species and determining their affiliation is a more complex and quickly evolving discipline than one would expect, particularly with today's increasingly sophisticated genetic analysis tools. Therefore we decided, albeit subjectively at times, to define species, subspecies and populations in this document as described below.

In this document, the term waterfowl is synonymous with anatid (family Anatidae in the order Anseriformes), according to the taxonomy used by the American Ornithologists' Union, referred to henceforth as the AOU check-list (American Ornithologists' Union 1998). We used the *Liste des oiseaux du Québec* (Regroupement QuébecOiseaux 2007) to draw up the list of waterfowl species that occur in Quebec (Table 1), since this list only takes into account species of wild origin, for which there is verifiable proof of their occurrence in the province. The family Anatidae is composed of three subfamilies observed in Quebec (although not necessarily regularly): Dendrocygninae (whistling-ducks), Anserinae (geese and swans) and Anatinae (ducks). In this document, waterfowl species are listed by tribe, the taxonomic level below subfamily. The status of the species listed in Table 1 is based mainly on *Liste des oiseaux du Québec* (Regroupement QuébecOiseaux 2007) and *Liste commentée des oiseaux du Québec* (David 1996), although we occasionally adapted or modified the list to take account of subspecies and populations, according to the experience of the authors and other contributors. In drawing up the list of species observed in Quebec and their status, we consulted the ÉPOQ database (up to April 18, 2007) (Larivée 2007), *Atlas saisonnier des oiseaux du Québec* (Cyr and Larivée 1995), *Recensement des canards hivernant dans la région de Montréal (1982-2008)* (Bannon 2008), *Liste des oiseaux observés au Québec* (Lepage 2008), *Birds of North America* species accounts, *Check-list of North American birds* (American Ornithologists' Union 1998) and *The Breeding Birds of Quebec: Atlas of the Breeding Birds of Southern Quebec* (Gauthier and Aubry 1996).

A total of 50 species of waterfowl have been observed in Quebec (Table 1) (including 1 extinct species), belonging to 7 tribes (American Ornithologists' Union 1998): (1) Dendrocygnini (whistling-ducks, 2 species); (2) Anserini (geese, 9 species); (3) Cygnini (swans, 4 species); (4) Anatini (dabbling ducks, 13 species); (5) Aythyini (diving ducks, 6 species); (6) Mergini (sea ducks, 15 species) and (7) Oxyurini (stiff-tailed ducks, 1 species). Among these 50 species, some are exceptional, occasional or regular visitors.

When the list is narrowed down to species that are regular breeders or migrants or that winter regularly in Quebec (i.e., are present every year), it is closer to 37 species belonging to 6 tribes (the tribe Dendrocygnini is not represented) (Table 2). Owing to their regular status in Quebec, the 37 species in Table 2 are discussed in greater detail in this document. In addition, tables 1 and 2 identify the various subspecies and populations considered under the NAWMP and discussed in this document. The English common names (and French names in the French version[1]) and Latin scientific names were taken from the AOU check-list. Lastly, note that the species in tables 1 and 2 follow the same order as in the AOU check-list.[2]

Does Quebec host a significant portion of the waterfowl species in North America and the world? To answer this question, agreement must first be reached on the number of

[1] The French common names on the AOU Check-List mainly follow those on the list drawn up by the Commission internationale des noms français des oiseaux (CINFO) (Commission internationale des noms français des oiseaux 1993).

[2] In the case of the French version of this document, this is different from the order used in the CINFO list.

waterfowl species found in North America and worldwide, which is not an easy task. The guide *Waterfowl: An Identification Guide to the Ducks, Geese and Swans of the World* (Madge and Burn 1988) lists 155 species of anatids worldwide (including 1 extinct species and 2 presumed to be extinct), based on Livezey's taxonomy (Livezey 1986), which breaks the world's anatids down into 7 subfamilies and 8 tribes. According to the *Handbook of the Birds of the World* (del Hoyo et al. 1992), there are probably 147 species of anatids that still occur in the world (plus 5 species that have been extinct since 1600) divided into 3 subfamilies and 12 tribes. A very different taxonomic list has been drawn up by Sibley and Monroe (Sibley and Monroe Jr. 1990): in their scheme, the infraorder Anserides consists of 157 species worldwide (including 2 extinct and 2 presumed extinct), divided into 2 families, Dendrocygnidae (9 species) and Anatidae (148 species). According to Sibley and Monroe, the family Anatidae can be divided into 4 subfamilies: Oxyurinae, Stictonettinae, Cygninae and Anatinae, the latter divided into 2 tribes, Anserini (geese) and Anatini (ducks). Finally, the recent classification scheme devised by Callaghan and Harshman (Callaghan and Harshman 2005) includes 161 living species of anatids, divided into 7 subfamilies including Anserinae (divided into 4 tribes, including Cygnini and Anserini), Oxyurinae and Anatinae (divided into 4 tribes, including Anatini, Aythyini and Mergini). As can be seen, there is no unanimous consensus on the exact number of waterfowl species that currently occur in the world, although around 155 species seems to be a common assessment.

In this document, in agreement with NAWMP, North America (or "the continent") refers to all the territory covered by Canada, the United States (including Hawaii) and Mexico. Therefore, we could not use the AOU check-list to determine the number of waterfowl species in North America because the AOU's definition of North America also includes Central America, Cuba and the West Indies, including the Greater and Lesser Antilles, Bahamas, Jamaica and others. Therefore, we opted for the list drawn up by NAWMP (North American Waterfowl Management Plan 2004), which consists of 50 native waterfowl species breeding on the continent, divided into 7 tribes, in accordance with the taxonomy proposed by the AOU. Since NAWMP does not consider Cackling Goose to be a separate species from Canada Goose (although this is recommended by the AOU), for the purposes of this document, the total number of North American waterfowl species is 51.

The answer to the initial question of whether Quebec is well represented in terms of waterfowl is that the province hosts nearly three quarters of the waterfowl species breeding in North America (37 out of 51) and almost one fourth (37 out of 155) of all the waterfowl species in the world.

Table 1. List of waterfowl species observed in Quebec and their status (excluding species of captive origin, or likely to be considered so, and species for which there is no verifiable proof of their occurrence)

Common name[a]	Scientific name[b]	Status[c]
Whistling-ducks – Tribe Dendrocygnini		
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*	Ve
Fulvous Whistling-Duck	*Dendrocygna bicolor*	Ve
Geese – Tribe Anserini		
Tundra Bean-Goose	*Anser serrirostris*	Ve
Pink-footed Goose	*Anser brachyrhynchus*	Vo
Greater White-fronted Goose		
Greenland subspecies	*Anser albifrons flavirostris*	Mr, We
Mid-continent population	*Anser albifrons frontalis*	Mo, We
Snow Goose		
Lesser subspecies	*Chen caerulescens caerulescens*	Mr, Br
Greater subspecies	*Chen caerulescens atlanticus*	Mr, Br, We
Ross's Goose	*Chen rossii*	Mr
Brant		
Atlantic population	*Branta bernicla hrota*	Mr, Be
Barnacle Goose	*Branta leucopsis*	Vo
Cackling Goose	*Branta hutchinsii*	Mr, Bo
Canada Goose		
Atlantic population	*Branta canadensis interior*	Mr, Br, Wo
North Atlantic population	*Branta canadensis canadensis*	Mr, Br
Atlantic Flyway resident population	*Branta canadensis maxima*	Mr, Br, Wr
Swans – Tribe Cygnini		
Mute Swan	*Cygnus olor*	Mr, Be, We
Trumpeter Swan		
Interior population	*Cygnus buccinator*	Vo
Tundra Swan		
Eastern population	*Cygnus columbianus columbianus*	Mr, Br, We
Whooper Swan	*Cygnus cygnus*	Ve
Dabbling ducks – Tribe Anatini		
Wood Duck		
Eastern population	*Aix sponsa*	Mr, Br, Wo
Gadwall	*Anas strepera*	Mr, Br, We
Eurasian Wigeon	*Anas penelope*	Mr
American Wigeon	*Anas americana*	Mr, Br, We
American Black Duck	*Anas rubripes*	Mr, Br, Wr
Mallard		
Subspecies *platyrhynchos*	*Anas platyrhynchos platyrhynchos*	Mr, Br, Wr
Blue-winged Teal	*Anas discors*	Mr, Br

Common name[a]	Scientific name[b]	Status[c]
Cinnamon Teal	*Anas cyanoptera*	Vo
Northern Shoveler	*Anas clypeata*	Mr, Br, We
White-cheeked Pintail	*Anas bahamensis*	Ve
Northern Pintail	*Anas acuta*	Mr, Br, Wr
Garganey	*Anas querquedula*	Vo
Green-winged Teal		
Eurasian subspecies	*Anas crecca crecca*	Vo
North American subspecies	*Anas crecca carolinensis*	Mr, Br, Wo
Diving ducks – Tribe Aythyini		
Canvasback	*Aythya valisineria*	Mr, We
Redhead	*Aythya americana*	Mr, Br, We
Ring-necked Duck	*Aythya collaris*	Mr, Br, Wo
Tufted Duck	*Aythya fuligula*	Vo
Greater Scaup		
North American subspecies	*Aythya marila mariloides*	Mr, Br, Wr
Lesser Scaup	*Aythya affinis*	Mr, Br, We
Sea ducks – Tribe Mergini		
Steller's Eider	*Polysticta stelleri*	Ve
King Eider	*Somateria spectabilis*	Mr, Br, Wr
Common Eider		
Southern subspecies	*Somateria mollissima dresseri*	Mr, Br, Wr
Northern subspecies	*Somateria mollissima borealis*	Mr, Br, Wr
Hudson Bay subspecies	*Somateria mollissima sedentaria*	Br, Wr
Harlequin Duck		
Eastern population	*Histrionicus histrionicus*	Mr, Br, Wo
Labrador Duck	*Camptorhynchus labradorius*	E
Surf Scoter	*Melanitta perspicillata*	Mr, Br, We
White-winged Scoter		
North American subspecies	*Melanitta fusca deglandi*	Mr, Br, Wo
Black Scoter	*Melanitta americana*	Mr, Br, We
Long-tailed Duck	*Clangula hyemalis*	Mr, Br, Wr
Bufflehead	*Bucephala albeola*	Mr, Br, Wr
Common Goldeneye		
North American subspecies	*Bucephala clangula americana*	Mr, Br, Wr
Barrow's Goldeneye		
Eastern population	*Bucephala islandica*	Mr, Br, Wr
Hooded Merganser	*Lophodytes cucullatus*	Mr, Br, Wr
Common Merganser		
North American subspecies	*Mergus merganser americanus*	Mr, Br, Wr
Red-breasted Merganser	*Mergus serrator*	Mr, Br, Wr
Stiff-tailed ducks – Tribe Oxyurini		
Ruddy Duck		
Continental population	*Oxyura jamaicensis rubida*	Mr, Br

[a] Common names were taken from the AOU check-list (American Ornithologists' Union 1998, 2003, 2004) and populations and subspecies from NAWMP (North American Waterfowl Management Plan 2004).

[b] Scientific name and taxonomic order according to the AOU (American Ornithologists' Union 1998; American Ornithologists' Union 2003) and the species accounts in the *Birds of North America* series in the case of North American species; according to Kear (Kear 2005b) for other species.

[c] The main documents used to draw up the list of species and their status include *Liste commentée des oiseaux du Québec* (David 1996) and *Liste des oiseaux observés au Québec* (Lepage 2008). ÉPOQ data (up to April 18, 2007; Larivée 2007), the *Atlas saisonnier des oiseaux du Québec* (Cyr and Larivée 1995), *Recensement des canards hivernant dans la région de Montréal (1982-2008)* (Bannon 2008), *Birds of North America* species accounts, the *Check-list of North American Birds* (American Ornithologists' Union 1998) and *The Breeding Birds of Quebec: Atlas of the Breeding Birds of Southern Quebec* (Gauthier and Aubry 1996) were also consulted.

Status code of birds

B = breeder
E = extinct
M = migrant
V = visitor
W = winter (does not necessarily refer to a successful and complete case of overwintering, but occurrence at least in January and February)

The status code is accompanied by a lower-case letter indicating the frequency of occurrence:
e = exceptional (may go unobserved for a number of years)
o = occasional (observed every two to five years)
r = regular (observed every year)

2.3 Population estimates

Table 2 shows the estimated world, North American and Quebec populations (in thousands of individuals) of the 37 species of waterfowl that occur regularly in Quebec and thus are covered in this document (see Section 2.2). These numbers correspond to the breeding population, or the number of individuals present during the breeding season, including adult males and females and immature birds. Numbers are presented by species, population or subspecies, as appropriate. For Quebec populations, only one of the three above-mentioned taxonomic divisions is used to avoid duplication. For North American and world populations, these different categories provide additional information that we believe is useful. For example, in the case of the Brant (Table 2), the estimated world population of the species is 526,000 individuals, 314,000 of which are found in North America. The Atlantic population, which corresponds to the subspecies *Branta bernicla hrota* (Table 1), numbers 164,000 individuals worldwide and in North America—therefore, none outside North America, as is the case for all "populations," and none in Quebec, since the species does not breed in the province. The population of this subspecies is included in Table 2 because it is observed regularly during migration in Quebec (status Mr; Table 1). Lastly, due to its status as an exceptional breeder (Be; Table 1), there is no regular breeding population in Quebec, hence its Quebec population is zero.

Unless indicated otherwise in Table 2, world population numbers were derived from the total of the estimated North American population (see below), and estimated populations in the rest of the word according to Wetlands International (Wetlands International 2006). When a range of values was provided by Wetlands International, the mean value in the range was used. For estimates of North American populations, unless indicated otherwise in Table 2, mean estimates for the 2001–2003 period, in the case of geese and swans, and mean estimates for the 1994–2003 period, in the case of ducks, were used; the numbers were taken from the *North American Waterfowl Management Plan 2004* (North American Waterfowl Management Plan 2004).

For Quebec populations, unless indicated otherwise in Table 2, estimates come mainly from waterfowl breeding surveys carried out by CWS-Quebec Region. First, the number of indicated breeding pairs of the species was calculated for each of the six Quebec BCRs; the numbers shown in Table 2 are the total of these estimates for each BCR, corrected to take account of the entire population (see discussion of the conversion factor below). Without delving too deeply into the details of the analyses, which can be found in the reports on the surveys and inventories in question (see also Chapter 3 on main databases), we provide a few general explanations relevant to this document. For BCR 3, the estimated numbers are the mean estimates for 2004–2006 from the Waterfowl Survey of Northern Quebec (WNOR), an aerial survey carried out by CWS and the USFWS (for a list of acronyms used in this document, see Appendix 8.3). WNOR estimates were calculated using a separate stratified ratio estimator (Cochran 1977: p. 164). In addition, numbers for all species, except for Tundra Swan (Eastern population), Canada Goose (Atlantic population) and Snow Goose (Lesser subspecies), were multiplied by 2.5 to take account of the fixed-wing:helicopter correction factor, estimated at “fixed wing = 0.37 helicopter” according to a preliminary report (S. Gilliland, CWS-Atlantic Region, unpubl. data). This factor was calculated based on results obtained in Labrador by the regular WNOR survey crew and a crew experienced with the helicopter survey method used by CWS in the Breeding Waterfowl Plot Survey of Eastern Canada (BWPSEC). The correction factor is applied so that WNOR data is comparable to the data for the other Quebec BCRs, in the latter case, obtained exclusively by helicopter. The three species for which the correction factor was not applied are large and fairly easy to spot in a barren northern environment with little vegetation, and consequently difficult to miss. For BCR 7, numbers were estimated by a simple mean expansion per km² from helicopter surveys of 25 plots of 100 km^2 each, spaced systematically every 100 km, in a vast area centred in the Grande rivière de la Baleine (Big Whale River) and Petite rivière de la Baleine (Little Whale River) watersheds. This CWS helicopter survey was carried out in 1991 thanks to logistical and financial support from Hydro-Québec.

For BCRs 8, 12, 13 and 14, population estimates were calculated independently for the Waterfowl Survey of Southern Quebec Lowlands (WLOW), Waterfowl Survey of Southern Quebec Uplands (WUPL) and Waterfowl Survey of the St. Lawrence Shoreline (WSHO) (see Chapter 3 on main databases), based on the 2004–2007 mean; the results of the three surveys (for BCRs 8 and 12) or two surveys (BCR 14: WUPL and WLOW; BCR 13: WLOW and WSHO) available were then added. The estimated annual population was calculated using stratified random sample equations (Cochran 1977: p. 89) for most species or a simple mean expansion for species in which the stratified analysis results were inadequate (e.g., sample too small, CV too high). All population estimates for each BCR, obtained in the form of total indicated breeding pairs, were then converted to obtain an estimate of the total population (adult

males and females and immatures). This arbitrary conversion is based on two tribe-based characteristics: (1) breeding age and (2) male to female ratio. Although these two characteristics vary slightly from species to species, at the tribe level, they are fairly similar. However, since data on these characteristics is scarce, we agreed to apply simple, arbitrary rules in this document. The male to female ratio was taken mainly from the *Birds of North America* species accounts while the proportion of immatures was determined more arbitrarily by taking account of breeding age and an overview of estimates of annual productivity in the literature. The conversion factors applied to estimate the total Quebec population (shown in Table 2) based on the estimated number of indicated breeding pairs are shown in Appendix 8.4. For example, for sea ducks (Mergini), 100 indicated breeding pairs in surveys would be multiplied by a conversion factor of 2.56, to obtain a total population of 256 individuals (used in Table 2). Of these 256 individuals, 100 would be adult females (1 female per indicated breeding pair) and 130 would be adult males (100 females multiplied by a male:female ratio of 1.3). The number of immatures, 26, would be obtained by subtraction (total of 256 minus 100 females and 130 males), which corresponds to 10% (arbitrary percentage estimated for sea ducks) of the total population.

Table 2. Estimated size (thousands of individuals) of world, North American and Quebec populations of waterfowl species discussed in this document; numbers correspond to the breeding population, or the number of individuals present during the breeding season, including adult males and females and immature birds. Numbers of 10,000 and greater were rounded off to the nearest thousand while numbers below 10,000 were rounded off to the nearest hundred.

Species Population/subspecies	**World**[a]	**North America**[b]	**Quebec**[c]	**%Qc**[d]	**Rank**[e]
Geese					
Greater White-fronted Goose	2,979	1,212			
Greenland subspecies	27	0	0	0	
Snow Goose	4,290	4,290			27
Lesser subspecies	3,342	3,342	<0.5	0.01	
Greater subspecies	718[f]	718[f]	<0.1	0.01	
Ross's Goose	619	619	0	0	
Brant	526	314[g]			
Atlantic population	164	164	0	0	
Cackling Goose	637[h]	637[h]	<0.1	0.02	28
Canada Goose	5,570[i]	5,570[i]			1
Atlantic population	667[j]	667[j]	667[j]	**100**	
North Atlantic population	130[k]	130[k]	36	**28**	
Atlantic Flyway resident population	1,022	1,022	18	2	
Swans					
Mute Swan	626	20	<0.1	0.5	32
Tundra Swan	299	186			23
Eastern population	103	103	2.9	3	
Dabbling Ducks					
Wood Duck	4,600	4,600			17
Eastern population	4,400	4,400	13	0.3	
Gadwall	5,252	3,900	1.3	0.03	25
Eurasian Wigeon	3,050	0	0	0	
American Wigeon	3,100	3,100	10	0.3	19
American Black Duck	910	910	558	**61**	2
Mallard	22,956	13,056			9
Subspecies *platyrhynchos*	22,875	13,000	134	1	
Blue-winged Teal	7,240	7,240	4.0	0.06	22
Northern Shoveler	5,940	3,800	1.1	0.03	26
Northern Pintail	6,360	3,600	72	2	14
Green-winged Teal	8,172	3,910[l]			8
Subspecies *carolinensis*	3,900	3,900	151	4	
Diving Ducks					
Canvasback	740	740	0	0	
Redhead	1,200	1,200	<0.1	0.01	31
Ring-necked Duck	2,000	2,000	273	14	5
Greater Scaup	1,510	800			16
Subspecies *mariloides*	1,050	800	43	5	
Lesser Scaup	4,400	4,400	57	1	15

Species Population/subspecies	World[a]	North America[b]	Quebec[c]	%Qc[d]	Rank[e]
Sea Ducks					
King Eider	1,375[m]	575	<0.1	0.02	30
Common Eider	3,331	1,160			6
Subspecies *dresseri*	300	300	96	**32**	
Subspecies *borealis*	1,410	550	128	**23**	
Subspecies *sedentaria*	255[n]	255[n]	26	10	
Harlequin Duck	336[o]	257[o]			21
Eastern population	6.8[o]	6.8[o]	5.4[o]	**79**	
Surf Scoter	600	600	102	17	12
White-winged Scoter	2,402	600			24
Subspecies *deglandi*	600	600	1.7	0.3	
Black Scoter	400[p]	400	112	**28**	11
Long-tailed Duck	6,475	1,000	119	12	10
Bufflehead	1,400	1,400	11	0.8	18
Common Goldeneye	3,855	1,345			7
Subspecies *americana*	1,345	1,345	222	17	
Barrow's Goldeneye	258	257			20
Eastern population	6.8[q]	6.8[q]	6.8[q]	**100**	
Hooded Merganser	350	350	97	**28**	13
Common Merganser	1,382	1,000			4
Subspecies *americanus*	1,000	1,000	302	**30**	
Red-breasted Merganser	1,008	700[r]	390	**56**	3
Stiff-tailed Ducks					
Ruddy Duck	1,110	1,102			29
Continental population	1,100	1,100	<0.1	0.01	
TOTAL (species)	119,258	76,850	3,660	---	---

[a] Unless otherwise indicated, estimates were calculated by adding estimates for North America and estimates for the rest of the world obtained from Wetlands International (Wetlands International 2006), using the mean value when a range of values was provided.

[b] Unless otherwise indicated, for geese and swans, the mean 2001–2003 population was used and for ducks, the mean 1994–2003 population according to NAWMP 2004 estimates was used (North American Waterfowl Management Plan 2004). North America is defined here as the territory covered by Canada, the United States (including Hawaii) and Mexico.

[c] Unless otherwise indicated, estimates consist of the total of the estimates for BCRs 7, 8, 12, 13 and 14 obtained from CWS helicopter waterfowl surveys and a follow-up fixed-wing survey (applying a fixed-wing:helicopter correction factor) of BCR 3 carried out jointly by CWS and the USFWS. Mean numbers for 2004–2006 obtained in WNOR were used for BCR 3, the results of a single 1991 survey for BCR 7 and mean 2004–2007 estimates for the other BCRs, using the WLOW, WUPL and WSHO results independently by BCR.

[d] Quebec portion of the North American population, expressed as a percentage (percentages in bold are those over 20).

[e] Quebec abundance ranking; 1 = most abundant waterfowl species.

[f] Population surveyed in the spring of 2008 (J. Lefebvre, CWS, unpubl. data).

[g] The Western High Arctic population (7,500 ind.) is included in this estimate and was obtained from Wetlands International (Wetlands International 2006).

[h] Since under NAWMP 2004 (North American Waterfowl Management Plan 2004), Cackling Goose is not considered to be a separate species from Canada Goose, indicated breeding pair estimates were calculated by adding the estimates for the following Canada Goose populations:

(i) half of the Tallgrass Prairie population (hutchinsii and parvipes; 421,900/2); (ii) half of the Shortgrass Prairie population (hutchinsii and parvipes; 160,600/2); (iii) Cackling population (minima; 166,300) and (iv) Aleutian population (leucopareia; 43,000). Half of the Taverner's population of Canada Goose was also added (taverneri and parvipes; 272,000/2) based on estimates by Wetlands International (Wetlands International 2006), since NAWMP 2004 does not estimate the Taverner's population.

[i] The Canada Goose population was estimated by totalling the estimates of the different populations in NAWMP 2004 (North American Waterfowl Management Plan 2004), supplemented by estimates of the following populations obtained from Wetlands International (Wetlands International 2006), which were not estimated in NAWMP: 1) Atlantic population [see note i]; 2) Vancouver population (fulva; 86,300); 3) Taverner's population (272,000/2) [see note g]. The estimate for the Cackling Goose population was then subtracted from the total.

[j] Estimate obtained by adding the mean 2004–2006 population obtained in WNOR, the 1991 estimate from the Grande-Baleine Complex waterfowl survey and mean 2004–2007 estimates of the Atlantic population (west of 70° 30′ W) obtained in WUPL.

[k] Estimated population according to Wetlands International (Wetlands International 2006).

[l] Including 10,000 Anas crecca nimia in the Aleutian Islands (Wetlands International 2006).

[m] No reliable estimates are available for the East Asia King Eider population. Gerasimov and Gerasimov (2003 in Wetlands International 2006) estimated that, in spring, 50,000 eiders migrate through the Kamchatka Peninsula. Uspenski (1972 in Cramp and Simmons 1977) estimated the entire Russian population (former USSR) at between 1.0 and 1.5 million adult individuals. For this comparative table, we arbitrarily used 500,000 for the East Asia population. This estimate was added to the Northern Europe and Western Siberia population, estimated at 300,000 individuals (Wetlands International 2006) and the North American population of 575,000 individuals (North American Waterfowl Management Plan 2004), for a very rough total of 1,375,000 individuals.

[n] Numbers taken from CWS winter surveys in 2003 (Gilliland et al. 2008).

[o] Estimate based on 62,500 individuals in the Asian population (pacificus; Wetlands International 2006), 250,000 individuals in the Western population (NAWMP 2004), 6,800 individuals in the Eastern population (1,400 individuals [550 breeding pairs in Newfoundland and Labrador; Thomas 2008 and Trimper et al. 2008] and 5,400 individuals in Quebec [50 breeding pairs in the Gaspé region, 50 pairs on the North Shore and 2,000 pairs in Nunavik; Morneau et al. 2008]), 12,000 individuals in the Iceland population (Wetlands International 2006) and 5,200 individuals in the Greenland population ("a few thousand pairs"; Boertman 2008).

[p] World population numbers from Wetlands International (Wetlands International 2006) are no longer up to date since the decision by the AOU to raise Melanitta nigra americana to the rank of species (M. americana). Consequently, the number shown in the table corresponds to the estimated population in North America and is taken from NAWMP 2004 (North American Waterfowl Management Plan 2004).

[q] Numbers obtained from BAGOS conducted by CWS in the East (Quebec and New Brunswick in 2009); however, almost all adults in this population breed in Quebec (M. Robert, CWS, pers. comm.).

[r] Numbers were clearly underestimated in NAWMP, which provided a number of 250,000 individuals in North America. The North American estimates in this table (700,000 individuals) correspond to the total number of birds in the West (> 200,000 individuals [set at 210,000]; Wetlands International 2006), Quebec (390,000) and a totally arbitrary number of 100,000 individuals for the rest of the Eastern part of the continent.

2.4 Distribution maps

Esri's ArcGIS 9.3 software and Spatial Analyst extension were used to generate abundance maps from data provided by the various waterfowl surveys. The study areas for the five surveys were defined as follows:

- WSHO: One-kilometre-wide strip along the shoreline of the St. Lawrence, Ottawa, Richelieu and Saguenay rivers and Lac Saint-Jean.
- WLOW: Lowland areas of Quebec south of 54° 14' N, excluding the WSHO study area.
- WUPL: Southern Quebec south of 54° 14' N, excluding the WSHO and WLOW study areas.
- Grande-Baleine Complex waterfowl survey: boundaries of 1:20,000 topographic maps from the BDTQ that were closest to the boundaries of the influence radius (see description of concept of influence radius below) of survey plots located on the edge of the study area.
- WNOR: Portion of BCR 3 in Quebec south of 61°N.

Since these five study areas extend throughout almost all of the territory of Quebec, the Lambert conformal conic projection for Quebec (LCCQ, NAD83) was used for all data layers (with the central meridian located at 68° 30' W, which corresponds to the centre of the province).

A reference point layer was created using the coordinates of the centroid of each survey plot, except in the case of WNOR, where linear transects were used and an additional step was required. Since survey transects were divided into segments in this survey, the coordinates of the centroid of each segment were used for the reference point layer. For each waterfowl species, the density value (indicated breeding pairs[IBP]/100 km^2) in each plot was linked to its reference point.

The inverse distance weighted (IDW) method was used for the interpolation process, based on a fixed radius without a minimum number of points. Radius length was arbitrarily defined for each survey (20 km for WSHO, 15 km for WLOW, 75 km for WUPL, 150 km for the Grande-Baleine Complex waterfowl survey and 50 km for WNOR) to ensure consistency between the results and the characteristics of each survey (distance between plots, plot size, etc.).

An analysis mask was applied to limit the analysis of each survey to the study area involved. In addition, a line layer ("barriers") was drawn manually to ensure that the interpolation did not take account of survey points located on the other side of large bodies of water such as the St. Lawrence estuary and Gulf. For example, survey points on the south shore of the St. Lawrence were not considered in the interpolation calculations for zones normally under their influence but on the other side (north shore) of the river.

To facilitate comparisons between species, the same legend was used for all waterfowl breeding density maps. The number of classes used was chosen arbitrarily, with their respective thresholds corresponding approximately to the 25th, 50th, 75th and 95th percentiles for mean density of indicated breeding pairs (all species combined).

It should be noted that the maps in this document show the distribution of species according to regular CWS surveys (WUPL, WSHO, WLOW and WNOR) and the 1991 Grande-Baleine Complex waterfowl survey and, consequently, they do not illustrate all the existing data on species distribution. The absence of indicated breeding pairs in a sector on a map does not mean that the species is actually absent there (although this may very well be the case) but rather that no indicated breeding pairs were reported in the CWS surveys. For example, in the distribution map for the Surf Scoter (see Figure 71), no indicated breeding pairs are shown in the Laurentide Wildlife Reserve although the species is known to breed there (see Section 4.5.4). This simply means that no Surf Scoters were detected in this location during the CWS surveys; since the WUPL survey plots were spaced 50 km apart (see Figure 2), some species with a very local occurrence could be missed. To obtain the most detailed description possible of a species' distribution in Quebec, please read the "Breeding" section of the species account.

3. Main databases

This section will describe the main databases that provided information on waterfowl for this document. Some can be consulted directly online, while, for others, authorization is required from the organization managing them.

3.1 Waterfowl Survey of Southern Quebec Uplands (WUPL)

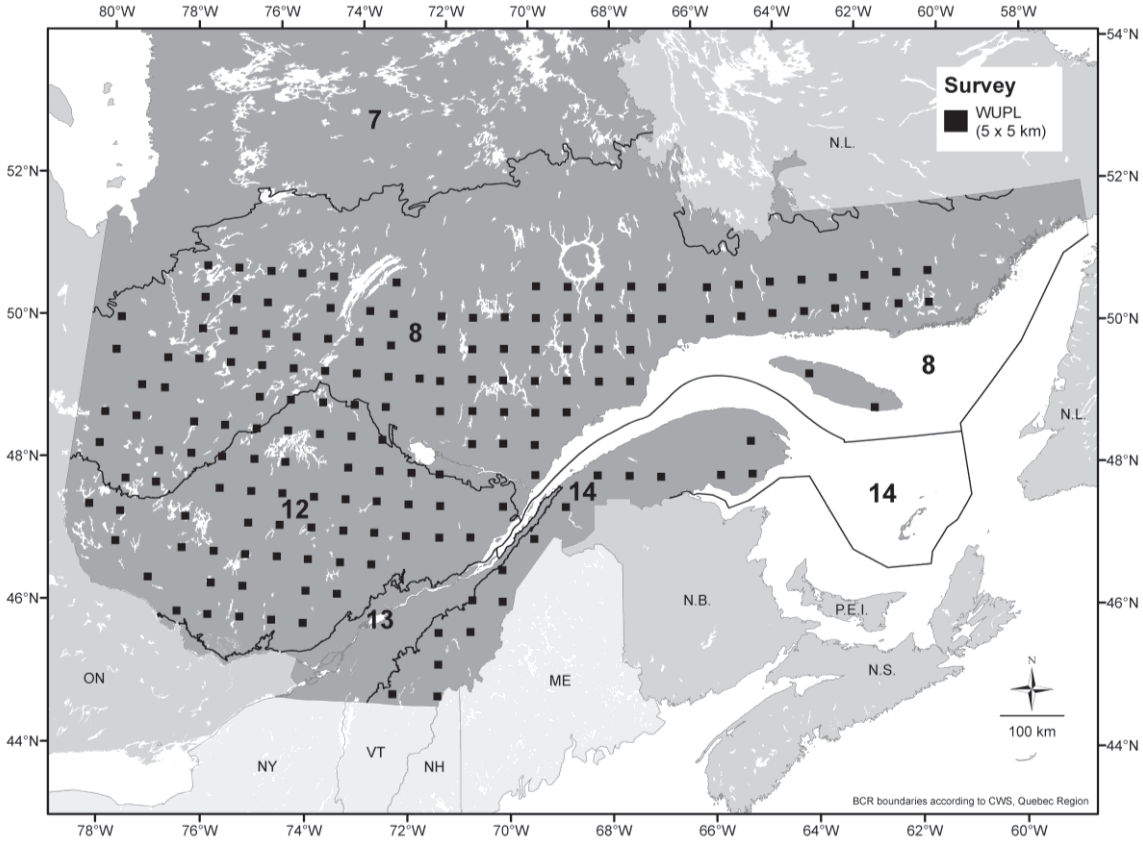
WUPL had its origins in an aerial survey established under the Black Duck Joint Venture (BDJV) in 1990 to monitor breeding populations of the American Black Duck in its core breeding range. The BDJV survey was modelled on experimental surveys conducted in 1985–1989 in Quebec, the Atlantic provinces and Ontario. In its first year (1990), the annual BDJV survey consisted of a helicopter survey of 100-km² plots (10 km × 10 km) in Quebec, Ontario, the Atlantic provinces (except Prince Edward Island) and Maine. In Quebec, 83 systematically distributed plots in a study area of roughly 530,000 km² were overflown annually by three teams of three observers each. Although the main target of the survey was breeding populations of American Black Ducks, all anatids were counted. In 1993, the number of plots was reduced to 43, and then to 35 in 1995. Budget cuts forced a re-evaluation of the monitoring program in 1996 and, as a result, the plot size was reduced to 25 km² (5 km × 5 km). However, the number of plots was increased to 156, 78 of which were overflown every year in an AB, BC, CD and DA rotation (Figure 2). The study area, slightly bigger than in previous years, was 582,494 km². To ensure that the chronological series followed from 1990 to 1995 was maintained, 74 plots were retained—each 5 km × 5 km and corresponding exactly to the southwest quarter of the original 83 plots of 10 km × 10 km—and the same survey methodology was used.

In 2004, responsibility for the annual BDJV surveys was handed over to the corresponding federal agencies, CWS and the USFWS, for an in-depth review of the surveys. In the same year, CWS-Quebec Region established the Waterfowl Survey of Southern Quebec Uplands (WUPL). WUPL consisted of 156 plots from the BDJV survey, to which were added eight 5 km × 5 km plots in the southern part of BCR 14 (primarily in the Chaudière-Appalaches and Estrie regions), which had not been

covered in the BDJV surveys. Two 5 km × 5 km plots on Anticosti Island were also added; one of the plots corresponded to the southwest quarter of a 10 km × 10 km plot surveyed by air in 1990–1992 in the BDJV surveys.

As a result of the review by CWS and the USFWS, a new annual monitoring program was instituted, the Breeding Waterfowl Plot Survey of Eastern Canada (BWPSEC), which combined aerial surveys (fixed wing) carried out by the USFWS in Eastern Canada and helicopter surveys by CWS. The results of the BWPSEC were published for the first time in 2006, in the November migratory game bird report by CWS (Canadian Wildlife Service Waterfowl Committee 2005). In Quebec, only the 156 WUPL plots from the BDJV survey are currently being monitored.

Figure 2. Distribution of WUPL survey plots (numbers on map represent BCRs)



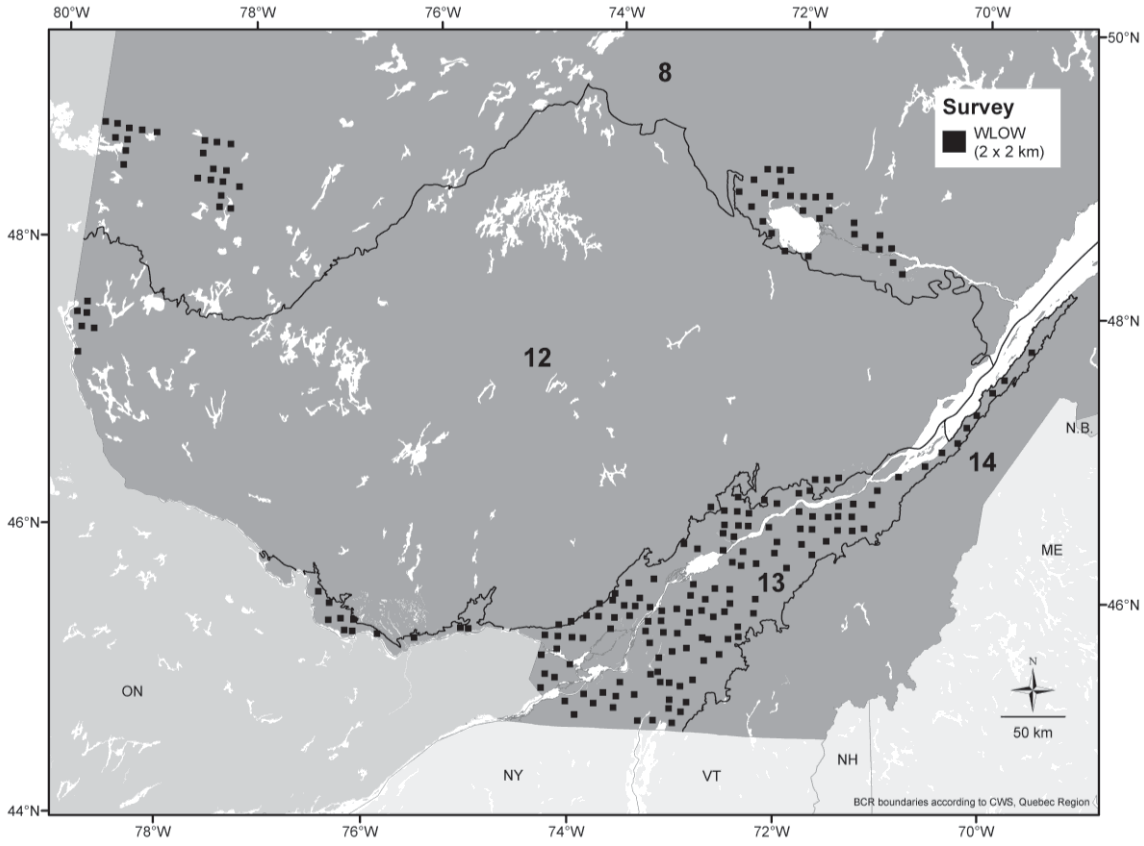
3.2 Waterfowl Survey of Southern Quebec Lowlands (WLOW)

Under the Eastern Lowlands Initiative, waterfowl surveys were carried out in the spring of 1998 and 1999 in the lowlands of the St. Lawrence Valley and Saguenay–Lac-Saint-Jean regions, as well as in agricultural portions of the Abitibi-Témiscamingue region. This was a joint initiative by CWS, the Ministère des Ressources naturelles et de la Faune (Quebec), Ducks Unlimited Canada and the Institute for Wetland and Waterfowl Research. Under the initiative, the helicopter surveys, which covered all aquatic habitats, were conducted by CWS; the survey consisted of 2 km × 2 km plots

distributed systematically throughout the 40,202 km² study area. The 343 plots (half of which were surveyed each year) were distributed as follows: 36 in the Abitibi-Témiscamingue region (BCR 8 and 12), 49 in the Saguenay–Lac-Saint-Jean region (BCR 8) and 258 in the St. Lawrence Valley (BCR 13). The data obtained, combined with information obtained from the interpretation of satellite images of the same territory, allowed an assessment of the total waterfowl population and its distribution in relation to five overall habitat types. The survey data was also used to develop a habitat use model for the American Black Duck and Mallard in all the lowlands of southern Quebec (Maisonneuve et al. 2006). These tools, particularly those for characterizing agricultural landscapes in southern Quebec (Jobin et al. 2003; Jobin et al. 2004), are used to guide conservation actions, notably certain Eastern Habitat Joint Venture projects.

Subsequently, in 2004, CWS launched the Waterfowl Survey of Southern Quebec Lowlands (WLOW), an annual survey modelled on the 1998 and 1999 efforts. Two hundred plots were randomly selected among the 343 used in the 1998–1999 surveys, and divided into four groups (A, B, C and D). According to the rotation plan adopted, 100 plots were surveyed each year: groups A and B in 2004, B and C in 2005, C and D in 2006, D and A in 2007, and then the four-year cycle began again. The 200 plots were distributed by lowlands sector as follows: 28 in Abitibi-Témiscamingue (BCR 8 and 12), 28 in Saguenay–Lac-Saint-Jean (BCR 8) and 144 in the St. Lawrence Valley (BCR 13; Figure 3). Environment Canada's Canadian Wildlife Service manages the WLOW database.

Figure 3. Distribution of WLOW survey plots (numbers on map represent BCRs)



3.3 Waterfowl Survey of the St. Lawrence Shoreline (WSHO)

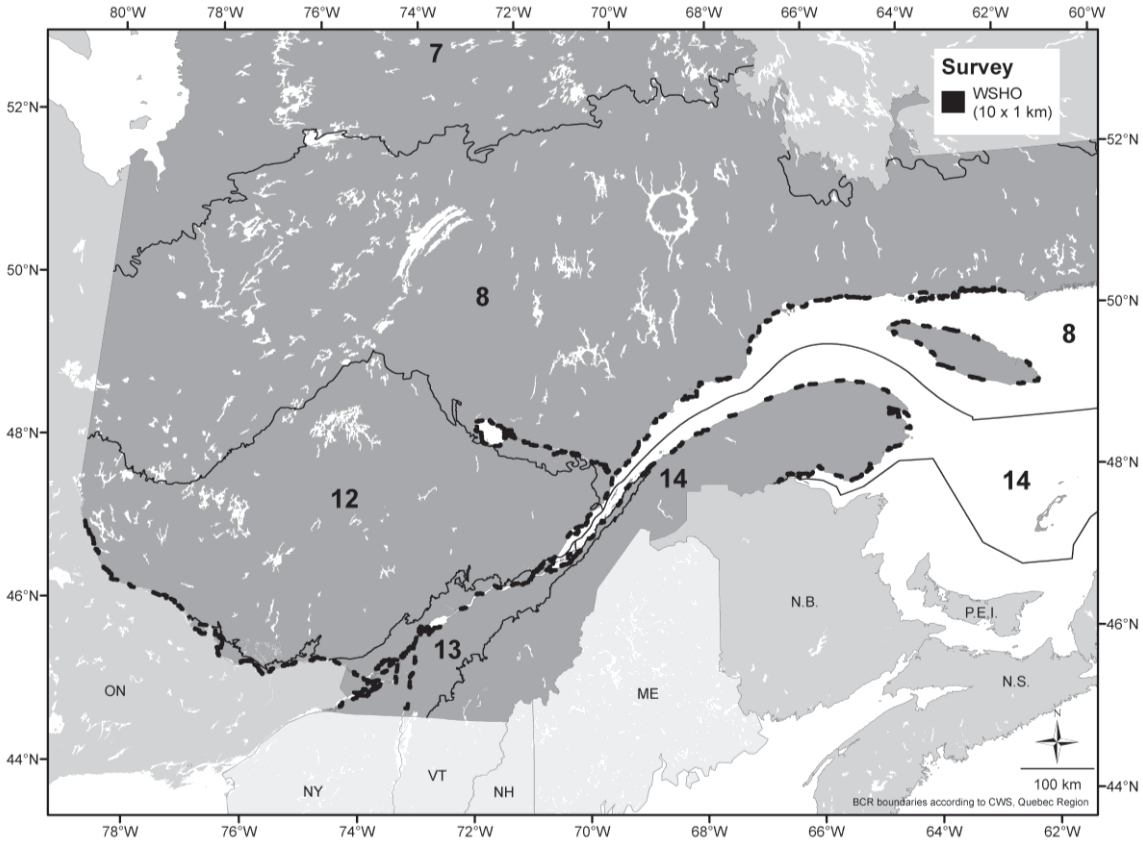
In the spring of 2004, CWS began the annual monitoring of waterfowl breeding pairs by helicopter along the shores of the St. Lawrence and its main tributaries. The WSHO study area consists of a roughly one-kilometre-wide strip along the banks of the St. Lawrence (from Cornwall to Natashquan on the north shore, and to Restigouche in Chaleur Bay on the south shore), Ottawa, Richelieu, and Saguenay rivers, and around Lac Saint-Jean. The shoreline of islands in these water bodies was also included, except on the Magdalen Islands, which unfortunately had to be left out given the high cost of travel to the region. The study area along the St. Lawrence and its three tributaries totals 7,294 km^2. A total of 212 transects of 10 km × 1 km were randomly selected in the study area according to the following distribution: 64 transects in the fluvial section of the St. Lawrence (including the Ottawa and Richelieu rivers), 72 in the estuary (including the Saguenay River and Lac Saint-Jean) and 72 in the Gulf of St. Lawrence (including Anticosti Island and Chaleur Bay; Figure 4). A letter (A, B, C or D) was assigned to each transect and the annual survey entailed covering half of the transects (106) according to the following rotation plan: groups A and B in 2004, B and C in 2005, C and D in 2006, D and A in 2007, and so on. Each transect was therefore surveyed two years in a row every four years in this study.

Although the WSHO was established to monitor trends in breeding pairs of waterfowl along the St. Lawrence, it also provides information (distribution and numbers) on

migrating geese and ducks. At the time the surveys are done (between the third week of April and mid-May), many migrating waterfowl are still in transit along the St. Lawrence, including scoters, Long-tailed Ducks and Brant in the Gulf and estuary. Although the data provided on migrants is not exhaustive, it is very valuable since there is no specific survey that targets migrating ducks and geese (except the Snow Goose) in Quebec. All data on migrating flocks along the St. Lawrence is immediately excluded from the trend analysis of breeding pairs.

Since the last aerial waterfowl surveys covering the entire St. Lawrence shoreline were done in 1974–1981, information was critically needed about waterfowl breeding in the St. Lawrence, which the WSHO helped to fill (Lehoux et al. 1985). This region contains sectors that are some of the most diverse and heavily used by waterfowl in the entire province. Furthermore, most of the province's human population is also concentrated along the St. Lawrence, making this area the location of most of the conflicts with waterfowl populations. A sprawling highway system, intensive agriculture, constant shipping traffic, numerous industries and intense hunting pressure are some of the daily challenges faced by waterfowl in the region. The WSHO helps to remedy this situation and allows CWS to adequately fulfill some of its mandates (environmental assessments, hunting regulations, etc.). The Canadian Wildlife Service of Environment Canada manages the WSHO database.

Figure 4. Distribution of WSHO transects (numbers on map represent BCRs)



3.4 Waterfowl Survey of Northern Quebec (WNOR)

Breeding waterfowl populations have been monitored in northern Quebec, the core breeding range of the Atlantic population of the Canada Goose, since 1993. Initially, reconnaissance surveys were conducted between 1955 and 1966 to document the distribution and breeding range of this population (Kaczynski and Chamberlain 1968). Additional surveys were carried out in 1988 to verify the status of the population (Malecki and Trost 1990). In the early 1990s, after a decrease in numbers in all Canada Goose populations, the Atlantic Flyway Council, USFWS and CWS decided to establish the Waterfowl Survey of Northern Quebec (WNOR). The first survey, which took place in 1993, covered all of northern Quebec and a part of the boreal forest. In 1994, flight lines were shifted and the portion north of Akulivik was eliminated, since the previous year's exploratory aerial surveys had shown that this mountainous area was little used by geese (Bordage and Plante 1993). The total length of flight lines overflown in each region was determined by estimating variance in relation to the 1993 survey, based on a target coefficient of variation (CV) of 10% for population estimates (Bordage and Plante 1994). Beginning in 1998, the survey concentrated solely on northern Quebec, and the boreal forest transects were taken over in part by the USFWS under the Breeding Waterfowl Plot Survey of Eastern Canada (BWPSEC) (fixed-wing component). Transects are overflown in a high-fixed-wing aircraft at an altitude of 30 m and a ground speed of roughly 140 km/h. Two observers, one in the co-pilot's seat on

the right and the second directly behind the pilot on the left, record all birds seen within 200 m of either side of the plane.

The study area in northern Quebec consists of approximately all the territory north of 57° N and west of 67° W (Figure 5a). It was stratified into three sectors by Malecki and Trost (Malecki and Trost 1990), roughly following northern Quebec ecoregions (Gilbert et al. 1985; Figure 5b). Region 1, covering 43,500 km^2, corresponds to coastal tundra characterized by lower relief and numerous ponds. Region 2, covering 116,000 km^2, corresponds to inland tundra characterized by extensive bedrock outcrops. Region 3 is a transition zone between the boreal forest and tundra covering 36,400 km^2 and is composed mainly of lichen with a scattering of stunted trees.

Figure 5a. Distribution of flight lines surveyed in WNOR used to contribute data to this document (numbers on map represent BCRs)

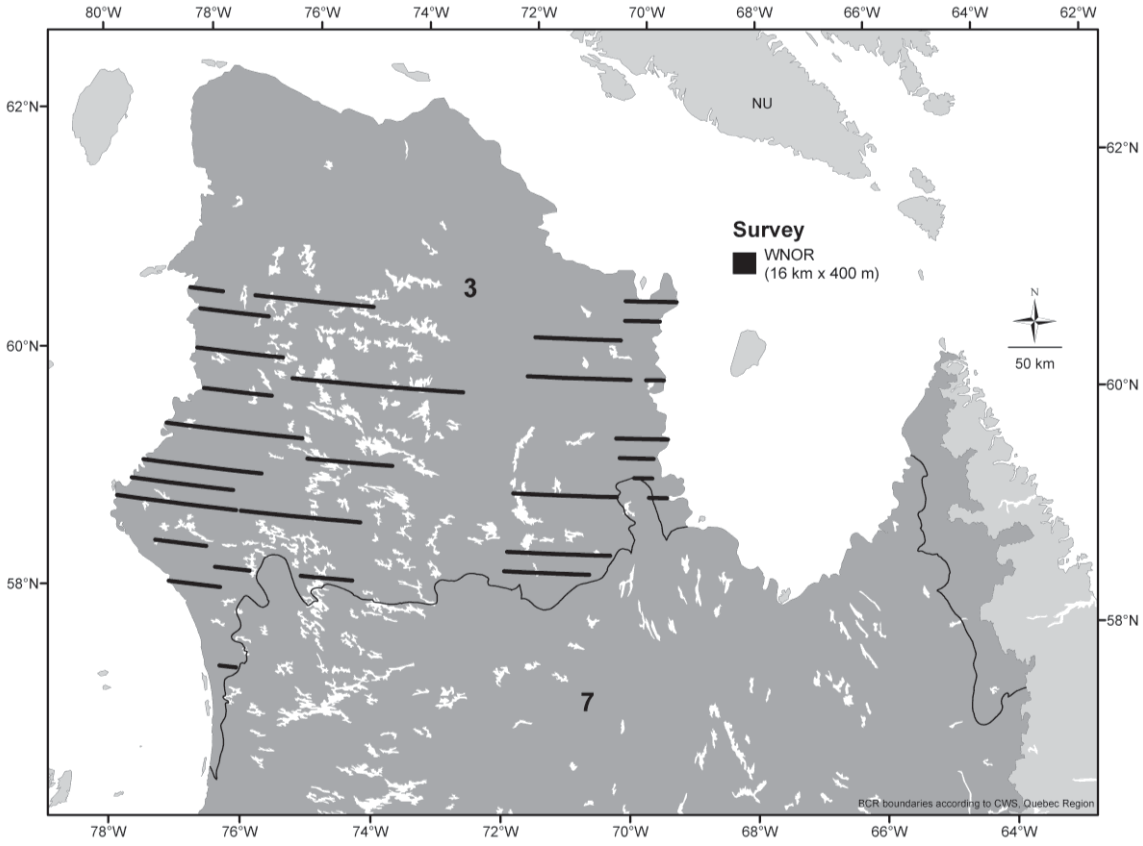
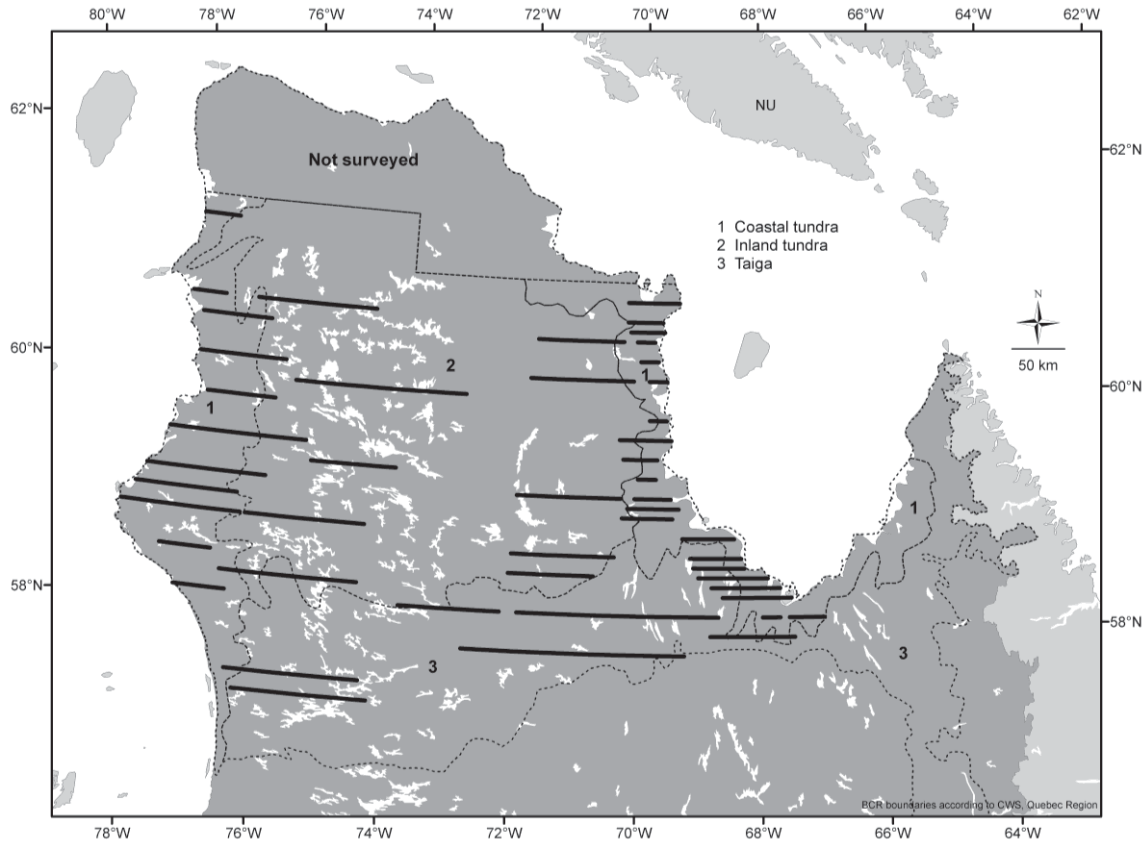


Figure 5b. WNOR survey sectors (lines illustrate flight lines)



3.5 Greater Snow Goose Spring Survey (GSGOS)

CWS has carried out its annual Greater Snow Goose Spring Survey (GSGOS) on the staging grounds used by the subspecies in southern Quebec since 1965. More recently, eastern Ontario and northern New Brunswick were added. All geese flocks are photographed during the survey and, until 1990, all birds were counted on the photos to determine the size of the total population. Since 1991, only samples of the flocks have been counted, owing to the skyrocketing population and the time and cost involved in processing the photos. Gradually, the number of surveys conducted annually has been reduced, from three a year, to two and then only one beginning in 2004. In the past, when more than one annual survey was done, the survey with the highest estimated numbers was retained (see Reed et al. 1998a and Béchet et al. 2004). The number of aircraft used, however, has increased over time, since 11–29% of the geese were not being detected: from only one in 1965–2001 to three in 2002 (Béchet et al. 2004) to five in 2004, thus providing better coverage of the study area. The survey takes place between the last week of April and the second week of May, the period when the entire population has left the U.S. but has not yet begun its migration to the Arctic (Béchet et al. 2004). A warm, sunny day is chosen for the survey, since these conditions encourage the geese to congregate on ponds and loafing areas in mid-day, reducing the possibility of missing some flocks. The area covered is vast, from Lake Champlain in the south to Lac Saint-Jean in the north and from extreme eastern Ontario in the west to Chaleur Bay in the east.

3.6 Barrow's Goldeneye Winter Survey (BAGOS)

In view of the situation of Barrow's Goldeneye in eastern Canada and the fact that a significant portion of the population overwinters in the estuary and Gulf of St. Lawrence, a winter survey of the species was established in 1999. This helicopter survey was carried out by CWS-Quebec Region in 1999, 2002, 2005 and 2009 (the 2008 survey was postponed for a year due to budgetary reasons). The surveys are conducted when there is significant ice cover, between late January and mid-February, and cover all coastal habitats suitable for the Barrow's Goldeneye. In winters when the survey is conducted, the St. Lawrence estuary is usually surveyed three times (on different days), since it usually has the highest concentration of goldeneyes and can be covered in its entirety in a single day. The Gulf of St. Lawrence is only surveyed once (a multiple-day process), including the Quebec portion of the Gulf and a small part of the New Brunswick coastline of Chaleur Bay (Dalhousie), where large concentrations of Barrow's Goldeneyes also occur. In 2009, most suitable areas in the Maritimes were also covered, with the participation of CWS-Atlantic Region. The survey presents several significant challenges, particularly picking out Barrow's Goldeneyes in mixed flocks that also include Common Goldeneyes and Red-breasted Mergansers, species that all look very much alike when seen from the air. To date, the survey provides the most reliable data on numbers, distribution (in winter) and population trends in the Eastern population of Barrow's Goldeneye.

3.7 Common Eider Winter Survey (COEIS)

In view of the fact that a significant portion of the *borealis* subspecies of the Common Eider overwinters in the estuary and Gulf of St. Lawrence, a winter aerial survey of these birds was instituted in Quebec in 2003. The Common Eider Winter Survey (COEIS) is conducted every three years by CWS (Quebec and Atlantic regions) using fixed-wing aircraft, with the latest survey carried out in 2009. COEIS is conducted in February, when the ice cover is at its maximum. This survey is set up like a census, with the objective of covering all suitable habitats for the species. The study area, which is covered in a single overflight, comprises the entire Gulf of St. Lawrence, including the portions in Quebec (North Shore, Anticosti Island, Magdalen Islands and the Gaspé Peninsula), Newfoundland and Labrador, and Saint-Pierre-et-Miquelon (France). A ratio estimator is used to relate visual estimates of all eider flocks with counts of a certain number of flocks from photographs (for detailed information on the survey methodology, see Bordage et al. 1998). Improvements made since 1998 include the use of a high-definition digital camera so that only a single pass over flocks is required; this also makes it possible to use a ratio estimator for "brown" eiders (adult females and immatures of both sexes) similar to that used for "white" eiders (adult males). COEIS has provided the most reliable data on numbers and population trends in Common Eiders overwintering in Quebec, Newfoundland and Labrador, and Saint-Pierre-et-Miquelon.

3.8 National Harvest Survey and Species Composition Survey

The system of Migratory Game Bird Hunting Permits was introduced in Canada in 1966. The following year, CWS launched the National Harvest Survey, a program to

measure hunting activity in Canada and provide estimates of migratory game bird harvests by species during the hunting season. The program has two components: the Harvest Questionnaire Survey and the Species Composition Survey.

Hunters agreeing to participate in the Harvest Questionnaire Survey are asked to respond to a series of questions on such topics as the hunting sites they used and the total number of birds bagged during the season and by hunting trip. The information gathered allows data to be compiled on waterfowl harvests and allows hunting activity to be documented, including the number of hunting days and rates of hunting success.

In the Species Composition Survey, selected hunters are asked to send a wing from each duck and the tail feathers from each goose killed during the hunting season to CWS (in the case of Canada Geese, the three outer primary feathers are also requested). Samples are sent to the closest CWS regional office in secure shipping envelopes. When the envelopes are received, they are opened and the contents identified to species, and then stored. At the end of January, all envelopes received at the various CWS regional offices across Canada are sent to a central office to continue the identification process (the regional office in question changes every year). This large-scale operation is called the Wingbee and brings together experts in aging and sexing, who determine the age and sex of the samples that were previously identified to species. This information, combined with the data obtained from the Harvest Questionnaire Survey, ultimately allows the number of birds killed by species to be estimated across Canada, including the two zones in the Quebec Region included in the National Harvest Survey (Table 3). Such estimates are quite reliable in the case of the most commonly harvested species but in the case of species with small harvests (such as sea ducks), estimates are less reliable due to the smaller sample size.

Table 3. Estimated duck and goose sport harvests in Quebec in the years 2003 to 2007, and average harvests during the 1975–1984, 1985–1994, 1995–2004 and 2003–2007 periods (data taken from Gendron and Collins 2007)

	2003	2004	2005	2006	2007	Mean 1975–1984	Mean 1985–1994	Mean 1995–2004	Mean 2003–2007	Rank 2003–2007
Snow Goose	86,028	66,326	67,245	73,585	61,652	30,009	39,210	69,092	70,967	
(% geese)	42%	47%	39%	48%	38%	39%	46%	57%	43%	2[a]
(% waterfowl)	23%	21%	19%	22%	18%	5%	8%	19%	21%	**2**[b]
Ross's Goose	0	0	0	0	0	0	18	104	0	
(% geese)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
(% waterfowl)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Brant	393	0	92	128	524	463	452	237	227	
(% geese)	0%	0%	0%	0%	0%	1%	1%	0%	0%	
(% waterfowl)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Canada Goose	112,807	75,163	104,344	79,569	100,811	35,801	36,480	32,291	94,539	
(% geese)	56%	53%	61%	52%	62%	47%	43%	27%	57%	1
(% waterfowl)	30%	24%	29%	23%	30%	6%	7%	9%	27%	**1**
Wood Duck	11,993	11,538	13,407	10,550	16,771	20,269	23,602	16,583	12,852	
(% ducks)	7%	7%	7%	6%	10%	4%	6%	7%	7%	4
(% waterfowl)	3%	4%	4%	3%	5%	3%	5%	5%	4%	**6**
Gadwall	2,502	1,357	2,498	2,611	1,467	7,101	5,326	2,906	2,087	
(% ducks)	1%	1%	1%	1%	1%	1%	1%	1%	1%	11
(% waterfowl)	1%	0%	1%	1%	0%	1%	1%	1%	1%	**13**
American Wigeon	2,873	1,365	1,641	2,601	1,270	7,517	5,297	2,916	1,950	
(% ducks)	2%	1%	1%	1%	1%	1%	1%	1%	1%	13
(% waterfowl)	1%	0%	0%	1%	0%	1%	1%	1%	1%	**15**
American Black Duck	35,078	30,590	34,472	33,900	27,596	113,649	100,932	44,476	32, 327	
(% ducks)	20%	18%	19%	18%	16%	22%	24%	19%	18%	2
(% waterfowl)	9%	10%	10%	10%	8%	19%	20%	12%	9%	**4**
Mallard	58,873	65,284	72,231	72,245	65,187	76,560	92,769	74,123	66,764	
(% ducks)	33%	38%	40%	39%	38%	15%	22%	32%	37%	1
(% waterfowl)	15%	21%	20%	21%	19%	13%	18%	21%	19%	**3**
Blue-winged Teal	1,843	1,627	3,532	933	1,695	23,995	6,197	3,753	1,926	
(% ducks)	1%	1%	2%	1%	1%	5%	1%	2%	1%	14
(% waterfowl)	0%	1%	1%	0%	1%	4%	1%	1%	1%	**16**
Northern Shoveler	1,016	746	829	837	427	3,980	2,534	1,181	771	
(% ducks)	1%	0%	0%	0%	0%	1%	1%	1%	0%	19
(% waterfowl)	0%	0%	0%	0%	0%	1%	1%	0%	0%	**21**
Northern Pintail	6,795	6,394	4,677	5,067	5,533	20,544	12,703	6,710	5,693	
(% ducks)	4%	4%	3%	3%	3%	4%	3%	3%	3%	6
(% waterfowl)	2%	2%	1%	2%	2%	3%	3%	2%	2%	**8**
Green-winged Teal	24,291	21,651	22,238	22,863	33,295	52,754	51,913	34,157	24,868	
(% ducks)	14%	13%	12%	12%	19%	10%	12%	15%	14%	3
(% waterfowl)	6%	7%	6%	7%	10%	9%	10%	10%	7%	**5**
Canvasback	0	58	0	0	0	1 832	393	24	12	
(% ducks)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
(% waterfowl)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Redhead	0	186	2,494	476	85	2,965	1,163	292	648	
(% ducks)	0%	0%	1%	0%	0%	1%	0%	0%	0%	22
(% waterfowl)	0%	0%	1%	0%	0%	1%	0%	0%	0%	**24**

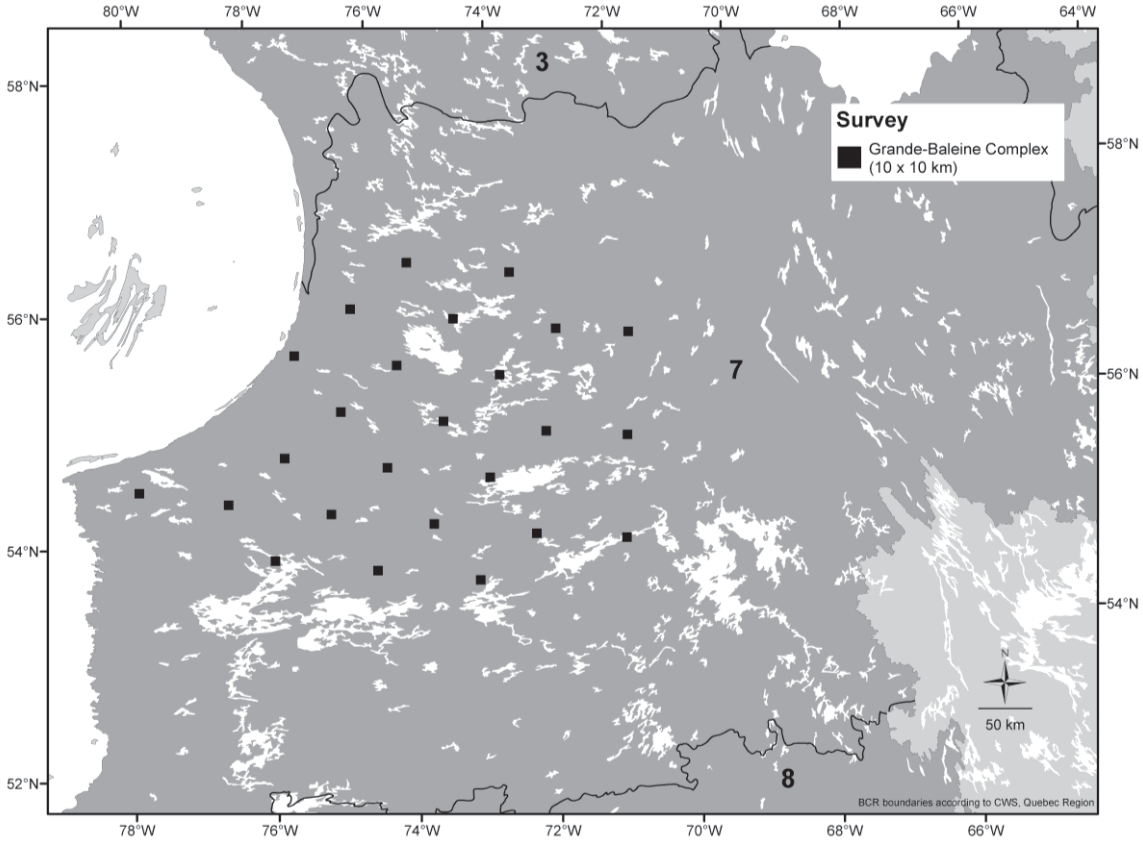
Ring-necked Duck	5,999	6,282	6,630	7,640	3,730	20,581	22,077	9,621	6,056	
(% ducks)	3%	4%	4%	4%	2%	4%	5%	4%	3%	5
(% waterfowl)	2%	2%	2%	2%	1%	4%	4%	3%	2%	**7**
Greater Scaup	2,101	3,042	1,562	4,002	815	20,279	9,495	3,514	2,304	
(% ducks)	1%	2%	1%	2%	0%	4%	2%	2%	1%	10
(% waterfowl)	1%	1%	0%	1%	0%	3%	2%	1%	1%	**12**
Lesser Scaup	8,604	3,619	3,459	7,219	1,953	26,420	19,987	7,050	4,971	
(% ducks)	5%	2%	2%	4%	1%	5%	5%	3%	3%	7
(% waterfowl)	2%	1%	1%	2%	1%	4%	4%	2%	1%	**9**
King Eider	0	228	0	0	0	69	67	28	46	
(% ducks)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
(% waterfowl)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Common Eider	2,266	1,719	1,407	2,505	2,331	7,305	3,330	3,072	2,046	
(% ducks)	1%	1%	1%	1%	1%	1%	1%	1%	1%	12
(% waterfowl)	1%	1%	0%	1%	1%	1%	1%	1%	1%	**14**
Surf Scoter	637	1,941	176	1,158	1,068	12,444	4,902	2,223	996	
(% ducks)	0%	1%	0%	1%	1%	2%	1%	1%	1%	16
(% waterfowl)	0%	1%	0%	0%	0%	2%	1%	1%	0%	**18**
White-winged Scoter	790	1,238	908	1,202	281	8,188	5,562	1,603	884	
(% ducks)	0%	1%	0%	1%	0%	2%	1%	1%	0%	17
(% waterfowl)	0%	0%	0%	0%	0%	1%	1%	0%	0%	**19**
Black Scoter	655	792	239	1,215	393	11,489	4,073	1,236	659	
(% ducks)	0%	0%	0%	1%	0%	2%	1%	1%	0%	21
(% waterfowl)	0%	0%	0%	0%	0%	2%	1%	0%	0%	**23**
Long-tailed Duck	1,020	1,356	709	320	285	9,299	3,942	1,836	738	
(% ducks)	1%	1%	0%	0%	0%	2%	1%	1%	0%	20
(% waterfowl)	0%	0%	0%	0%	0%	2%	1%	1%	0%	**22**
Bufflehead	939	226	777	498	633	6,950	4,193	1,394	615	
(% ducks)	1%	0%	0%	0%	0%	1%	1%	1%	0%	23
(% waterfowl)	0%	0%	0%	0%	0%	1%	1%	0%	0%	**25**
Common Goldeneye	3,561	5,493	4,897	2,489	1,210	24,104	14,802	5,386	3,530	
(% ducks)	2%	3%	3%	1%	1%	5%	4%	2%	2%	8
(% waterfowl)	1%	2%	1%	1%	0%	4%	3%	2%	1%	**10**
Barrow's Goldeneye	449	222	0	129	56	2,453	825	284	171	
(% ducks)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
(% waterfowl)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Hooded Merganser	2,336	1,897	2,536	2,961	3,955	10,300	9,043	4,392	2,737	
(% ducks)	1%	1%	1%	2%	2%	2%	2%	2%	2%	9
(% waterfowl)	1%	1%	1%	1%	1%	2%	2%	1%	1%	**11**
Common Merganser	2,243	1,815	693	1,177	1,864	13,678	8,952	3,994	1,558	
(% ducks)	1%	1%	0%	1%	1%	3%	2%	2%	1%	15
(% waterfowl)	1%	1%	0%	0%	1%	2%	2%	1%	0%	**17**
Red-breasted Merganser	961	882	639	1,287	431	4,452	3,834	1,370	840	
(% ducks)	1%	1%	0%	1%	0%	1%	1%	1%	0%	18
(% waterfowl)	0%	0%	0%	0%	0%	1%	1%	0%	0%	**20**
Ruddy Duck	0	70	0	151	254	314	184	92	95	
(% ducks)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
(% waterfowl)	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Total geese	203,163	141,724	171,948	153,333	162,987	76,589	84,896	121,772	166,631	
Total ducks	177,880	171,619	182,650	186,036	172,585	510,644	418,290	234,246	178,154	
Total waterfowl	381,044	313,343	354,599	339,369	335,572	587,233	503,174	356,018	344,785	
Number of permits	29,376	28,872	28,095	27,058	27,871	70,817	53,936	31,299	28,254	

[a] Ranking of species in relation to all geese (if species is a goose) or all ducks (if species is a duck).
[b] Ranking of species in relation to all waterfowl.

3.9 Grande-Baleine Complex waterfowl survey

In 1991, CWS carried out helicopter surveys in a vast area of northern Quebec during the nesting and brood-rearing periods to document waterfowl abundance and distribution as part of studies for the Grande-Baleine Complex hydro project. The study, funded in large part by Hydro-Québec, focused on Canada Goose and Black and Surf scoters and was combined with a habitat analysis using remote sensing data (Bordage et al. 1992). To better assess the extent to which the specific territory targeted in the Grande-Baleine project was used by waterfowl, compared with the birds' use of taiga in general, the study area consisted of a huge area representative of the northern taiga landscape. The systematic sampling plan consisted of 25 square plots (10 km × 10 km), with 100-km spacing between them (in both latitude and longitude) (Figure 6). This survey, similar to CWS surveys farther south in terms of coverage and methodology, has proven to be a very valuable source of information on the use of BCR 7 by waterfowl (see *Quebec Waterfowl Conservation Plan, 2010*; Lepage et al., in prep.). However, since the survey was only carried out for one summer, it cannot provide any information on population trends in this BCR.

Figure 6. Distribution of survey plots in the Grande-Baleine Complex waterfowl survey (numbers on map represent BCRs)



3.10 Étude des populations d'oiseaux du Québec (ÉPOQ)

The ÉPOQ database (ÉPOQ is short for Étude des populations d'oiseaux du Québec, or Study of Bird Populations in Quebec) (Larivée 2007) was established in 1975 by Jacques Larivée, then a computer programmer at Quebec's Ministère de l'Éducation. At the time, personal computers did not exist yet and, in the early days, ÉPOQ data was entered on punch cards and stored on magnetic tape. As the technology improved, the data was transferred to PC and managed using a program developed by Jacques Larivée called the Système de gestion des données ornithologiques. ÉPOQ contains all the records (in large part, contributed by amateur ornithologists) recorded on daily field checklists (Feuillet d'observations quotidiennes des oiseaux du Québec) since 1955, as well as previous historical data. The information recorded on the checklists consists of the number of individuals of each species observed at a single site on the same day. Currently, ÉPOQ contains slightly over 6 million records from roughly 433,000 checklists and is probably the oldest ornithological database of its kind in the world. ÉPOQ has been managed by Regroupement QuébecOiseaux since 1988.

3.11 Christmas Bird Count (CBC)

As its name implies, the Christmas Bird Count (CBC) is conducted during the Christmas season. Since 1900, amateur ornithologists in each region have gathered on a single day between December 14 and January 5 to count all the birds within a given territory, a 24-km-diameter circle. In 2007–2008, 371 counts were conducted in Canada, including 33 in Quebec. The data obtained allows the distribution and abundance of bird species to be monitored on their wintering grounds. Interestingly, the CBC allows some populations to be monitored that would otherwise not be covered in a survey, such as the Long-tailed Duck. In 1987, 27,500 Long-tailed Ducks were observed during the Tadoussac CBC, the greatest number of individuals of this species ever counted on a single occasion in Quebec.

The CBC is coordinated by Bird Studies Canada in Canada and by the National Audubon Society in the United States. All the information on CBCs (including a feature allowing the results of any CBC to be displayed) can be viewed at the website www.audubon.org/bird/cbc/index.html.

3.12 Atlas of the Breeding Birds of Southern Quebec

The first *Atlas of the Breeding Birds of Southern Quebec* was published in 1995 in French, with the English edition following in 1996. The Atlas is the result of the synthesis of data from a number of databases, as well as from surveys carried out between 1984 and 1989 by nearly 1,000 amateur ornithologists (Gauthier and Aubry 1996). The primary databases used include the Quebec Nest Record Card Program, ÉPOQ, Base informatisée des oiseaux marins du Québec (Quebec Seabird Database) and various databases compiled by the former Ministère du Loisir, de la Chasse et de la Pêche du Québec. The abundance maps shown in the Atlas also take account of information obtained during the 1990, 1991 and 1992 BDJV waterfowl surveys, as well as other data.

The Atlas provides information on 241 bird species for which breeding was "confirmed" in Quebec, as well as 8 "possible" breeders (e.g., Long-tailed Duck), 15 "probable" breeders (e.g., Black Scoter and Barrow's Goldeneye) and a few additional species that were confirmed as breeders in the province for the first time (e.g., Snow Goose in the St. Lawrence estuary). The Atlas also provides species distribution maps (broken down into confirmed and possible/probable breeding) and an overview of the ecology of each species. The Atlas territory consisted of all of Quebec south of the 50th parallel.

4. Status of Quebec waterfowl populations

In the species account for each of the 37 species of waterfowl observed regularly in Quebec (see Section 2.2), we provide an overview of the species' seasonal occurrence (breeding, migration, moulting period and winter), with an emphasis on abundance and distribution. In addition, a section on the conservation of the species assesses provincial and continental population trends, conservation issues pertaining to the species and the importance of the role played by Quebec in its conservation.

4.1 Geese (Anserini)
(by Christine Lepage)

The main characteristic distinguishing members of the Anserini tribe from other species of waterfowl (except swans) is the fact that pairs mate for life. Sexual dimorphism is relatively weak in this tribe, except that males are generally larger than females. Geese feed mainly on plant matter, either by grazing and grubbing in fields or dabbling in shallow water. Geese are highly gregarious, regularly nesting in colonies and migrating in large flocks, often in an inverted "V" formation. Although six species in the tribe are observed regularly in Quebec (Table 2), the only common breeder is the Canada Goose, which is also an abundant migrant. The Snow Goose (Greater subspecies) and Brant typically breed in Nunavut, although there are some isolated breeding records in Quebec. These two species are observed in large numbers mainly during migration and use Quebec as a major stopover area. The core breeding ranges of the Greater White-fronted Goose, Ross's Goose, the Lesser subspecies of the Snow Goose and Cackling Goose are in northwestern Canada, and Quebec is east of their traditional migration routes. However, these four species are observed annually in the province in small numbers, among flocks of other species of migrating geese.

4.1.1 Greater White-fronted Goose *Anser albifrons flavirostris* (Mr, We)[3] and *A. a. frontalis* (Mo, We)
(by Christine Lepage)

With a circumpolar Arctic distribution, the Greater White-fronted Goose occurs in Greenland, Europe and Asia as well as in North America (Ely and Dzubin 1994; Fox and Owen 2005). Of all the species of "grey geese" found in the Palearctic, it is the only

[3] Status taken from Table 1; see note at end of table for meaning of codes.

one that also breeds in the Nearctic. There are four subspecies: *A. a. albifrons* (Europe and Asia), *A. a. flavirostris* (Greenland), *A. a. frontalis* (Asia and North America; smaller form) and *A. a. gambeli* (North America; larger form) (Ely and Dzubin 1994; Fox and Owen 2005). In North America, the Greater White-fronted Goose nests in colonies on the tundra of the Low Arctic, from Point Barrow, Alaska to the northwest coast of Hudson Bay, its breeding range taking in Alaska, the northern part of Yukon and the Northwest Territories, and southwestern Nunavut. Two North American populations have been identified: the Pacific population (made up of *frontalis* and *gambeli*), which winters from Washington State in the north to the western coast of Mexico in the south; and the Mid-continent Population (mainly *frontalis*), which overwinters chiefly in the U.S. Gulf states (Louisiana and Texas) as well as on the east coast of Mexico (U.S. Fish and Wildlife Service 2008; Ely and Dzubin 1994). North American individuals vary widely in size and plumage, making it difficult to determine to which subspecies or population they belong (Ely and Dzubin 1994).

Migration and wintering

A total of 89% of eligible ÉPOQ records (i.e., Greater White-fronted Goose records that could be identified to subspecies, based on the detailed description provided on the checklist) involved the *flavirostris* (Greenland) subspecies. Although the main migration pathway used by the Mid-continent Population is west of the Mississippi, which is not that far from Quebec relatively speaking, only 11% of the records involved this subspecies (*frontalis*).

The Greater White-fronted Goose is observed annually in very small numbers along the St. Lawrence and its main tributaries, from the Outaouais region to roughly Rivière-du-Loup. Every year, mainly during spring migration, one or sometimes two individuals (and very rarely more) are observed in scattered locations, most often among flocks of Snow Geese (ÉPOQ; Cyr 1995c). In the spring of 2005, 9 birds found at Baie-du-Febvre (BCR 13) and 15 birds in the Abitibi region (BCR 8) were the largest groups of Greater White-fronted Geese observed in Quebec to date (Bannon et al. 2005a; 2006b). In April 2006, however, this record was surpassed by the sighting of a flock of 29 geese in the Abitibi region (Bannon et al. 2006b). The regions where the species is reported most often include the St. Lawrence lowlands (BCR 13), Bas-Saint-Laurent (Lower St. Lawrence) (BCR 14), Gaspésie (Gaspé) (BCR 14), Laurentides (Laurentians) (BCR 12) and Lac-Saint-Jean (BCR 8) (Cyr 1995c). The only record of the species overwintering was near Deauville in the Estrie (Eastern Townships) region (BCR 14) (David 1996).

Conservation

The Greenland population (*flavirostris*), estimated at around 27,000 individuals (Table 2), has probably been declining since the late 1990s (Wetlands International 2006). In 2001–2003, the Mid-continent population was estimated to be roughly 802,200 birds on average (North American Waterfowl Management Plan 2004), which is similar to the estimate of 764,300 individuals obtained in the fall of 2007 (Canadian Wildlife Service Waterfowl Committee 2007). The Mid-continent population probably declined by an average of 5% annually between 1998 and 2007 (U.S. Fish and Wildlife Service 2008).

The Mid-continent population faces a number of threats, including fairly large sport harvests (Canadian Wildlife Service Waterfowl Committee 2007; Hines 2006): 69,800 birds in Canada (9% of the population) and 287,500 in the U.S. (36% of the

population) in 2007 (Gendron and Collins 2007; Richkus et al. 2008). This is not an issue in Quebec, however, since, according to the National Harvest Survey, the species is very rarely taken by Quebec hunters (fewer than one year out of five) (Gendron and Collins 2007). The survival rate in the Mid-continent population is declining and the average lifespan of individuals has also decreased (Canadian Wildlife Service Waterfowl Committee 2007).

Quebec does not bear any responsibility for the conservation of the Greater White-fronted Goose since only a few individuals migrate through the province, which is well east of the customary migration corridor of *A. a. frontalis*, and well west of that of *A. a. flavirostris*.

4.1.2 Snow Goose *Chen caerulescens*
(by Christine Lepage)

The Snow Goose breeds mainly in dense colonies in the Canadian High and Low Arctic, extreme northeastern Siberia and northwestern Greenland (Mowbray et al. 2000). Geographic variation in size can be observed in the species, allowing it to be divided into distinct stocks. Two subspecies have been identified: the Greater Snow Goose (*C. c. atlantica*), a larger bird which is mainly found in eastern North America and considered to be a single population, and the Lesser Snow Goose (*C. c. caerulescens*), a smaller bird found mainly in the western and central portions of the continent and divided into two populations (U.S. Fish and Wildlife Service 2008; Mowbray et al. 2000). Each subspecies has its own species account (4.1.2.1 and 4.1.2.2) below.

4.1.2.1 Lesser Snow Goose *Chen caerulescens caerulescens* (Mr, Br)
(by Pierre Brousseau and Christine Lepage)

This subspecies breeds in colonies throughout most of the Canadian Arctic, including the west coasts of James Bay, Hudson Bay and Ungava Bay. During migration, the subspecies occurs in British Columbia and the other western provinces, as well as along the Ontario coast of James and Hudson bays (Abraham and Jefferies 1997). Lesser Snow Geese overwinter in the western and central United States and in Mexico (Mowbray et al. 2000).

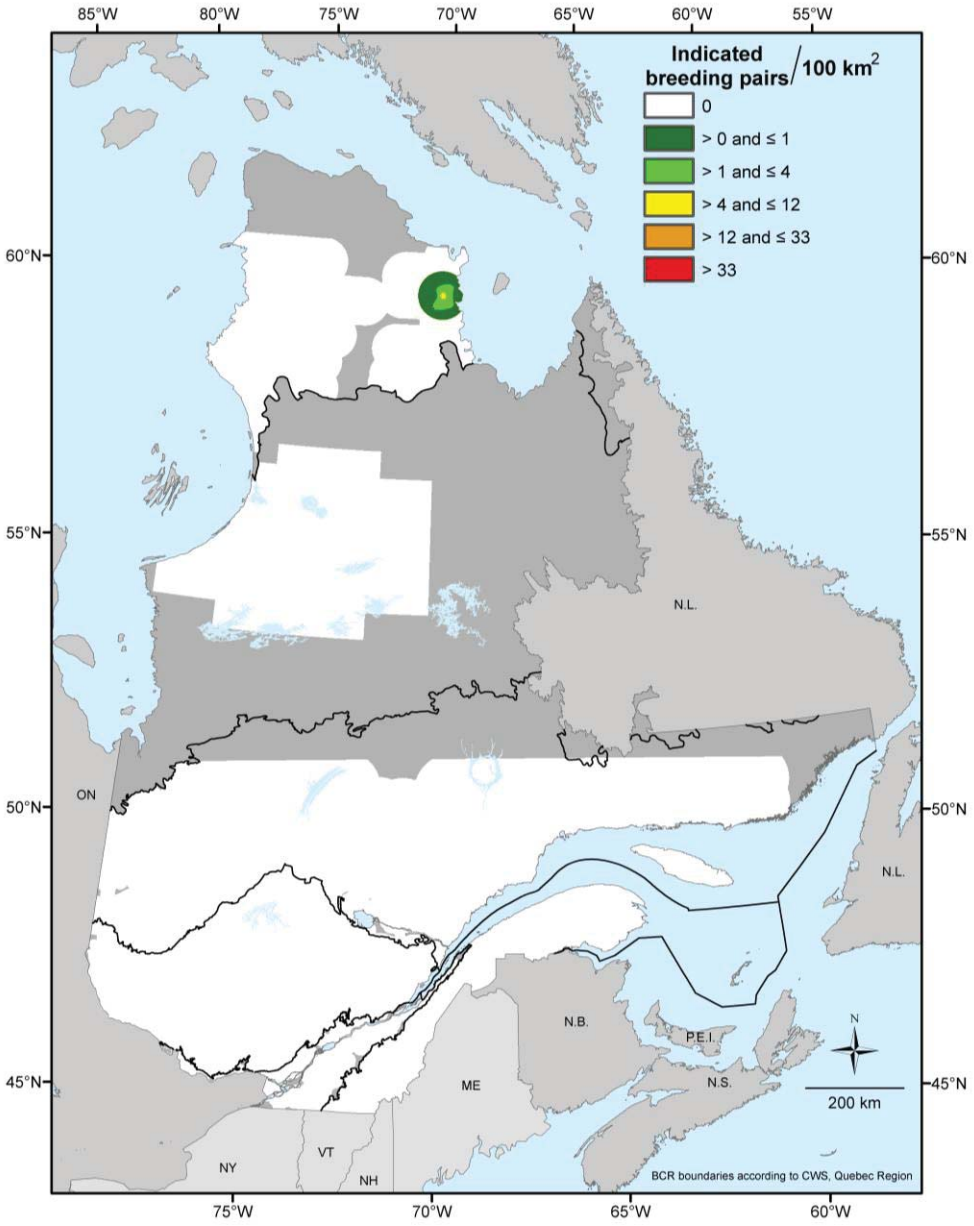
Breeding

The Lesser Snow Goose was observed in scattered locations on the coastal plain on the east coast of Hudson Bay during a Canada Goose breeding ground study (BCR 3). Between 1998 and 2001 and in 2003, nests and broods (up to seven annually) were found in the study area, which stretched from Korak River in the north to Mariet River in the south, roughly 100 km on either side of Puvirnituq (CWS, unpubl. data). In addition, since 2004, after the study was completed, family groups of Lesser Snow Geese have been sighted during banding activities; a record number of 22 adults and 17 young were reported in 2009 (R. Cotter, CWS, unpubl. data).

In June 2001, biologists also found what appears to be a small colony, containing at least 4 nests and nearly 26 adults, along the coast of Ungava Bay, directly south of Aupaluk (BCR 3) (A. Reed, CWS, pers. comm.). Subsequently, during Canada Goose banding activities in 2003, 42 juvenile and 24 adult Lesser Snow Geese were captured and banded in the coastal lowlands near Aupaluk, a surprising number for the

subspecies. In the same area, 3 adults and 2 young were captured in 2004, 5 adults and 1 young in 2006, and 15 adults and 13 young in 2007 during the same banding program (CWS, unpubl. data). The only other breeding records in Quebec date back to 1966–1968, on the east coast of Hudson Bay near Puvirnituq (Reed 1996b). Figure 7 shows the distribution of indicated breeding pairs of Lesser Snow Geese in Quebec according to WNOR.

Figure 7. Breeding distribution of the Lesser Snow Goose in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration
During migration, the Lesser Snow Goose frequents the coasts of Rupert Bay and Hudson Bay as well as the Ungava Peninsula (Reed 1996b; Tecsult Environnement Inc. 2004). In the 1970s and 1990s in Rupert Bay (BCR 7), the subspecies was abundant during spring and fall migration (6,000–9,000 individuals and 12,000–103,000 individuals respectively) (Curtis and Allen 1976; Consortium Gauthier & Guillemette – G.R.E.B.E. 1992b), although a one-time survey carried out in 2002 found much lower numbers (fewer than 1,000 individuals) in spring (Tecsult Environnement Inc. 2004). Elsewhere in spring, several thousand migrating birds have been observed north of Kuujjuaq (BCR 7) (CWS, unpubl. data). In staging areas in the St. Lawrence Valley (BCR 13), a few Lesser Snow Geese mingle with the flocks of Greater Snow Geese; the percentage of smaller geese in these flocks is unknown but is probably less than 5% (Reed 1996b).

Conservation
The Lesser Snow Goose population, like that of the Greater Snow Goose, has grown steadily over the last 20 years, resulting in increased numbers in the traditional breeding colonies as well as the establishment of new colonies. The North American population of the subspecies was estimated to be 3.3 million birds in 2001–2003 (Table 2).

To reduce the size of the population, the CWS has allowed a spring Lesser Snow Goose hunt in Manitoba since 1999, extending this to Saskatchewan and Nunavut in 2002, as it has for the Greater Snow Goose. The spring hunt has never been successful in Canada, but is popular in the adjacent U.S. states. Despite this, adult survival rates have decreased since the introduction of this measure.

Since the Lesser Snow Goose breeds, stages and winters primarily in central and western North America, and breeding and migration is marginal in Quebec, the management of the subspecies is not a priority for CWS-Quebec Region. However, since it is considered overabundant, the Lesser Snow Goose is monitored closely in western Canada and the Prairie provinces (Canadian Wildlife Service Waterfowl Committee 2007).

4.1.2.2 Greater Snow Goose *Chen caerulescens atlantica* (Mr, Br, We) **(by Josée Lefebvre)**

There is only one Greater Snow Goose population worldwide, and southern Quebec provides a crucial stopover area for the subspecies in the narrow migration corridor between the High Arctic where the birds breed, and the U.S. East Coast, where they overwinter. The breeding range of the subspecies extends from the northern half of Baffin Island and Foxe Basin to the islands further north (Bylot, Bathurst, Axel Heiberg, Somerset, Devon, Ellesmere), as far west as 105^{o} W longitude and as far east as northwestern Greenland (U.S. Fish and Wildlife Service 2008; Reed 1996b). In winter, Greater Snow Geese are found along the Eastern Seaboard of the U.S., particularly in salt marshes and adjacent farm fields from New Jersey to South Carolina (U.S. Fish and Wildlife Service 2008; Reed 1996b).

Breeding
In Quebec, there is a very small Greater Snow Goose population breeding on the Battures aux Loups Marins in the St. Lawrence estuary (BCR 13), where between 3

and 16 pairs have nested since 1990 (CWS, unpubl. data). The presence of nests roughly 4,000 km south of the subspecies' traditional breeding range is noteworthy, showing these birds' high degree of adaptability.

Spring and fall migration

Since 1965, the entire Greater Snow Goose population has been surveyed every spring while it is in transit through Quebec (see Figure 8). Monitoring is done in spring since the entire population is confined to a few staging areas, while it is much more dispersed during the rest of the year. The geese have greatly expanded their staging areas over the years and now occur from the eastern tip of Ontario to Chaleur Bay (BCR 14) and from Lake Champlain (BCR 13) to Lac Saint-Jean (BCR 8).

For example, on May 6, 2007, the day of the Greater Snow Goose Spring Survey, geese were distributed as follows: > 60,000 southwest of Lake Saint-Francois (BCR 13), including the Montérégie region and the region east of the Hawkesbury-Cornwall axis in Ontario; > 200,000 in the Lake Saint-Pierre region (BCR 13); > 200,000 between Trois-Rivières and Québec City (BCR 13); > 360,000 between Québec City and Saint-Roch-des-Aulnaies (BCR 13); and > 70,000 in the Saguenay–Lac-Saint-Jean (BCR 8) and Bas-Saint-Laurent (BCR 14) regions. Lastly, roughly 15,000 individuals were found in the Côte-Nord (North Shore) (BCR 8) and Gaspésie (BCR 14) regions. Since the geese move around a great deal at this time of year, their distribution could have been quite different had the survey been held on another date. In addition, readers should note that these numbers leave out a certain percentage of the birds that go undetected owing to the huge extent of the territory to be covered (Béchet et al. 2004).

Less is known about the distribution of the geese in autumn since their entire range is not surveyed at this time. However, thanks to band recoveries from birds bagged by hunters, population trends in the subspecies can be discerned. The relative proportion of geese harvested in fall in the estuary has declined, from over 90% in the 1970s to close to 50% in the 1990s. At the same time, the proportion of geese harvested in areas southwest of the estuary has increased from negligible numbers to close to 40% during the same period (Calvert et al. 2007a). Recently, the birds' migration pattern seems to have undergone further changes, and increasing numbers of geese are frequenting the Lac-Saint-Jean region when they arrive in southern Quebec, which has repercussions on the proportion of the population present elsewhere in the province.

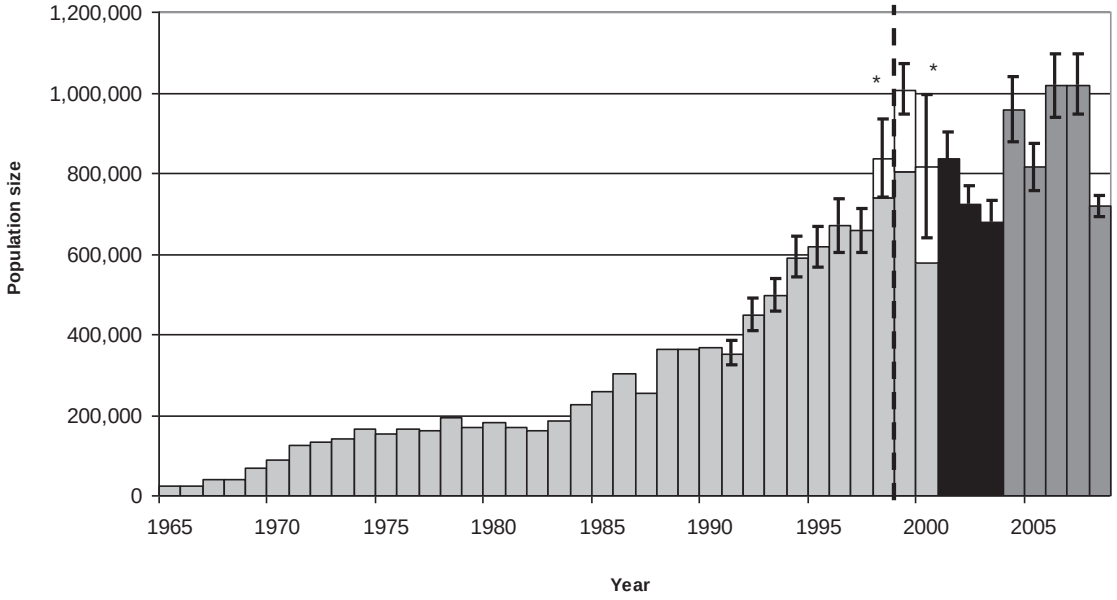
Wintering

Greater Snow Geese occasionally manage to overwinter in Quebec. In 2002, for example, 11 individuals overwintered in Victoriaville in the Centre-du-Quebec region (BCR 13) and 7 individuals in Saint-Jean-sur-Richelieu in the Montérégie region (BCR 13) (Bannon et al. 2002c). The first case of a bird successfully overwintering in the Saguenay region was reported in 2005–2006, when a goose remained in Saint-Fulgence for the season (BCR 8) (Bannon et al. 2006c). Records of individuals overwintering have also been obtained in the Montréal (BCR 13), Québec City (BCR 13) and Bas-Saint-Laurent regions (BCR 14) (Bannon et al. 2002c; Bannon 2008).

Conservation

In the early 1900s, the Greater Snow Goose population consisted of an estimated 3,000 individuals only. Thanks to favourable climatic conditions, strict hunting restrictions and the establishment of a system of wildlife refuges and bird sanctuaries, the population grew steadily and then stabilized in the 1970s. Subsequently, the population began to increase again—strongly this time—reaching a record of over 1 million individuals in the spring of 1999 (Figure 8) (Calvert et al. 2007a). The spring survey in Quebec is used to determine the size of the North American population, which in 2008 was estimated at 718,000 birds (Table 2).

Figure 8. Greater Snow Goose population (total number of individuals surveyed) in spring in Southern Quebec, 1965–2008. The different shades of the bars show changes in survey methodology, while the white portion of the bars (1998–2000) show corrections in the numbers resulting from the use of radiotagged birds. The dotted vertical line shows the beginning of the application of special conservation measures. The 1998 and 2000 error bars (indicated by an *) represent the confidence intervals for the total population, while the other error bars show the margin of error in the population estimates.



This unprecedented population growth could result in negative consequences for the geese themselves, as well as for other plant and animal species occupying the same habitat (Abraham and Jefferies 1997). A group of researchers even fear that the species' breeding grounds will suffer the same impacts as those observed in Lesser Snow Goose breeding areas, with the decimation of vegetation leading to a deterioration in individuals' body condition and lowered reproductive success (Cooch et al. 1991; Williams et al. 1993; Giroux et al. 1998).

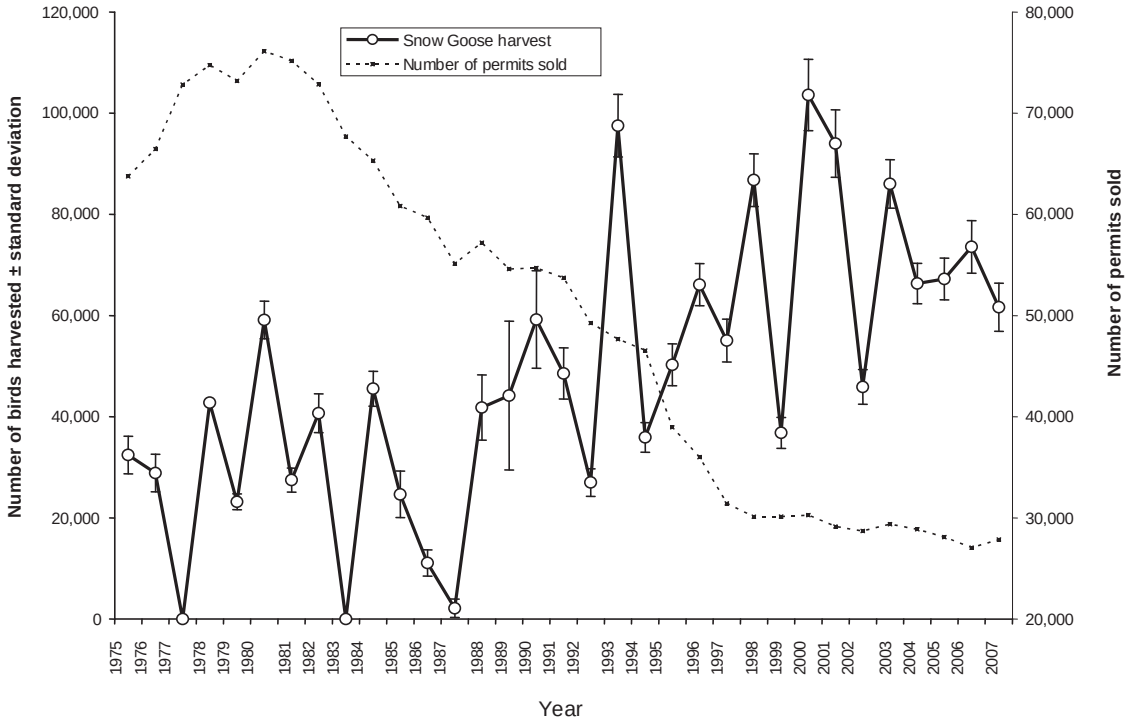
The main causes of this population explosion include a major shift in the geese's foraging habits during the 1970s and 1980s—when they began to feed increasingly in farm fields—and climatic changes that improved reproductive success (Gauthier et al. 2005). Consequently, a committee was set up in 1996 in Quebec, the Committee for the Integrated Management of Greater Snow Geese, to deal with the situation. Led by CWS,

the committee's mandate is to consult various stakeholders in the community (government agencies, non-governmental organizations and universities) on the management of the Greater Snow Goose. In the same year, the Arctic Goose Habitat Working Group was also created to review current knowledge on the Greater Snow Goose and make recommendations on its management (Batt 1998). The group's main recommendation was to stabilize the population at between 800,000 and 1 million birds by the spring of 2002 to minimize: (1) the long-term threat to the ecological integrity of the Arctic ecosystem; (2) degradation of the *Scirpus* marshes along the St. Lawrence and salt marshes along the U.S. East Coast and (3) crop damage in southern Quebec.

Following the recommendations issued by the working group, CWS put special measures in place beginning in spring 1999, including the liberalization of hunting techniques, the relaxing of daily bag and possession limits, and the establishment of a spring conservation hunt, a first in North America since the signing of the Migratory Birds Convention in 1916 (Calvert et al. 2007d). To assess the impact of these special measures on the goose population, a second scientific assessment was published in 2007 (Reed and Calvert 2007). The average spring goose harvest was 28,400 birds from 2003 to 2007 (CWS, unpubl. data). These measures are still in effect, and since their implementation, the population of this subspecies seems to have stabilized.

In the fall hunt, the Snow Goose ranks second among species taken by Quebec hunters, both in terms of all waterfowl and all geese (average of 71,000 geese in 2003–2007; Table 3). The average harvest increased from 30,000 geese in 1975–1984, to 39,000 in 1985–1994 and 69,000 in 1995–2004 (Table 3 and Figure 9). This increase can be attributed to the establishment of special conservation measures following the demographic explosion in the species.

Figure 9. Estimated Snow Goose sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



In Quebec, the ecological integrity of the *Scirpus* marshes used by staging Greater Snow Geese appears to have been negatively affected by the birds; in some parts of the St. Lawrence estuary, a decrease in *Scirpus* density by close to one half has been observed over the last 30 years (Calvert et al. 2007b).

In the Greater Snow Goose, gosling production is highly variable from year to year, depending mainly on climatic conditions, predation during the breeding season and the mortality associated with fledging, which is itself linked to climatic conditions, body weight and date of fledging (Calvert et al. 2007c).

The conservation of the Greater Snow Goose is probably the greatest challenge among that of all waterfowl species in Quebec, since the expectations and needs of the different stakeholders (farmers, outfitters, hunters and birdwatchers) must be balanced. A new action plan has been published (Bélanger and Lefebvre 2006) and was implemented in the spring of 2006, with a population objective of 500,000–750,000 birds; this objective takes account of ecological and socio-economic considerations.

4.1.3 Ross's Goose *Chen rossii* (Mr)
(by Christine Lepage)

The Ross's Goose has a limited distribution in North America, except for a few large breeding colonies in central Nunavut. Most of the continental population breeds in these colonies (with 95% of pairs nesting in the Queen Maud Gulf Migratory Bird Sanctuary), with small numbers also breeding along the west coast of Hudson Bay, on

Southampton and Baffin islands and in western Nunavut (Ryder and Alisauskas 1995; American Ornithologists' Union 1998; McGill 2005). This small goose overwinters mainly in the Central Valley of California, but also in New Mexico, Texas, Arkansas and Louisiana and in north-central Mexico (Ryder and Alisauskas 1995; American Ornithologists' Union 1998). On their breeding and wintering grounds, Ross's Geese are often found in the company of Lesser Snow Geese.

Migration

The increase in the Ross's Goose population has resulted in the expansion of its traditional breeding and wintering ranges over the last decade, particularly to the east (Canadian Wildlife Service Waterfowl Committee 2007). The same eastward shift has been observed in its migratory range (Ryder and Alisauskas 1995). It is therefore not surprising that the species is being observed in Quebec, particularly during spring migration (roughly three times the number of records as in fall) amongst flocks of Greater Snow Geese (Cyr 1995b). Since the early 1980s, one or more individuals have been reported every year along the St. Lawrence, particularly in the Québec City region (BCR 13), as well as in the Chaudière-Appalaches (Montmagny; BCR 13) and Bas-Saint-Laurent (BCR 14) regions (ÉPOQ; Cyr 1995b). However, the fact remains that Quebec is east of the species' traditional staging areas.

Conservation

The Ross's Goose population was estimated at 619,000 individuals on average in 2001–2003 (Table 2) and is increasing (North American Waterfowl Management Plan 2004). According to more recent data, there were 801,000 adults in the Karrak Lake colony in the Queen Maud Gulf Migratory Bird Sanctuary in 2007 (representing an average annual increase of 9% during the period 1997–2007, which is significant), with a similar population in Colony 10 (roughly 100 km east of Karrak Lake) (U.S. Fish and Wildlife Service 2008).

The Ross's Goose harvest by Canadian hunters was 23,100 birds on average in 2000–2007 (Gendron and Collins 2007). Since the species is at the limit of its breeding range in Quebec, it is found very rarely in hunter's bags (Table 3). The harvest by U.S. hunters along the Atlantic Flyway is also very low (no birds from 1999 to 2005, 82 in 2006 and 1,500 in 2007) (Richkus et al. 2008).

Since Ross's Goose is only a rare migrant in the province, Quebec does not really have a role to play in the conservation of the species.

4.1.4 **Brant** *Branta bernicla hrota* (Mr, Be)

(by Pierre Brousseau and Christine Lepage)

The Brant breeds throughout the Northern Hemisphere (Reed et al. 1998b; Boyd 2005b). The species has been divided into four North American populations to facilitate its management. Quebec's breeding population is part of the Atlantic population, which breeds in the Low and Mid-Arctic, centred in Foxe Basin (including Coats, Southampton and Prince Charles islands and the Great Plain of the Koukdjuak in Nunavut). The species winters on the Atlantic Coast from Massachusetts to North Carolina, with large winter concentrations occurring in the states of New Jersey, New York and Virginia (Reed et al. 1998b; New Jersey Division of Fish and Wildlife 2003).

Breeding
Although the core breeding range of the Atlantic population is concentrated around Foxe Basin, there is a very unusual breeding record in the Abitibi region of Quebec dating from 1984 (BCR 8) (J.-G. Lavigne in Reed 1996a).

Spring migration
In spring, the majority of the Atlantic population migrates through Quebec to reach their breeding grounds in the Foxe Basin (U.S. Fish and Wildlife Service 2008). The birds are much more spread out in southern Quebec during spring migration than in fall (Cyr 1995d) and use two migration routes through the province, one in the east and the other in the west (Reed 1996a).

The eastern route takes the birds along the coast of New England, through the Maritimes and into the estuary and Gulf of St. Lawrence (BCR 8 and 14), and from there to James Bay, probably via the Saguenay River (BCR 8) (Reed 1996a). A Brant was shot in the traditional subsistence hunt in the spring of 2002 near Lake Mistassini (P. Castelli, NJDFW, pers. comm.). A telemetry study carried out in 2002 and 2003 confirmed the importance of the St. Lawrence estuary to Brant during spring migration, specifically the section between Kamouraska (BCR 13) and Rimouski (BCR 14) (CWS, unpubl. data). During WSHO surveys, Brant were sighted along both shores of the lower estuary as well as in the Gulf; in the Gaspé region (BCR 14), the birds seem to favour the area between Chaleur Bay in the west and Gaspé Bay in the east, while on the Middle North Shore, they seem to prefer the Sept-Îles area and the Mingan Islands (BCR 8) (CWS, unpubl. data). In the past, Sept-Îles Bay on the Middle North Shore was an important stopover area in spring for individuals on their way to Ungava Bay and Hudson Strait and then to their breeding grounds in Foxe Basin (Lewis 1937); this route to Ungava Bay appears to be no longer used by the geese (Reed et al. 1998b). On the north shore of the estuary, several hundred birds can be observed around Île aux Grues (BCR 12) and several thousand in the Les Bergeronnes and Pointe-aux-Outardes sector (BCR 8) (ÉPOQ). Lastly, Brant are a regular and common spring migrant in the Magdalen Islands (BCR 14) (Fradette 1992). Several thousand birds use the intertidal marshes in the estuary and Gulf of St. Lawrence, although more accurate estimates are needed.

The second, more direct, route used in spring takes the birds from the states of New Jersey and New York overland to James Bay (New Jersey Division of Fish and Wildlife 2003; Reed 1996a; Ward et al. 2005). The 2002 and 2003 telemetry study showed birds making stopovers in the Lake Champlain, Montréal and Lake Saint-Pierre region, and then flying overland over the Ottawa River watershed, Abitibi-Témiscamingue and Eastern James Bay regions (New Jersey Division of Fish and Wildlife 2003). Other birds made an almost direct flight between their wintering grounds and James Bay. This study confirms that the coast of James Bay, particularly Rupert Bay (BCR 7), is used extensively by Brant during migration (New Jersey Division of Fish and Wildlife 2003; CWS, unpubl. data). Some birds spent as many as four or five weeks in James Bay building up fat reserves (New Jersey Division of Fish and Wildlife 2003). Surveys in Rupert Bay (BCR 7) confirmed concentrations of over 50,000 Brant in late May (Tecsult Environnement Inc. 2004). Small numbers of birds were also found in the Montréal region (CWS, unpubl. data).

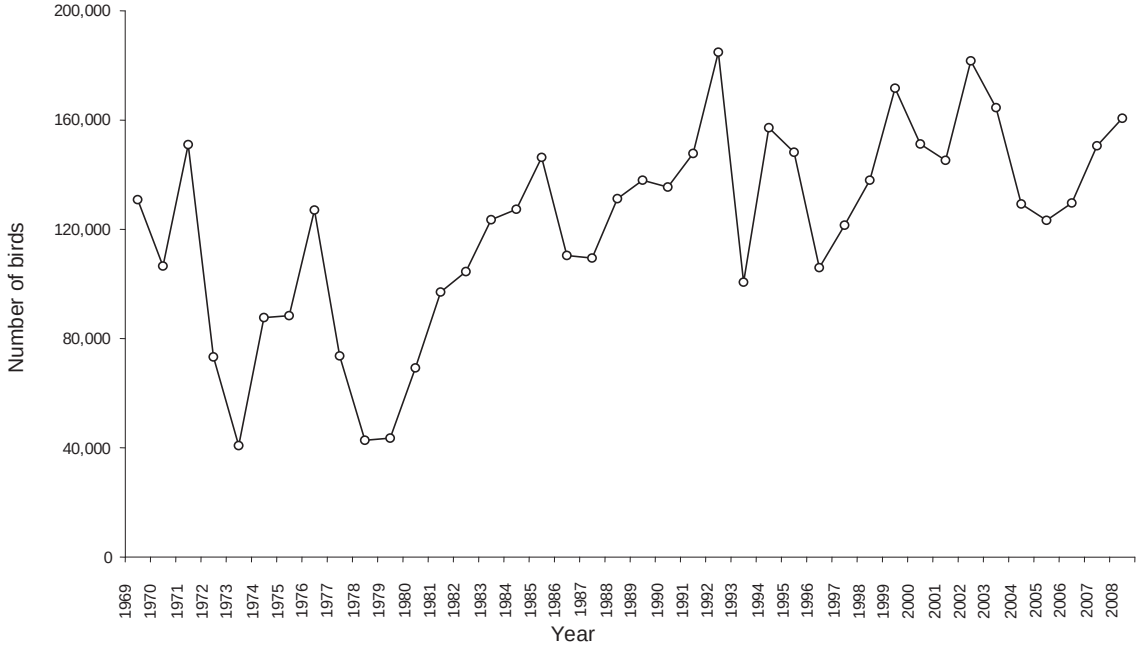
Fall migration

During fall migration, Brant still use the shoreline of James Bay (BCR 7) (New Jersey Division of Fish and Wildlife 2003) as they did in the 1970s and 1990s (Curtis and Allen 1976; Reed et al. 1996). Some individuals stage in the bay for up to a month before continuing south (New Jersey Division of Fish and Wildlife 2003). To travel from James Bay to their wintering grounds on the U.S. East Coast, the birds seem to prefer the "western" route through Quebec; in fall, the species is observed less often along the St. Lawrence and in Eastern Quebec (Cyr 1995d). The 2002 and 2003 telemetry study confirmed that, although most birds fly non-stop from James Bay south to the mid-Atlantic and adjacent states where they winter, some individuals stop over in the eastern James Bay, Abitibi-Témiscamingue, Outaouais (Ottawa Valley) and Laurentides regions (New Jersey Division of Fish and Wildlife 2003; Cyr 1995d). Harvest data (see below) confirm that few Brant stage in southern Quebec in fall.

Conservation

Numbers of the species are low when compared with the other goose species in North America (Table 2). During the last 20 years, the Atlantic population of Brant ranged between 100,000 and 180,000 birds (Figure 10) and, in the winter of 2007–2008, was estimated at roughly 161,600 individuals (U.S. Fish and Wildlife Service 2008). An analysis of data for the 1998–2008 period indicates neither a significant increase nor decrease in the population (U.S. Fish and Wildlife Service 2008).

Figure 10. Brant population according to winter surveys in the United States, 1969–2008



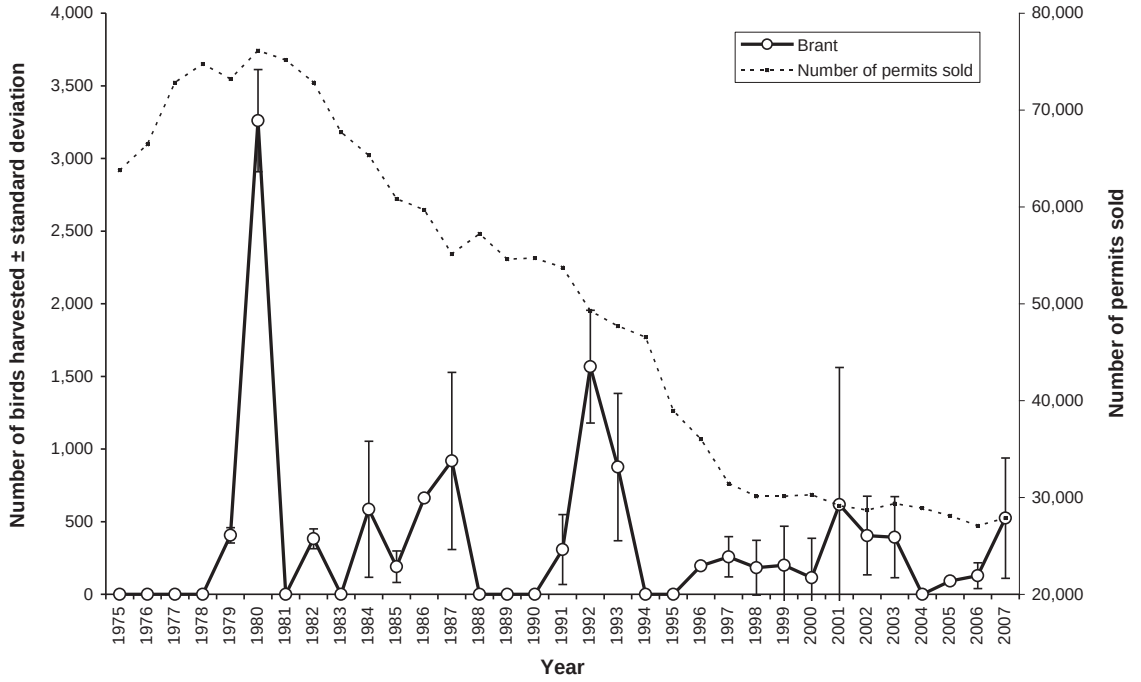
The Brant's diet is composed almost exclusively of eelgrass, which makes it particularly vulnerable to fluctuations in the availability of this resource (Ward et al. 2005). This is illustrated by two major events that occurred in the 1930s and 1970s (Reed 1996a; Ward et al. 2005). The first, in 1931–1932, was a disease that almost completely wiped out eelgrass beds in North America (including those in the estuary and Gulf of

St. Lawrence). The second, extreme cold temperatures on the U.S. East Coast during the winters of 1976–1977 and 1977–1978, resulted in thick ice cover on the intertidal habitats frequented by Brant, preventing them from feeding (in Ward et al. 2005). As a result, the population dropped by roughly two-thirds due to starvation (Reed 1996a), which prompted the authorities to stop harvests of the species for several years. Lastly, in 1999, a fairly generalized decline in eelgrass beds occurred along the coast of James Bay, but it is not known whether this decline affected the abundance and distribution of Brant in the region (Lalumière and Lemieux 2002). The reason for the decline is unknown and it is not known whether the eelgrass beds are recovering.

Unlike other species of geese, Brant have not for the most part modified their diet to include cultivated farm crops, whether in their staging areas or wintering grounds (Ward et al. 2005). Only an estimated 5% of individuals feed on cultivated plants in their wintering quarters, and the inland sites where the birds forage (school fields and golf courses) are located within 2 km of the coast, confirming that the species is almost exclusively coastal (Ward et al. 2005). On the wintering grounds along the U.S. East Coast, water quality in the estuaries and lagoons has deteriorated due to excessive inputs of nutrients and sediments from urban and shoreline development, which have promoted the growth of phytoplankton and filamentous algae instead of eelgrass (Ward et al. 2005).

In Quebec, the average annual harvest between 2003 and 2007 was 227 birds (Table 3; Figure 11). Nearly 67% of Brant were taken along the Richelieu and St. Lawrence rivers between the Ontario border and Lake Saint-Pierre; 20%, in inland areas and 13% in the fluvial estuary between Trois-Rivières and Québec City (Gendron and Collins 2007). U.S. hunters harvested roughly 27,100 Brant annually between 2001 and 2007 along the Atlantic Flyway (Padding and Klimstra 2008); hunting pressure by our southern neighbours (2001–2007, mean = 17%) is therefore fairly high when the estimated harvest is compared with the estimated population. The annual harvest by the James Bay Crees has been estimated at roughly 6,420 birds for the hunting seasons from 1972–73 to 1978–79 (Reed 1991); the harvest by other First Nations groups was probably negligible during this period (A. Reed, CWS, pers. comm.). The current levels of Aboriginal harvests are unknown.

Figure 11. Estimated Brant sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



The species' diet consists mainly of eelgrass. Since this resource is abundant along the estuary and Gulf of St. Lawrence, a large percentage of the Atlantic population stages in eastern Quebec in spring. For the same reasons, the coasts of James Bay are also extensively used by the species in spring and fall. Consequently, Quebec plays a central role in the conservation of the Atlantic population, whose vulnerability does not have to be demonstrated.

4.1.5 Cackling Goose *Branta hutchinsii* (Mr, Bo)
(by Pierre Brousseau and Christine Lepage)

The Canada Goose forms a complex of subspecies, the number of which varies depending on the author (Dickson 2000). In 2004, after numerous genetic studies to characterize these subspecies, the American Ornithologists' Union decided to split Canada Goose into two species: Canada Goose and Cackling Goose (American Ornithologists' Union 2004). Cackling Goose includes the populations represented by the subspecies *hutchinsii*, *asiatica*, *leucopareia*, *taverneri* and *minima.* The Cackling Goose breeds in the Arctic, from the Aleutian Islands, western and northern Alaska, and northern Yukon to the Mackenzie Delta and eastward to Baffin Island in Nunavut (American Ornithologists' Union 2004; Sibley 2004). A family group, of which one of the two adults was a Cackling Goose, was observed in 1982 on Akpatok Island in Nunavut, farther east than the species' known breeding range (CWS, unpubl. data).

Breeding

Regular breeding by the species has not yet been documented in Quebec. In 1999, a brood was captured during Canada Goose banding operations at the mouth of the Kogaluc River, about 40 km south of Puvirnituq (BCR 3), on the northeast coast of Hudson Bay (J. Hughes, CWS-Ontario Region, pers. comm.). In addition, during other

banding operations, adults, many in pairs, were captured on the east coast of Hudson Bay (BCR 3), including several females with brood patches (J. Hughes, CWS-Ontario Region, pers. comm.). More recently, in August 2006, a group of 34 adults—including 21 Cackling Geese—and 50 goslings were banded just south of Neakongut Bay, roughly 55 km north of Puvirnituq; the goslings were not identified to species but it is very likely that some were Cackling Geese (R. Cotter, CWS, unpubl. data). This is all the more likely given the fact that a young goose banded in 2001 and recaptured in 2006 in the same location (again, south of Neakongut Bay) turned out to be a Cackling Goose once morphometric measurements were taken (R. Cotter, CWS, unpubl. data). Lastly, a breeding pair and three goslings were banded in August 2008, roughly 20 km northwest of Puvirnituq (R. Cotter, CWS, unpubl. data). All in all, this suggests that breeding in the region by the species is fairly well established. Although the Cackling Goose is currently considered an occasional breeder in the province based on observations to date, the species may very well be upgraded to a regular breeder in the future in the light of the results of ongoing Canada Goose banding operations.

Migration

In southern Quebec, sightings of the species have mainly occurred during fall migration, involving one or a few birds (ÉPOQ). Currently, records are concentrated in the St. Lawrence lowlands (BCR 13), Lac Saint-Jean lowlands (BCR 8) and in the Saguenay region (BCR 8). However, it is a safe bet that birders will put more effort into looking for this “new” species from now on.

Conservation

Since the Cackling Goose has only recently been declared a separate species, data on numbers, population trends and harvests has not yet been obtained.

Although there are some breeding records for the Cackling Goose in BCR 3, Quebec is mainly only a place that the species passes through during migration. Since migration and breeding occur primarily in the central and western portions of Canada, Quebec’s responsibility in conserving the species is low.

4.1.6 Canada Goose *Branta canadensis* (by Jean Rodrigue)

The Canada Goose is found in Greenland, Europe, Asia and Australia as well as in North America (Mowbray et al. 2002; Boyd and Dickson 2005). It is the most widely distributed species of Anserini on our continent. For management and conservation purposes, the species is divided into different populations according to birds’ breeding and wintering ranges (Dickson 2000). Quebec is considered to have three Canada Goose populations, the Atlantic, North Atlantic and resident populations (see Figure 12). A majority of the resident geese are associated with the Atlantic Flyway Population, although a portion of the Mississippi Flyway birds also undertake a moult migration to the province. Given their different distributions, behaviour and needs, each of these subspecies is discussed in a separate species account (4.1.6.1 to 4.1.6.3) in this document. The Canada Goose is the most abundant anatid in Quebec, with a total population (three populations combined) of 721,000 individuals (Table 2). Figure 13 shows the distribution of Canada Geese by indicated breeding pair density (three populations combined) in Quebec according to various surveys and inventories, carried out primarily by CWS (see Chapter 3).

Figure 12. Distribution of the three Canada Goose populations in Quebec

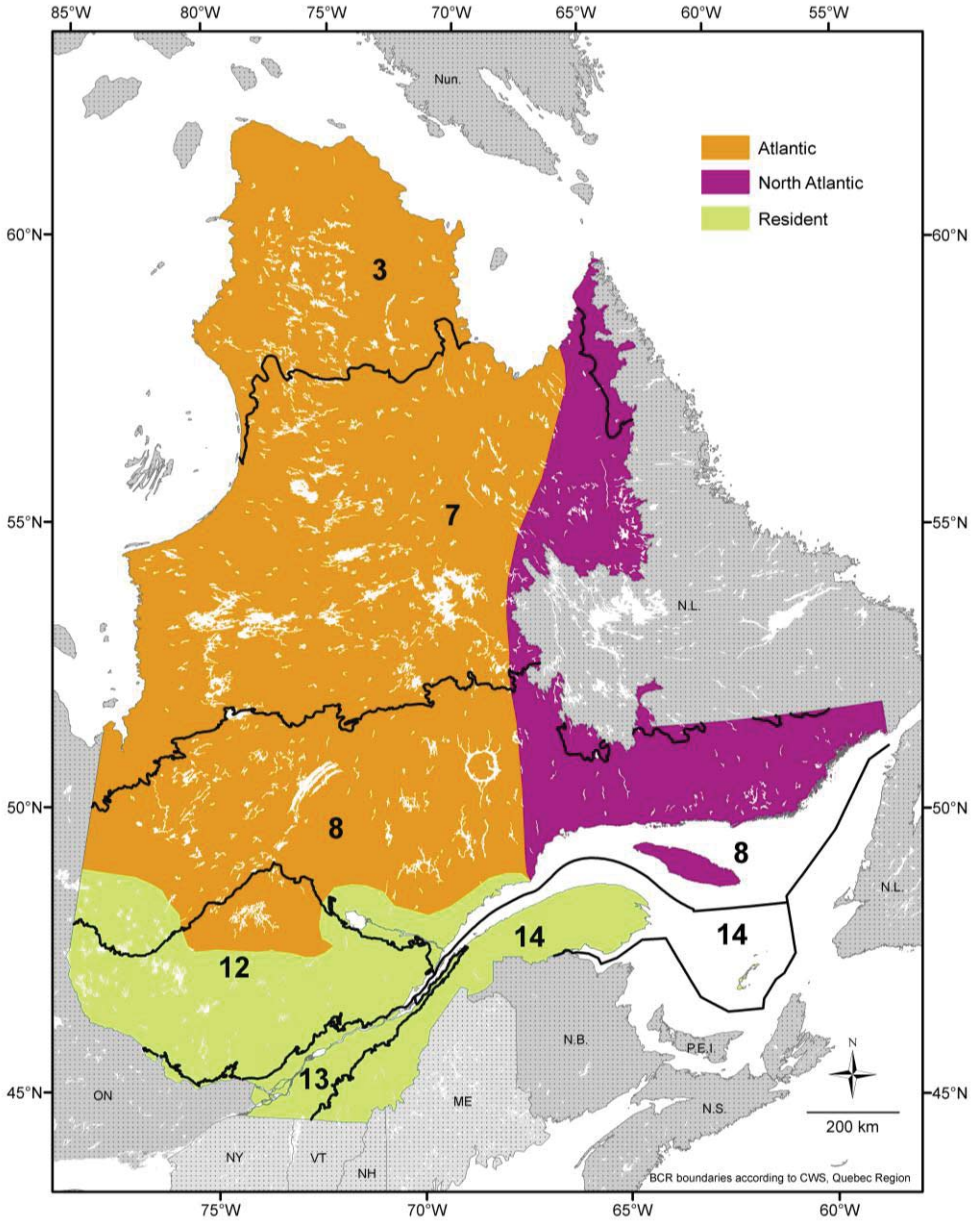
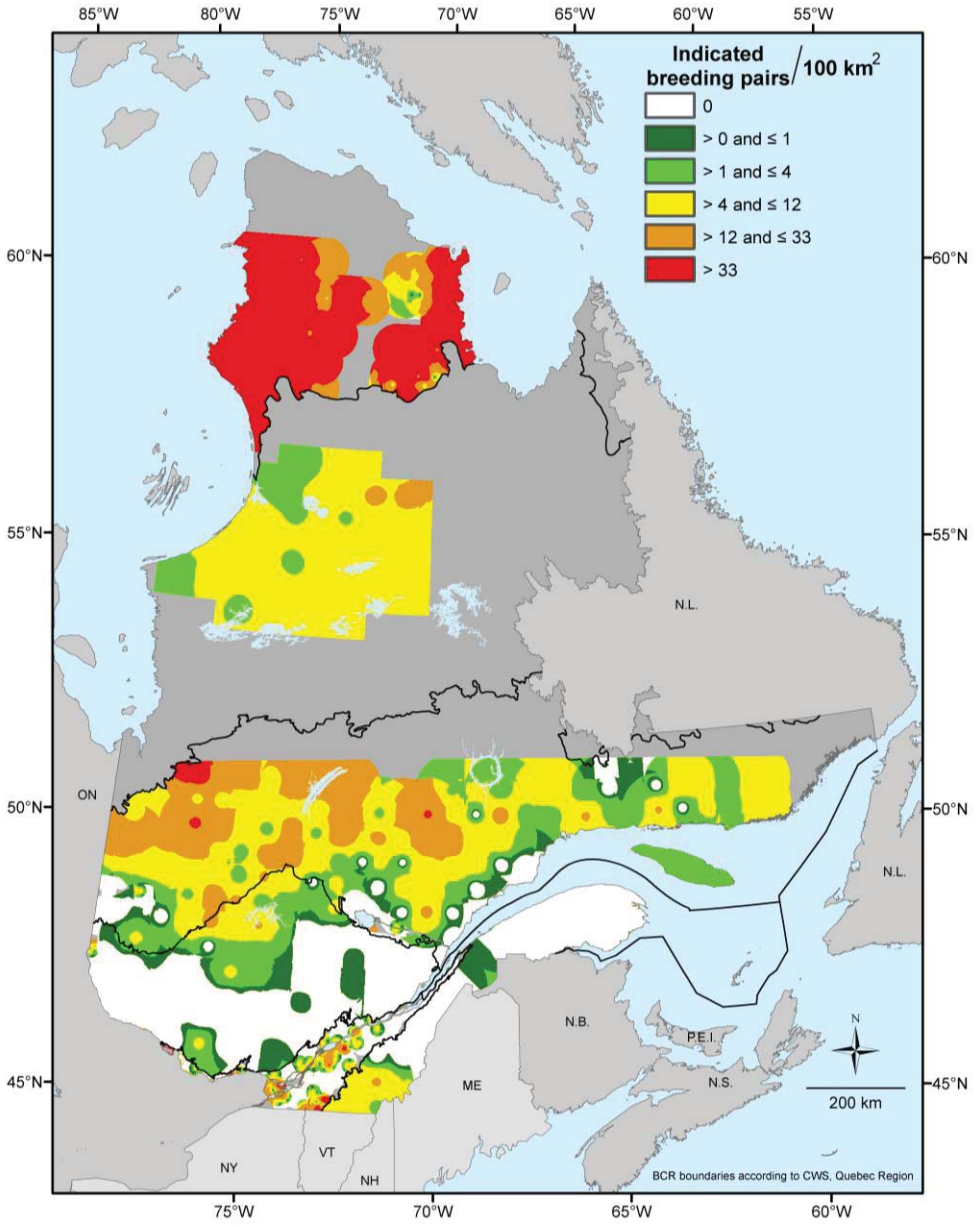
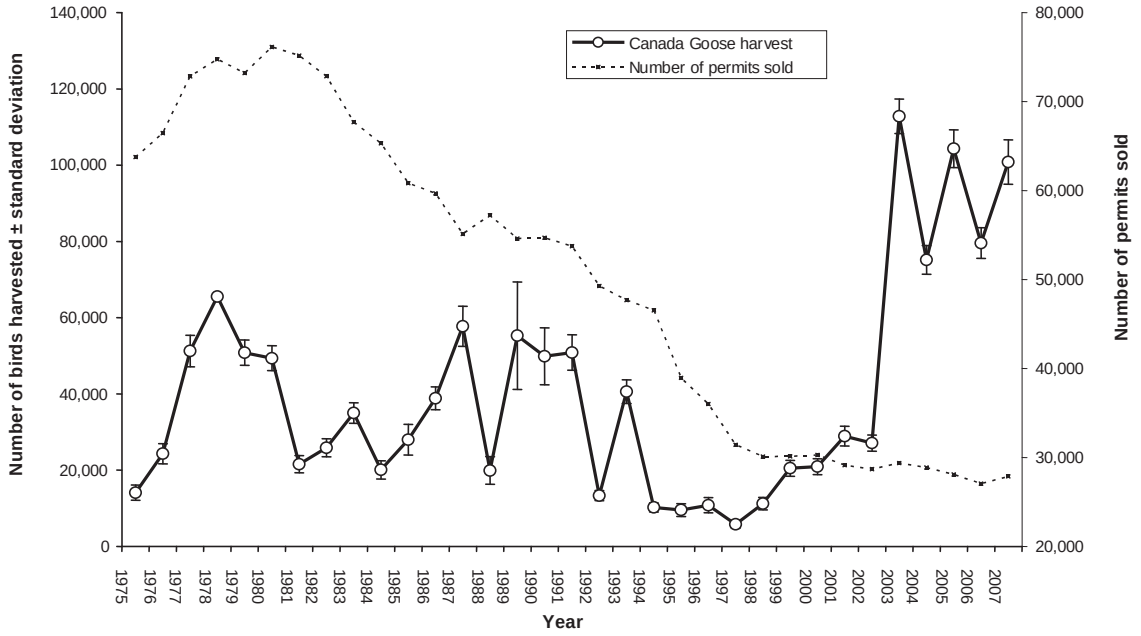


Figure 13. Breeding distribution of the Canada Goose in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



In 2000–2007, U.S. hunters bagged 678,000 Canada Geese annually on average (all populations combined) along the Atlantic Flyway (Padding and Klimstra 2008); roughly 263,000 birds were harvested annually in Canada during the same period (Gendron and Collins 2007). Sport harvests continue to increase in both countries. In Quebec, harvests rose dramatically from 1995 to 2007 (note that the Atlantic Population hunt was closed in 1995–1998 and restricted in 1999–2001) (Table 3; Figure 14). In 1975–1999, hunters killed an average of 33,400 geese annually, compared with 94,500 geese in 2003–2007 (Gendron and Collins 2007; Table 3). Since the return of the regular hunting season for the species in 2002, the Canada Goose has occupied the top spot in the sport harvest in Quebec, outranking both the Snow Goose and Mallard, and currently accounts for 27% of the total waterfowl harvest in Quebec (Table 3).

Figure 14. Estimated Canada Goose sport harvest in Quebec and number of Migratory Game Bird Hunting permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



4.1.6.1 Atlantic Population *Branta canadensis interior* (Mr, Br, Wo)

(by Jean Rodrigue)

The Atlantic Population of the Canada Goose (*B. c. interior*) is made up of individuals intermediate in size and, of the three Canada Goose populations in Quebec, is the one that breeds the farthest north. Although the population's core breeding range is in Nunavik in northern Quebec, it also breeds in the boreal forest above the 49th parallel. These geese overwinter mainly on the Delmarva Peninsula (Delaware and eastern shores of Maryland and Virginia) in Chesapeake Bay, as well as in certain parts of New York, New Jersey, Pennsylvania and the western shore of Virginia (Hindman et al. 2004).

Breeding

In the southern half of their breeding range (BCR 7 and 8), Atlantic Population geese frequent peatlands, small streams, marshes and lakes with islands, scattered through the boreal forest and taiga, while, in the northern part of the range, they breed right on the tundra (BCR 3 and 7). In and around Parc National des Pingualuit (Pingualuit provincial park) (BCR 3) in the extreme northern part of the province, the population even nests on cliff ledges overlooking rivers (Robert 2007). The highest density of breeding pairs is found in the Hudson Bay and Ungava Bay coastal lowlands (Malecki and Trost 1990; Harvey and Rodrigue 2005). In 2002, on the Ungava Peninsula, breeding density was 2.11 breeding pairs/km^2 in the coastal lowlands of Ungava Bay, compared with 0.49 breeding pair/km^2 in inland tundra and 0.26 breeding pair/km^2 in the taiga (Harvey and Rodrigue 2002). In the best breeding habitat, densities were

much higher in the coastal lowlands of Hudson Bay (85.1 nests/km^2) than those of Ungava Bay (31.7 nests/km^2).

Some of the population's breeding range in Quebec is too far south to be covered in the WNOR surveys, and WUPL allows a significant portion of the breeding population to be monitored at the southern edge of its range (Bordage et al. 2003). Average breeding density in the WUPL study area was 6.6 IBP/100 km² in 2000–2007.

Figure 13 (see Section 4.1.6), together with Figure 12, provide a picture of the distribution of the Atlantic Population of the species (in indicated breeding pairs) according to data from WNOR, the Grande-Baleine Complex waterfowl survey and WUPL.

Migration

The Atlantic Population migrates mainly through central and western Quebec. It is particularly abundant during migration in the Outaouais (Plaisance; BCR 13), Montérégie (BCR 13), Lanaudière (Saint-Barthélemy; BCR 13) and Centre-du-Québec (Baie-du-Febvre; BCR 13) regions (ÉPOQ).

In fall, geese that nest on the Ungava Peninsula begin to leave their breeding grounds around late September and arrive in southern Quebec in early October; in the second half of October, they leave the province to head for Maryland (Malecki et al. 2001a).

Conservation

There are an estimated 667,000 Atlantic Population geese in North America (Table 2). In 2007, there were roughly 196,000 breeding pairs in northern Quebec (Figure 15) (Harvey and Rodrigue 2009) and 23,500 pairs in the southern boreal forest (Figure 16) (WUPL).

From 1955 to 1985, this population was only surveyed in the winter. However, since geese from different populations mingle on the wintering grounds, it is impossible to track trends in a single population. In the mid-1980s, overall numbers of Canada Geese began to decline despite the fact that resident geese were flourishing in the temperate parts of the breeding range and more restrictive hunting regulations were being enforced in the Atlantic Flyway states.

Owing to the declining numbers in the species as a whole, the Atlantic Flyway Council, USFWS and CWS decided to establish the Waterfowl Survey of Northern Quebec, or WNOR (see Section 3.4). In 1993, the number of breeding pairs of Canada Geese on the Ungava Peninsula was estimated at 91,300, a 23% decrease from the 1988 count. The population continued to decline until 1995, when it reached a historic low of 29,300 breeding pairs, and the sharp drop prompted authorities to completely close the sport hunting season for the Atlantic Population. Since then, the population has recovered rapidly and, since 2002, has appeared to be stable (Figure 15) (WNOR). Further south in the province, data from WUPL shows a similar trend; numbers fell to 10,000 IBP in 1994–1995 but became fairly stable in 1999–2007, with roughly 23,550 IBP (Figure 16). On a regional scale, a significant ($P < 0.05$) annual increase of 5.9% was observed in BCR 8 in 1990–2007 (Lepage et al., in prep.). In 1999, the re-establishment of the population was proceeding sufficiently well according to the data that most states and provinces authorized a limited hunt. Beginning in 2002, all hunting

restrictions on the species were lifted in Canada, while a shortened hunting season was permitted in the U.S.

Figure 15. Number of breeding pairs of Atlantic Population Canada Geese on the Ungava Peninsula, 1988 and 1993–2007 (WNOR data)

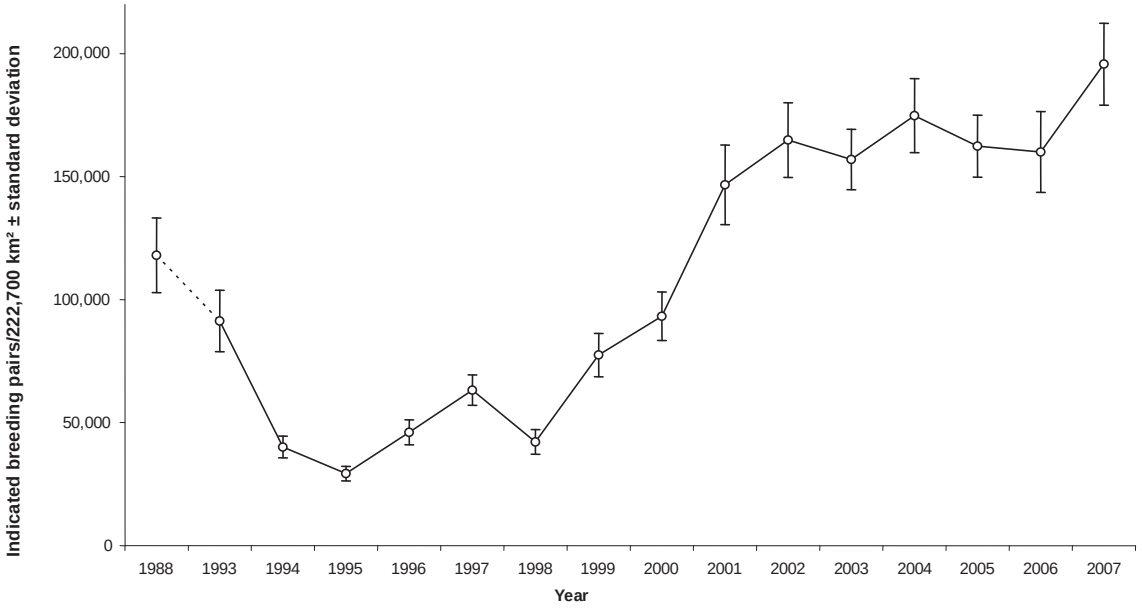
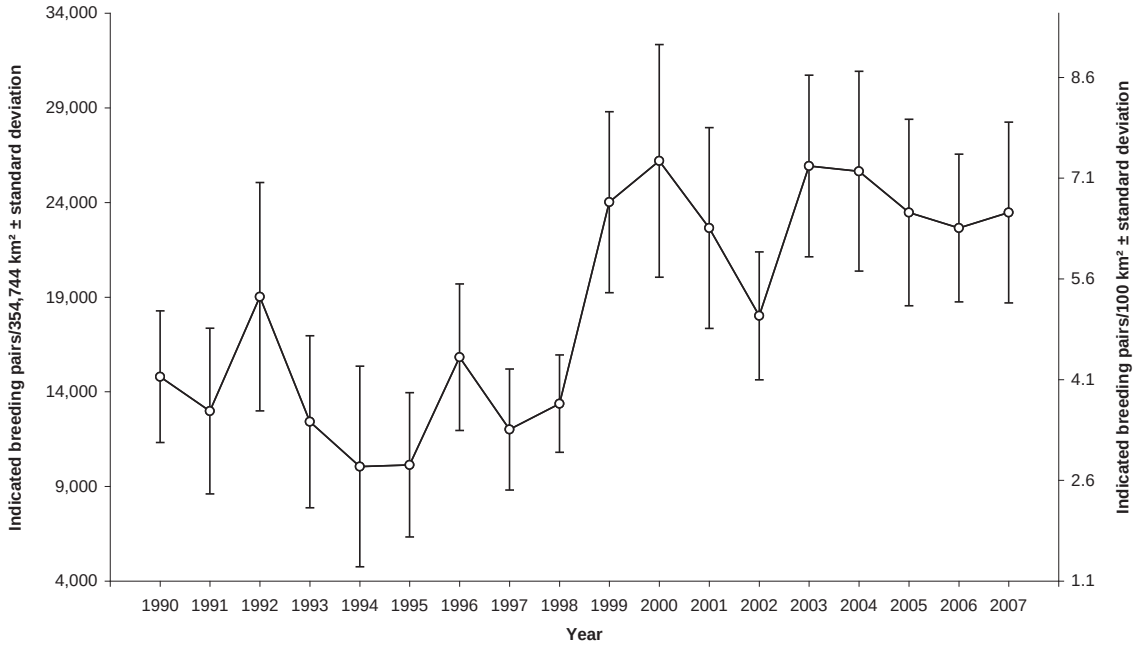


Figure 16. Trends in the breeding population of the Atlantic Population of the Canada Goose in southern Quebec uplands (southern boreal forest), 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



In parallel with the surveys, a research program was launched to study reproduction in the population. Atlantic Population Canada Geese have a high reproductive potential. The most influential factor in productivity is the weather, particularly temperature and snow cover during the critical egg-laying and incubation periods (late May to early June). These two variables directly influence snow melt which, in turn, is a determining factor in the nest initiation date. Late snow melt decreases the availability of suitable nesting habitats, thus delaying nesting and even preventing many pairs from breeding altogether. In every year of this breeding ground study, breeding success along Ungava Bay was poorer than that observed along Hudson Bay (in sectors surveyed yearly). This difference could be attributed to the higher predation rates along Ungava Bay, particularly by black bears (*Ursus americanus*), which are rarer along Hudson Bay (Kolenosky and Strathearn 1987).

Since the entire Atlantic Population of the Canada Goose breeds in Quebec, the province has a very high degree of responsibility for the conservation of this population in North America.

4.1.6.2 North Atlantic Population *Branta canadensis canadensis* (Mr, Br)

(by Jean Rodrigue)

Canada Geese belonging to the North Atlantic Population (*B. c. canadensis*) are intermediate in size. They breed in Quebec's eastern boreal forest, Newfoundland, Labrador and Greenland (Fox et al. 1996). The population's main wintering grounds are in the Maritimes and New England (Massachusetts, Rhode Island and Maine), as well as some parts of New York and New Jersey (Erskine 1997; Hestbeck and Bateman 2000).

Breeding

In Quebec, North Atlantic Canada Geese breed along the north shore of the Gulf of St. Lawrence (BCR 8), in generally low densities except on Anticosti Island (Cotter et al. 1996b). These geese often build their nests on small islands or large boulders in lakes and streams; hummocks in bogs are also preferred nesting sites. Figure 13 (see Section 4.1.6), together with Figure 12, provide a picture of the distribution of the North Atlantic Population of the Canada Goose (in indicated breeding pairs) based on WUPL data. Average breeding density was 7.7 IBP/100 km² in Quebec (2000–2007; Figure 17) according to these surveys.

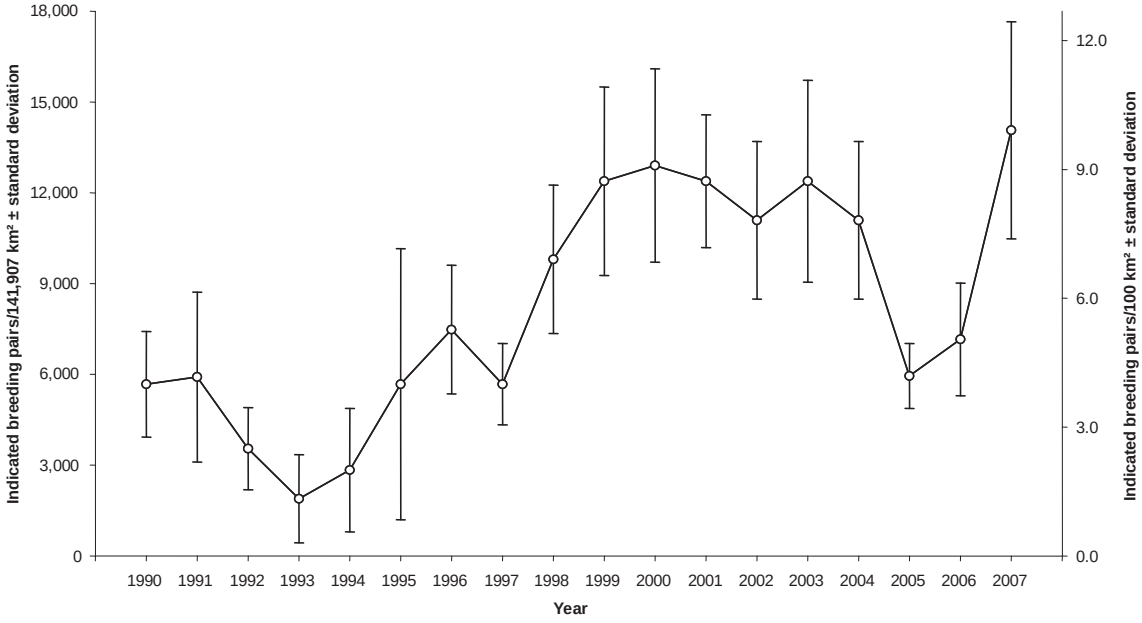
Migration

This population migrates mainly through the Maritimes. Birds passing through Quebec use a primarily eastern migration route through the Gaspésie (BCR 14) and Côte-Nord regions, as well as Anticosti Island (BCR 8), although certain individuals take a more central route (BCR 7 and 8) (Malecki et al. 2001b). Greenland breeders have been harvested in fall in eastern Quebec (CWS, unpubl. data).

Conservation

In 2007, the North Atlantic Population of the Canada Goose consisted of an estimated 46,900 breeding pairs (Canadian Wildlife Service Waterfowl Committee 2007), with roughly 130,000 individuals in North America as a whole (Table 2). Although most of the population breeds in Newfoundland and Labrador, nearly 25% of the geese, or roughly 11,000 breeding pairs, breed in Quebec (2000–2007) (WUPL). The population has been relatively stable in recent years (Figure 17).

Figure 17. Trends in the breeding population of the North Atlantic Population of the Canada Goose in southern Quebec uplands (southern boreal forest), 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



The North Atlantic Population of the Canada Goose is one of the few game bird populations in which most of the sport harvest occurs in Canada. Canadians, particularly Maritimers, account for 70% of the total harvest, with the Quebec harvest representing 5%. Band recoveries for the population are very low. An individual shot in the Matapédia Valley in Quebec had been banded in Greenland.

Quebec bears a quite high level of responsibility for the conservation of the North Atlantic Population of the species, since one fourth of individuals breed in (Table 2) and migrate through the province.

4.1.6.3 Atlantic Flyway resident Population *Branta canadensis maxima* (Mr, Br, Wr) **(by Jean Rodrigue)**

So-called "resident" Canada Geese consist of a mixture of different subspecies: mainly *Branta canadensis maxima,* along with *B. c. moffitti*, *B. c. interior* and *B. c. canadensis* (Canada Goose Committee – Atlantic Flyway Technical Section 1999; Dickson 2000). These are the largest Canada Geese in Quebec, although the females overlap in size somewhat with males of the two other populations. The Atlantic Flyway resident Population has been expanding for a number of years, with the northern limit of its range shifting several times in recent years. Before 1975, there were no records of Atlantic Flyway resident geese nesting in southern Quebec. Since the southern limits of the ranges of the other two Canada Goose populations (Atlantic and North Atlantic) generally lie south of the 49th parallel (excluding the agricultural areas in the Abitibi and Lac Saint-Jean regions), it is reasonable to expect that, in coming years, the resident Population will occupy all the territory south of the breeding ranges of the other two populations.

Breeding

In Quebec, breeding of the Atlantic Flyway resident Population was confirmed in 1977 in the Outaouais region (BCR 13). Since then, the population has expanded its breeding range to cover all of southern Quebec (BCR 13 and 14). The highest breeding densities are found in the area between Boucherville and Contrecoeur (BCR 13); for example, densities of 1.7 nests/ha were found on the Varennes Islands in 2007 (J.-F. Giroux, UQAM, pers. comm.). The resident goose Population is growing exponentially in this region (Giroux et al. 2001). Figure 13 (see Section 4.1.6), together with Figure 12, provide a picture of the distribution of the Atlantic Flyway resident Population of the Canada Goose (in indicated breeding pairs) according to WLOW, WUPL and WSHO data.

Migration and moulting

These geese are designated *resident* birds because their movements during migration tend to be much shorter than those of their close relatives, the *migratory* geese (in Quebec, the Atlantic and North Atlantic Populations). They are therefore not sedentary as is commonly thought. In Quebec, breeding resident geese are joined in July and August by resident geese from the Atlantic and Mississippi flyways that come here to moult. The birds from the Atlantic and Mississippi flyways moult not only along the St. Lawrence, but also in the hydroelectric reservoirs of the La Grande complex (BCR 7) and along the east coast of Hudson Bay (BCR 7) (Brousseau and Gagnon 2004; Harvey and Rodrigue 2005). Generally, resident geese that have undertaken a moult migration return to their wintering quarters in September (Brousseau and Gagnon 2004).

Wintering
Since the 1990s, fewer than 100 Canada Geese have overwintered every year in the Montréal region (BCR 13) (Bannon 2008); although it is difficult to identify them to subspecies, it is very likely that some are resident geese.

Conservation
The Atlantic Flyway resident Population consists of an estimated 1.0 million individuals (Table 2) and was increasing during the 1994–2003 period (North American Waterfowl Management Plan 2004). In 2004–2007, Quebec was estimated to have roughly 6,800 IBP, or 18,000 individuals, on average (Table 2). In the province, a significant upward trend (11.5% annually) in the resident Population has been observed in BCR 12 (Lepage et al., in prep.); no significant trends were found in the data for BCRs 13 and 14 (WLOW, WUPL and WSHO), which is more fragmentary. At the local scale, nest surveys in the Varennes region (BCR 13) have shown a sharp increase in the breeding population, with the number of nests increasing from 10 in 1996 to 190 in 2007 (J.-F. Giroux, UQAM, pers. comm.).

The giant form of the Canada Goose has gone from near extinction to overabundance in many parts of the U.S. and Canada in the space of 100 years. In the early 20th century, it was believed that giant Canada Geese had been extirpated from their traditional breeding grounds in the Central and Mississippi flyways. The discovery of a group of birds breeding in Manitoba was the basis of efforts to re-establish this subspecies, which began around 1950 and gathered steam in the 1960s in both Canada and the United States (Dill and Lee 1970; Dennis et al. 2000). Birds used to establish breeding stocks include individuals captured illegally in spring, birds wounded during hunting and captured, and geese from hunting clubs (wild geese captured by the clubs and used as live decoys). This helped to create a foundation stock that was highly diverse in origin, which was reintroduced into an area much greater than the subspecies' known historical range.

The traits in this population responsible for its success include the resident birds' tendency to move shorter distances during migration and their higher and more constant reproductive success. Furthermore, due to their frequentation of more urban habitats, they are less exposed to hunting pressure.

The resident Canada Geese have become so abundant that they cause significant damage in some regions of the U.S. and Canada. Authorities have tried various methods to control the expanding population. Since the birds seek large open areas with well-maintained grass near ponds and other water bodies, conflicts between geese and humans are most apparent in urban parks, golf courses and beaches. Depredation of crops by the geese is also a serious problem. In 2005, CWS published a pamphlet on the problems of living with resident Canada Geese in urban environments and CWS biologists are currently preparing a management plan for resident Canada Geese in Quebec. The main goal of the plan is to participate in achieving the population objective set by the Atlantic Flyway Council, which is to reduce the Atlantic Flyway resident Population from 1.2 million to 650,000 birds (Canada Goose Committee – Atlantic Flyway Technical Section 1999).

Although the population objective for resident geese in Quebec is zero, obviously this will never be achieved. Measures can be taken to control population growth and limit

the population's expansion, however. Furthermore, the general public's appreciation and tolerance of the resident geese must be preserved and the recreational potential of the population's presence maximized.

4.2 Swans (Cygnini)
(by Christine Lepage)

Swans can be distinguished from geese by their larger size, relatively longer neck and bare skin extending from the base of the bill to the eye. Like geese, swans mate for life. The tribe Cygnini (swans) includes two species that breed in Quebec (Table 1); only the Tundra Swan is a regular breeder, in northern Quebec. The Mute Swan breeds more in the Great Lakes, although there is one breeding record from the Abitibi region. In the southern half of Quebec, the Tundra Swan is mainly observed during migration and the Mute Swan as a visitor, but this occurs irregularly and in small numbers in both cases.

4.2.1 Mute Swan *Cygnus olor* (Mr, Be, We)
(by Christine Lepage)

The Mute Swan is a native of Eurasia that was introduced in North America in the second half of the 19th century, mainly as an ornamental species (Ciaranca et al. 1997; Delany 2005). Now well established on our continent, the Mute Swan is found along the U.S. East Coast (from New Hampshire to Virginia; 13,000 individuals) and in the southern Great Lakes (2,700 individuals) (Badzinski 2007). In Ontario, this swan mainly breeds along the north shores of Lake Ontario and Lake Erie, quite often in or near urban environments (Cadman et al. 1987; Sandilands 2005; Badzinski 2007).

Breeding

The only known case of nesting in Quebec dates back to 1978 and involves a breeding pair that was released in Lake Édouard in Rouyn-Noranda, in the Abitibi region (BCR 8) (Club des ornithologues du Québec 1978). Another single record, from July 1995, involves a family group, including four downy young, that was photographed in Saint-Sulpice (BCR 13) in the Lanaudière region (Aubry and Bannon 1995).

Migration

The Mute Swan is a rare visitor to Quebec but, since 1993, has been seen regularly in the province, occurring singly or in small groups (up to six), primarily in western Quebec (ÉPOQ). This anatid is observed mainly in April and May and between July and October, although these birds cannot be considered migrants per se since the species is known to be sedentary. Instead, these records most likely involve erratic movements by birds breeding in New England or Ontario (David 1996), although the origin of these birds (escapees from captivity or wild birds) is often disputed.

Montérégie (BCR 13) is the only region visited by the species every year in spring or fall since 2000 (ÉPOQ). The other regions most often frequented in these seasons, but not on a yearly basis, are Lanaudière (BCR 12 and 13), Québec City (BCR 12 and 13) and Charlevoix (BCR 12) (ÉPOQ).

Wintering

Mute Swans have probably succeeded in overwintering on a few occasions in the Montréal and Montérégie regions (BCR 13) (David 1996; Bannon et al. 2005c; Bannon

2008), although the only actual record of successful overwintering occurred in the Eastern Townships (BCR 14) (David 1996). The other winter records involve single stopovers, in the Outaouais (BCR 12 and 13), Abitibi-Témiscamingue (BCR 8 and 12), Mauricie (BCR 12 and 13) and Charlevoix (BCR 12) regions (Aubry et al. 1999; Bannon et al. 2002c; 2003b).

Conservation

The Mute Swan population is increasing in North America (North American Waterfowl Management Plan 2004), despite control measures in some U.S. states (Ciaranca et al. 1997; Maryland Department of Natural Resources 2003). The North American population is estimated to be 20,000 individuals (2001–2003 mean; Table 2). In Lake Ontario and Lake Erie, the population is growing by between 10% and 18% a year on average (Petrie and Francis 2003). Although the Great Lakes birds are generally sedentary, they may move short distances in fall and winter to find open water or to seek new food sources when local ones have been depleted (Peck and James 1983; Cadman et al. 1987; Ciaranca et al. 1997; Sandilands 2005).

There is no evidence that Mute Swan sightings are increasing in Quebec (ÉPOQ). However, given the rapid rise in numbers breeding in Ontario (the closest location to Quebec where the species regularly breeds), it would not be surprising if this occurred in the future. The fact that our winters, even in southwestern Quebec, are harsher than those in the Great Lakes region could limit the expansion of the species in Quebec.

Although the Mute Swan is prized for its ornamental value, its presence has raised some controversy in regions where it is viewed as being “too” abundant. Experiences with the species in some states on the U.S. East Coast have prompted governments to implement control measures to prevent local populations from expanding too much (Ciaranca et al. 1997). Maryland, which is the state in the Atlantic Flyway with the greatest number of Mute Swans, has implemented its own management plan for the species (Maryland Department of Natural Resources 2003). According to authorities, a population boom could affect native species and their conservation and the integrity of habitats, among other things.

Once the species becomes established in an area, it quickly becomes dominant and is difficult to eliminate. Pairs defend their nest and young very aggressively, causing seabirds to abandon their colonies and driving away ducks from their nests (Therres and Brinkler 2004). In addition, the Mute Swan has been blamed for habitat modification, particularly the overgrazing of submerged aquatic vegetation (Allin and Husband 2003; Therres and Brinkler 2004). Since overgrazing reduces food availability, it may affect other waterfowl species, particularly during winter (Allin and Husband 2003; Therres and Brinkler 2004). In the past, Mute Swans were used to chase resident Canada Geese from marshes and ponds (Smith et al. 1999). This practice is no longer recommended due to the species’ high level of aggressivity, which extends to even chasing humans from the shoreline or adjacent water. Given their semi-domestic origins, Mute Swans do not fear humans and are able to easily adapt to urban environments.

The Mute Swan is protected in Canada and the U.S. under the *Migratory Birds Convention Act, 1994*, which protects all species of swans, whether native or introduced. Recently, CWS drafted a policy on managing non-native waterfowl, which will allow authorities to take appropriate action when needed.

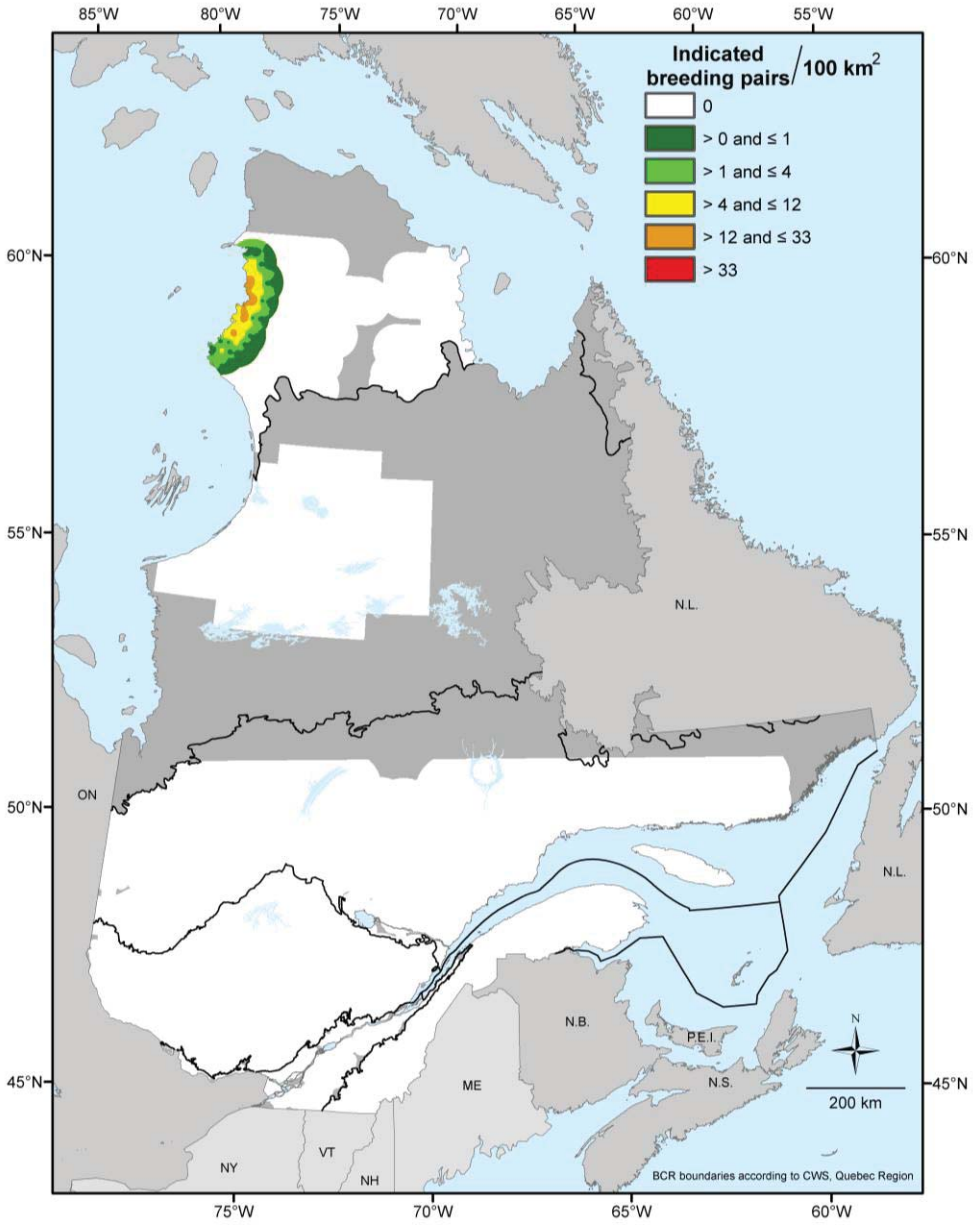
4.2.2 **Tundra Swan** *Cygnus columbianus columbianus* (Mr, Br, We)
(by Jean Rodrigue and Christine Lepage)

The Tundra Swan is divided into two subspecies: Bewick's Swan (*Cygnus columbianus bewickii*), which breeds in Russia, and the nominate subspecies (*C. c. columbianus*), which breeds in North America (Limpert and Earnst 1994; American Ornithologists' Union 1998; Bowler 2005a; b). On our continent, two populations of Tundra Swans have been identified, based mainly on geographic discontinuity: the Eastern and Western populations. Birds breeding in Quebec make up part of the Eastern population, which ranges from the Seward Peninsula in Alaska to the north and east coast of Hudson Bay and as far east as Baffin Island (Canadian Wildlife Service Waterfowl Committee 2007; U.S. Fish and Wildlife Service 2008). The Mackenzie and Anderson river deltas in the Northwest Territories are also major breeding grounds for the species (U.S. Fish and Wildlife Service 2008; Limpert and Earnst 1994). The Eastern population overwinters along the U.S. East Coast, mainly from New Jersey to South Carolina (Limpert and Earnst 1994).

Breeding

A very small proportion of Eastern population Tundra Swans breed in Quebec, which is on the eastern edge of the species' North American range. In the province, the species breeds in the coastal wetlands of Nunavik, particularly along Hudson Bay in the area between Inukjuak and Ivujivik (BCR 3) (Alvo 1996a). Tundra Swan nests and broods (1–4 nests and broods annually) were found around the Polemond and Sorehead rivers (BCR 3), north of Inukjuak, during a 1996–2003 Canada Goose breeding ground study (R. Cotter, CWS, unpubl. data). Further south, breeding pairs were observed north of Umiujaq (BCR 7) (CWS, unpubl. data), while broods and family groups were sighted at the mouth of Rivière au Phoque (Seal River) (BCR 7) and in Bay of Many Islands (BCR 7), on the northeast coast of James Bay (Benoit et al. 1991; Benoit et al. 1993; Alvo 1996a). In the summer of 2008, breeding by the species was confirmed in Deception Bay, roughly 50 km east of Salluit, by a sighting of four adults and three young of the year (Poulin and Plourde 2010). All these records come from north of the 54th parallel. During WNOR surveys, pairs were generally observed within 20 km of the coast of Hudson Bay although one pair was found as far as 116 km inland; nine nests were located over the years during these surveys (CWS, unpubl. data). Figure 18 shows the distribution of Tundra Swans in Quebec according to WNOR data.

Figure 18. Breeding distribution of the Tundra Swan in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration and wintering

In southern Quebec, Tundra Swans are mainly observed during spring migration (April to June) and, to a lesser extent, during fall migration (October and November) (ÉPOQ). Southern Quebec is not on the species' regular migration route, which is located further west, in the Great Lakes (Limpert and Earnst 1994; Palmer 1976; Petrie and Wilcox 2003). Birds that do migrate through southern Quebec are usually observed singly or in groups of up to 7, although there have been sightings of 25 individuals in the Outaouais region (BCR 12 and 13) in 1996 and 30 individuals in the Saguenay region (BCR 8) in 2003 (Bannon et al. 2003a). Although no region of southern Quebec hosts staging swans on an annual basis, the species is seen most frequently during migration in the Outaouais region (9 years out of 13 in 1990–2003); in addition, individuals are also

seen fairly regularly in the Abitibi (BCR 8), Montérégie (BCR 13), Lanaudière (BCR 12 and 13) and Saguenay–Lac-Saint-Jean (BCR 8) regions (ÉPOQ).

There is only one known winter record of the species in Quebec, in Lake Témiscouata (Bas-Saint-Laurent region; BCR 14), in 1968–1969 (Larivée 1993).

Conservation

According to USFWS winter surveys, the Eastern population of Tundra Swans consisted of 103,400 individuals on average in 2001–2003 (Table 2), while more recent surveys (2008) have provided estimates of 96,200 individuals (U.S. Fish and Wildlife Service 2008). The Eastern population has been declining over the last 10 years (statistically insignificant decrease of 2% per year, 1999–2008) (U.S. Fish and Wildlife Service 2008), although the 1994–2003 period showed an increase (North American Waterfowl Management Plan 2004). The Quebec population is estimated at roughly 1,100 IBP, or around 2,900 individuals (WNOR; Table 2).

In Canada, the species has an interesting conservation history. The population was unprotected until the enactment of the *Migratory Birds Convention Act, 1994,* and had been virtually extirpated from its traditional breeding grounds due to the trade in swan skins. It was only after the Act was passed that the population began to get re-established. After an absence of over 150 years, the Tundra Swan has returned to breed in Manitoba, Ontario and Quebec (Lumsden 1984).

Sport hunting of the species is forbidden in Canada but permitted in the United States. U.S. hunters bagged 3,332 Eastern population individuals on average during the 2000–2007 period (Padding and Klimstra 2008). In North America, an estimated 10,000–15,000 Tundra Swans are killed annually in the sport and First Nations hunts and by poachers (Bartonek et al. 1991). In northern Quebec, hunting of the species by Inuit is probably negligible if it exists at all.

The distribution of Tundra Swans on their wintering grounds has varied greatly over the years. While winter numbers have increased in Pennsylvania, Virginia and North Carolina, those in Maryland—which represents the core of the species' traditional wintering range—have decreased by 40% during the last 25 years (Maryland Department of Natural Resources 2003). In this state, researchers have observed that Mute Swans, which are subject to control measures, were adopting aggressive behaviours towards Tundra Swans, with which they compete in foraging areas and in refuges (Maryland Department of Natural Resources 2003). These researchers do not know, however, the extent to which interspecific competition is responsible for the Tundra Swan's decline on its wintering grounds in Maryland (Maryland Department of Natural Resources 2003). Increased foraging by Tundra Swans in farm fields in North Carolina has been observed to coincide with a decline in submerged aquatic vegetation in Chesapeake Bay in Maryland (Bowler 2005b).

The conservation of the species' traditional stopover areas is no doubt crucial since the swans spend half their year migrating between their wintering grounds along the Atlantic Seaboard and their breeding grounds in the Arctic (Petrie and Wilcox 2003). On their breeding grounds in the Northwest Territories and Yukon, Tundra Swans face numerous challenges, including increasingly high harvest rates, declining survival rates, and planned oil and gas development (Hines 2006; Hines et al. 2006). Lastly, it should be noted that Tundra Swans have a low reproductive output (Hines 2006).

Quebec is not a major player in the conservation of Tundra Swans in North America, with only a very low percentage (< 5%; Table 2) of the population breeding in northern Quebec and migrating through southern Quebec. However, given the continent-wide situation of the population (in decline according to the most recent data, competition with the Mute Swan, etc.), protecting the species' traditional breeding grounds is crucial.

4.3 Dabbling ducks (Anatini)

(by Christine Lepage)

The tribe Anatini is made up of ducks frequenting shallow-water habitats, which forage by filter feeding along the surface or upending themselves to take food further down. The tribe includes nine species that are regular breeders in Quebec (Table 2); another species, Eurasian Wigeon, is observed most often in summer, although no breeding evidence has been obtained for it in the province. The American Black Duck is the only member of the tribe that breeds exclusively in northeastern North America, while most of the other species occurring in Quebec—Gadwall, American Wigeon, Mallard, Blue-winged Teal, Northern Shoveler and Northern Pintail—were originally Prairie natives (Gauthier and Aubry 1996; Rohwer et al. 2002). The Wood Duck and Green-winged Teal are shy, retiring species intimately linked to forest habitats; the Wood Duck is the only representative of the tribe that nests in tree cavities.

4.3.1 Wood Duck *Aix sponsa* (Mr, Br, Wo)

(by Christine Lepage)

The Wood Duck's world breeding range is limited to North America and Cuba. There are two populations: Eastern and Western (North American Waterfowl Management Plan 2004). The Western population is small, consisting of an estimated 200,000 birds, breeding mainly from southern British Columbia to extreme southwest Alberta in the north to California and the inland Northwest states in the south (Semenchuk 1992; Hepp and Bellrose 1995). Western birds winter mainly in the U.S. Pacific Northwest and California, and from Montana to northwestern Utah (Hepp and Bellrose 1995). The Eastern population breeds from southeastern Saskatchewan to Prince Edward Island and Nova Scotia, as well as in the eastern half of the U.S. and in Cuba (Hepp and Bellrose 1995). Southern Quebec is therefore on the northern edge of the species' breeding range. Birds also breed in the central U.S. from the extreme eastern part of Wyoming to Colorado. Eastern population individuals breeding in the northern half of the breeding range migrate to the southern part of the range and the adjoining states in the southwestern and western U.S. to overwinter (Utah, Colorado, Arizona, New Mexico, Oklahoma and Texas), with some going as far as extreme northeastern Mexico (Hepp and Bellrose 1995; Kear 2005a).

Breeding

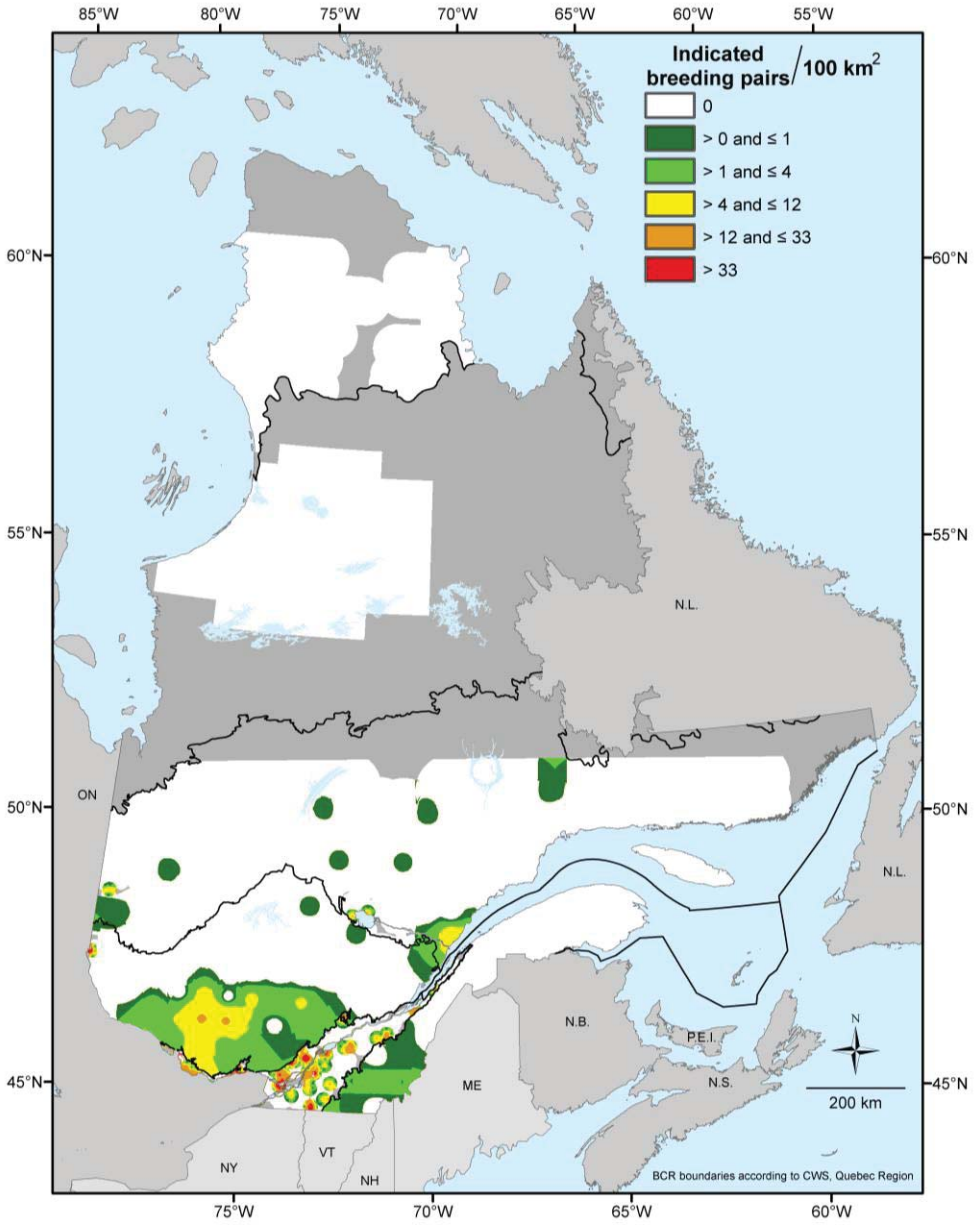
In Quebec, Wood Ducks are mainly associated with mature deciduous and mixed forests sprinkled with wetlands. Cavity nesters, they generally choose trees with a diameter at breast height of at least 30 cm, and most often less than a kilometre (but as much as two kilometres) from a slow-flowing stream or water body surrounded by dense vegetation (Soulliere 1990; Dugger and Fredrickson 1992; Hepp and Bellrose 1995). The species' favourite habitats therefore include flooded forest, swamps and beaver ponds.

In Quebec, Wood Ducks breed mainly south of the 51st parallel, from the Ontario border east to Sept-Îles (BCR 8) on the Middle North Shore and the Gaspé Peninsula (BCR 14) (WUPL). It is also an irregular breeder on the Magdalen Islands (BCR 14) (Fradette 1992). Figure 19 shows the distribution of the species (by indicated breeding pair density) in the province according to data from various monitoring programs and surveys, carried out primarily by CWS (see Chapter 3).

In the WUPL survey area, the highest breeding densities occur roughly along the southern half of the Ontario–Quebec border (6–11 IBP/100 km^2; BCR 12 and 13). Densities of roughly 2–5 IBP/100 km^2 were obtained in southwestern Quebec (Outaouais [BCR 12 and 13], Laurentides [BCR 12 and 13] and Abitibi [BCR 8] regions), but values dropped off rapidly farther east and north. Along the St. Lawrence, only the fluvial section (BCR 13) has significant breeding densities: around 12 IBP/100 km^2 (WSHO). Lastly, the Wood Duck is an infrequent breeder in agricultural habitats; estimated breeding densities were 4.5 IBP/100 km^2 in the Abitibi lowlands (BCR 8) and 4.7 IBP/100 km^2 in the St. Lawrence lowlands (BCR 13) (WLOW).

Outside the species' regular breeding range, there are scattered records of individuals, breeding pairs and broods farther north (above the 52nd parallel), as far as the Eastmain River (BCR 7) (St-Hilaire and Morrier 1996; Tecsult Inc. 2006) and Opinaca River (BCR 7) (Tecsult Inc. 2006), and east along the North Shore (BCR 8) (Bannon et al. 1998; David in Cyr 1995g). More recently, new sightings have pushed the northern limits of the range even further: a female observed in June 1999 on a pond in the Caniapiscau Reservoir area (54° 15' N; BCR 7) (Morneau 1999b); a male harvested in Kuujjuaq (58° 06' N; BCR 7) in the spring of 2001, and a breeding pair observed in the same location in the spring of 2006 (P. May, Makivik Corporation, pers. comm.).

Figure 19. Breeding distribution of the Wood Duck in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration, moulting and wintering

In spring and fall, individuals migrate inconspicuously along the St. Lawrence corridor, particularly the fluvial section (BCR 13). According to ÉPOQ data, birds are generally seen in small groups, although there are records in the first decade of the 21st century of flocks of 20–50 individuals in the Outaouais (Masson, Plaisance; BCR 13), Montréal (Rivière des Mille Îles; BCR 13), Montérégie (Dundee; BCR 13) and Estrie (Compton; BCR 14) regions. In fall, groups of 75–200 birds have been observed in the Outaouais (Masson, Plaisance, McLaurin Lake), Lanaudière (Mascouche; BCR 13) and Bas-Saint-Laurent (Cacouna; BCR 13) regions.

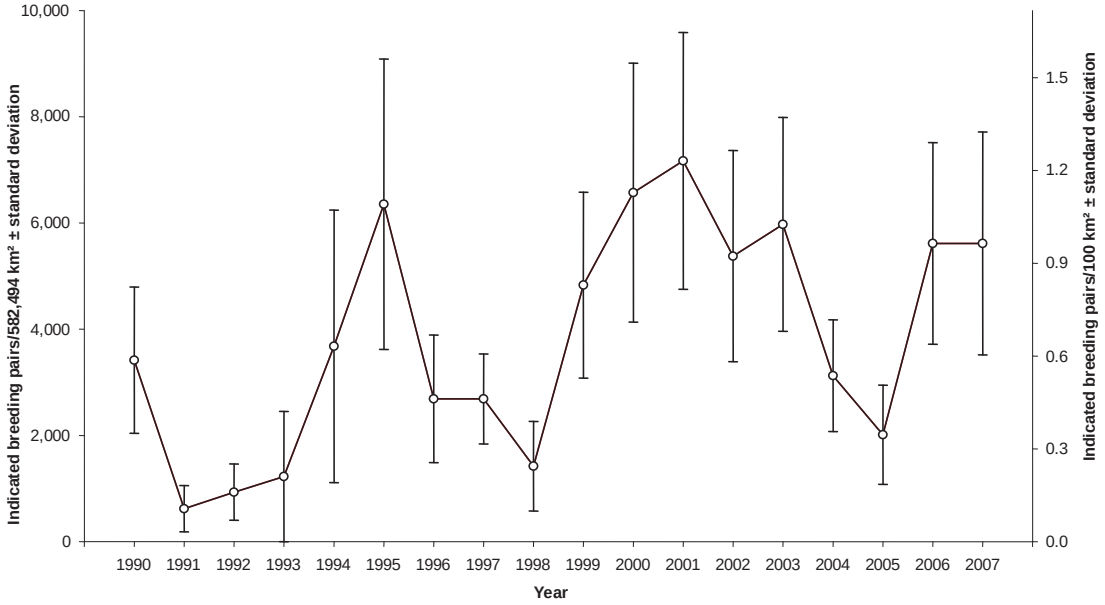
Information on moult in the species is scant. Moulting individuals—mainly drakes—have been sighted in July on the Sainte-Marguerite 3 Reservoir northwest of Sept-Îles, in flooded forest, which is extensive around this reservoir (Morneau 2003). Several dozen birds also moult in the aquatic grass beds along the south shore of Lake Saint-Pierre in late July and early August (CWS, unpubl. data).

Almost every year, a few individuals overwinter in the Montréal region (BCR 13) (Bannon et al. 2003b; Bannon 2008), and overwintering also occurs occasionally in the Montérégie region (BCR 13) (Bannon et al. 2001b; 2003b). Overwintering occurs on an exceptional basis in the following regions: Laurentides (BCR 12 and 13) (Bannon et al. 2006c), Centre-du-Québec (BCR 13) (Bannon et al. 2005c), Québec City (BCR 12 and 13) (Bannon et al. 2006c) and Bas-Saint-Laurent (BCR 14) (Bannon et al. 2002c). The first winter record in Abitibi was obtained in 2005 (BCR 8) (Bannon et al. 2005c).

Conservation

The Eastern population of the Wood Duck is estimated at 4.4 million individuals (Table 2). According to NAWMP, this population, like its counterpart in the West, is probably increasing in North America (North American Waterfowl Management Plan 2004). This trend is corroborated by data from the Breeding Waterfowl Plot Survey of Eastern Canada (helicopter plots) in 1990–2003 (significant increase of 6.5%, $P < 0.05$) (CWS, unpubl. data). Ontario, which hosts the greatest percentage of the breeding population, has also experienced a strong increase (53% between 1981–1985 and 2001–2005; Zimmerling 2007). In Quebec, WUPL surveys pointed to a significant increase (13.7%) in the number of Wood Duck breeding pairs in 1990–2003 (CWS, unpubl. data). Wood Duck pairs increased from an average of 2,800 in 1990–1999 to 5,200 in 2000–2007 in the temperate forests of southern Quebec (Figure 20). Regionally, two significant increases were recorded during the 1990–2007 period: 10.1% per year in BCR 12 and 12.3% per year in BCR 8 (Lepage et al., in prep.). The Quebec population is estimated to be around 13,000 individuals (Table 2).

Figure 20. Trends in the Wood Duck breeding population in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



Overhunting has been identified as the primary cause of a severe decline in the population in the late 19th century and early 20th century. The signing of the Migratory Birds Convention between Canada and the United States and severe restrictions on hunting were the first steps in the conservation of the species. However, new threats emerged in the 20th century: large-scale deforestation, unfavourable forest management practices, the degradation and destruction of wetlands, intensification of agriculture, and urban and industrial development. These development practices have all contributed, and continue to contribute in varying degrees, to the scarcity of nesting cavities—Wood Ducks do not excavate their own cavities—in suitable habitats, particularly in southern Quebec.

In the 1970s, private and public agencies established programs to install artificial nest boxes in the province (Chapdelaine 1974; 1979). In 1995, the Société d'aménagement de la baie Lavallière (SABL) and its partners consolidated existing nest box programs, which were scattered here and there in Quebec, in a single network and now oversee the compilation of province-wide data on the species using standardized data sheets (Angers et al. 1996). According to data compiled by SABL, out of 970 nest boxes checked by volunteers in 2005, 18% were occupied by Wood Ducks (which accounted for 48% of all occupied nest boxes), with a gross productivity of 833 ducklings (Société d'aménagement de la baie Lavallière 2006).

Aside from the effort to provide artificial cavities for the species, the availability of natural cavities has proven to be key in Wood Duck conservation. Natural cavities may be excavated by other species or form naturally in old trees and snags. Mature forests containing large trees likely to develop such cavities are therefore crucial for the species. According to a study in the United States, 85% of cavities used by Wood Ducks are found in healthy trees (Soulliere 1990). Along with naturally forming cavities, Wood Ducks also use cavities excavated by woodpeckers, particularly Pileated

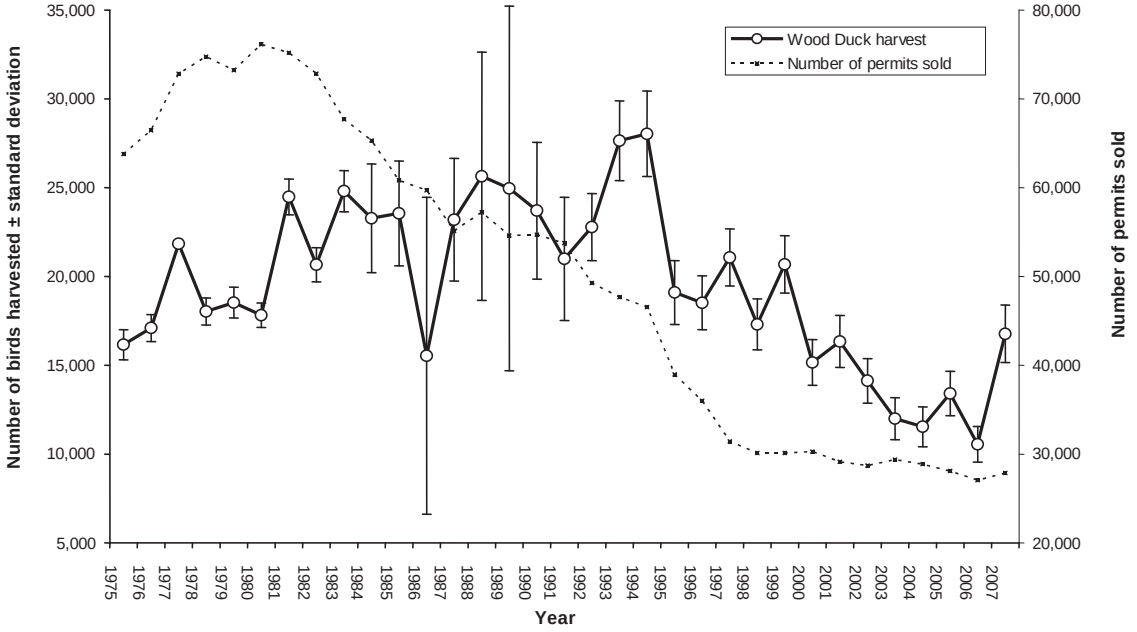
Woodpeckers (Chapdelaine 1979; Cyr 1995g; Maisonneuve 2004). Consequently, population levels in Pileated Woodpeckers may play a role in influencing Wood Duck populations at a local level (Cyr 1995g).

Since tree cavities are rare and the Wood Duck is not the only cavity nesting duck in southern Quebec, it not only competes with members of its own species for cavities, but also faces a certain amount of competition from other cavity nesting anatids (Common Goldeneye, Hooded Merganser and Bufflehead). Preserving riparian buffer strips that are wide enough (up to 2 km) to provide suitable habitat for Wood Ducks may also be a key element in protecting the species (Soulliere 1990).

Lastly, the status of beaver populations is also a factor to be considered in the conservation of the species. Beaver ponds often have sizable numbers of snags for nesting and provide prime brood-rearing habitat. In Quebec, beaver numbers are increasing in a number of regions (Fortin et al. 2001), with the highest beaver densities recorded in the Outaouais, Abitibi-Témiscamingue, Laurentides and Lanaudière regions (Lafond and Pilon 2004), which also correspond to the regions with the greatest densities of Wood Ducks.

In the U.S. portion of the Atlantic Flyway, Wood Ducks are the second most commonly harvested duck after Mallard, with close to 345,100 individuals bagged annually in 2000–2007 on average (Padding and Klimstra 2008). Therefore, the hunting pressure on this species from U.S. hunters is high (Dugger and Fredrickson 1992). In Quebec, 12,900 individuals were taken per year on average by hunters between 2003 and 2007 (Table 3; Figure 21). Unless large numbers of the species from outside the province are present in fall, which does not appear to be the case according to observations (see the section on migration, moulting and wintering), the comparison of the estimated harvest (12,900) and the estimated population (13,000; Table 2) in Quebec seems to indicate that at least one of these estimates is incorrect. If these estimates were correct, almost all individuals breeding in Quebec would be harvested every year by Quebec hunters. The comparison of statistics by decade shows that Wood Ducks accounted for 4% of all ducks bagged in the province in 1975–1984, 6% in 1985–1994 and 7% in 1995–2004, representing a slight increase (Table 3).

Figure 21. Estimated Wood Duck sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec is at the northeastern limit of the Wood Duck's breeding range and consequently is not an important player in the conservation of the species at the continental level (less than 1% of the North American population breeds in Quebec; Table 2). Wood Ducks are increasing in the province, perhaps due to a combination of factors such as nest box programs, thriving beaver populations and increasingly favourable silvicultural practices. The future of the Wood Duck in Quebec is closely tied to the sound management of Quebec forests and the presence of suitable wetlands for the species.

4.3.2 Gadwall *Anas strepera* (Mr, Br, We) **(by Christine Lepage)**

The Gadwall is a Northern Hemisphere species (LeSchack et al. 1997; Fox 2005b). Although its core breeding range in North America is in the Canadian Prairies and U.S. Great Plains, it also breeds from the Aleutian Islands, southern coast of Alaska and southern border of Yukon east to Quebec and the Maritimes, as well as in all the western and northeastern states. It winters along the southern coast of Alaska and British Columbia to Baja California (Mexico); in the western, southern and southeastern states; in the southern Great Lakes; along the Atlantic Seaboard and the Gulf of Mexico; and in Mexico, the Bahamas and Puerto Rico (LeSchack et al. 1997; American Ornithologists' Union 1998).

Breeding

Gadwalls nest later in the season since they seek out tall, dense vegetation for the nest site (Giroux and Rail 1996). Particularly favoured are small islands covered with tall dense grass—mainly reed canary-grass—where the nest is well camouflaged. In

Quebec, Gadwalls breed primarily along the St. Lawrence and its main tributaries, from the Ontario border to the Lower St. Lawrence (BCR 13 and 14) (Cyr 1995h; Giroux and Rail 1996; Giroux et al. 1995). In WSHO surveys of the St. Lawrence (fluvial section, estuary and Gulf), 90% of all breeding pairs observed were in the fluvial section. The greatest concentrations of the species occur in wetlands in the St. Lawrence Valley, between Valleyfield and Trois-Rivières (BCR 13) (Cantin et al. 1976; Giroux and Rail 1996). The Gadwall is particularly numerous in the stretch between the Boucherville Islands and Berthier-Sorel Islands (BCR 13), where it is the most abundant nesting waterfowl species (Bélanger 1989). In the Îles de Contrecœur National Wildlife Area (NWA), Gadwalls made up 47% of nesting ducks in 1976, with 151 nests (found overwhelmingly in tallgrass meadows), and 42% of nesting ducks in 1994, with 144 nests (Cantin et al. 1976; Giroux et al. 1995). In a 2007 survey on the Varennes Islands (BCR 13), 29 nests of the species were found, mainly in abandoned and improved pastureland; Gadwall nests accounted for 37% of the duck nests located, making it the second most abundant breeding duck on the islands after the Mallard, which accounted for 44% of nests (Giroux 2007).

CWS surveys along the St. Lawrence reported average breeding densities of 21.5 IBP/100 km^2 in the fluvial section (including the Ottawa and Richelieu rivers), or a total of 524 IBP (WSHO; Figure 22). This number probably underestimates the actual number of breeding pairs, however, since the species nests in high densities on some islands, which were not all systematically surveyed. Although it is considered a confirmed breeder in the Saguenay–Lac-Saint-Jean (BCR 8) and Abitibi (BCR 8) lowlands, and as a possible or probable breeder in the St. Lawrence lowlands (BCR 13) (Giroux and Rail 1996), annual surveys of breeding pairs in these areas did not turn up any pairs in 1998 and 1999 or in 2004–2007 (WLOW). However, the habitat covered in this survey—flat agricultural land—does not typically correspond to the Gadwall's preferred breeding habitat (see previous paragraph). The Gadwall also breeds, to a lesser extent, in the following other regions: Québec City (BCR 12 and 13), Saguenay–Lac-Saint-Jean (BCR 8), Côte-Nord (BCR 8), Bas-Saint-Laurent (BCR 14), Gaspésie (BCR 14) and the Magdalen Islands (BCR 14) (Fradette 1992; Cyr 1995h; Giroux and Rail 1996; Bannon et al. 2007). Interestingly, on the Middle North Shore, a number of pairs nest along the shoreline of ponds and pools on many of the islands in the Mingan Archipelago (WSHO), where the habitat, consisting of water bodies with a limestone bottom and riparian vegetation typical of the tundra, is very different from the grassy islands in the fluvial section.

Information on the Gadwall's status in the northern half of Quebec is scarce. No breeding evidence has been obtained for the species and the only records in BCR 7 consist of two individuals at Kakassituq Point in August 1990 (Benoit et al. 1991) and a few indicated breeding pairs in the northwestern part of the BCR (Grande-Baleine Complex waterfowl survey carried out by CWS in 1991), as well as in the central and southwestern parts of the BCR (USFWS waterfowl survey) (see Guérette-Montminy et al. 2009).

The distribution of Gadwalls (by indicated breeding pair density) in Quebec according to various surveys and inventories carried out mainly by CWS is shown in Figure 23. Although it is difficult to distinguish the species' distribution in southern Quebec on the map, breeding has been confirmed there (which is not the case in BCR 7) and Gadwalls have been observed in many locations along the shoreline of the

St. Lawrence, particularly west of Lake Saint-Pierre where densities exceeding 33 IBP/100 km^2 have been found.

Figure 22. Mean number of indicated breeding pairs of Gadwalls along the shoreline of the St. Lawrence and its main tributaries, 2004–2007 (WSHO data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis).

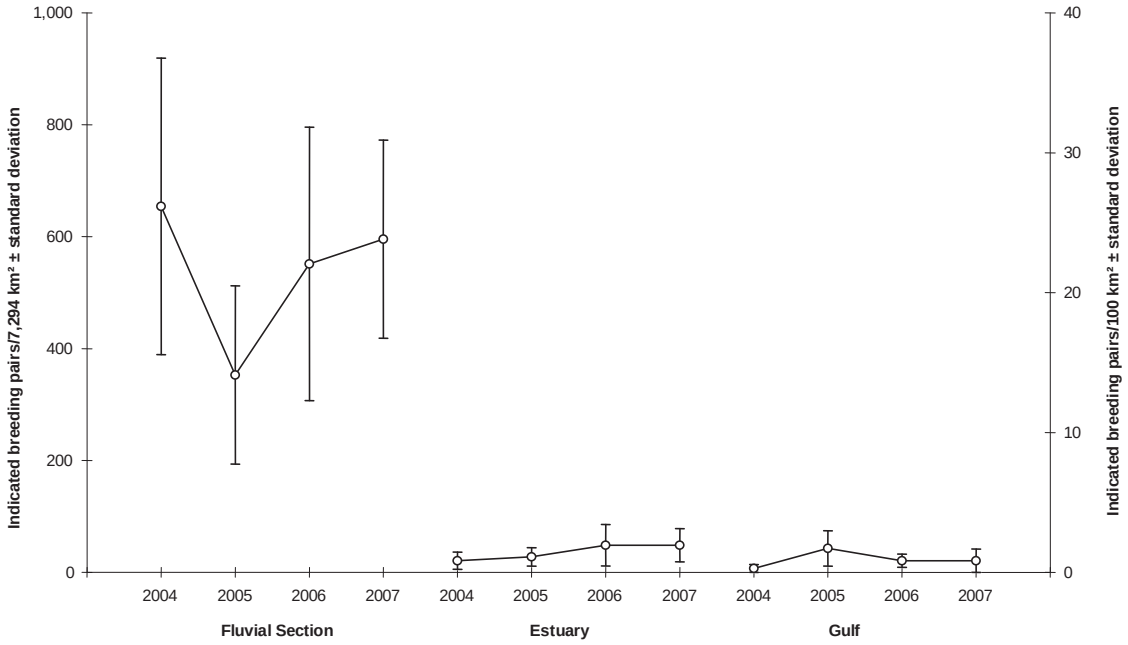
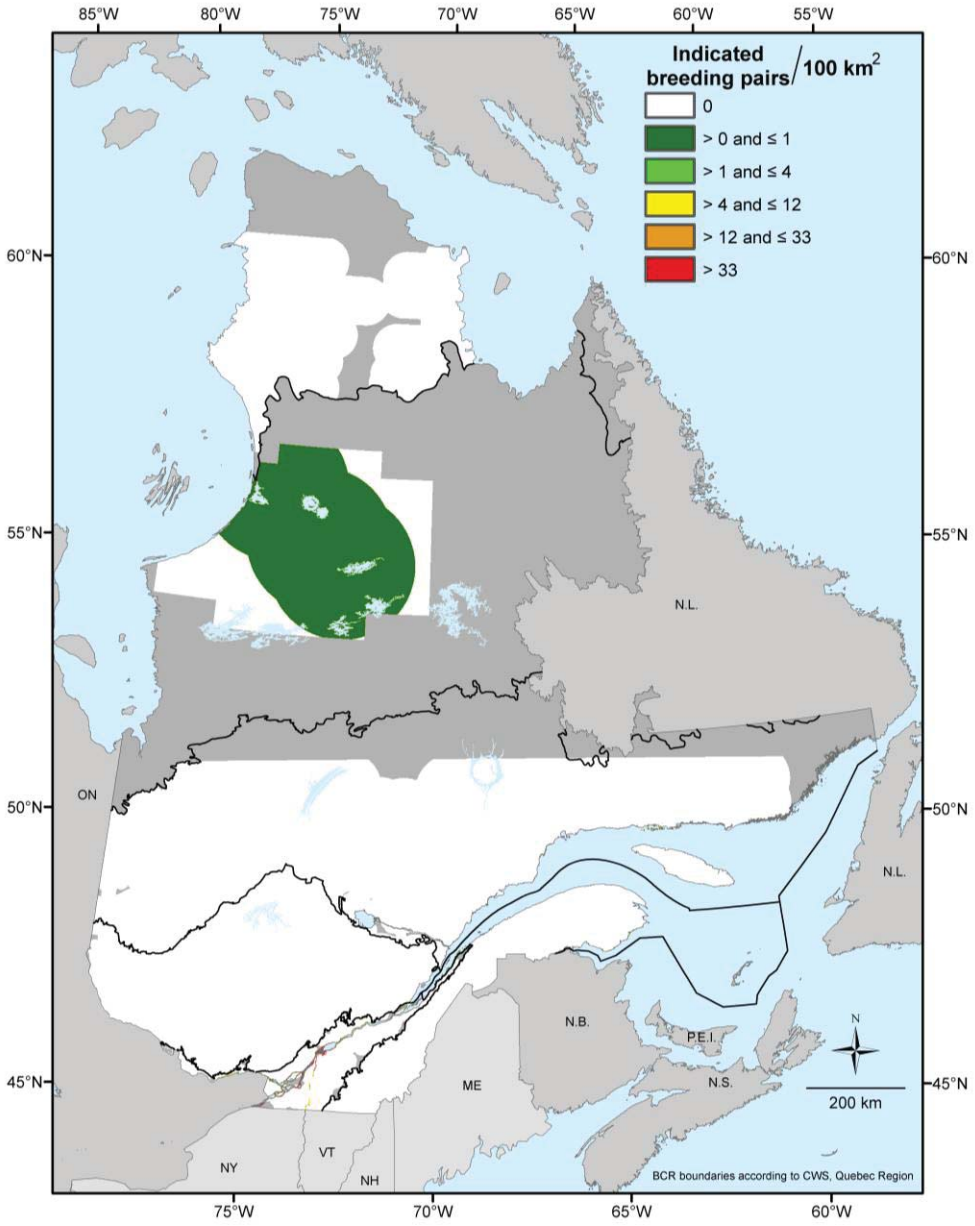


Figure 23. Breeding distribution of the Gadwall in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration and wintering

During migration, Gadwalls frequent roughly the same regions that they do during the breeding season, with the greatest concentrations occurring from Lake Saint-François to Lake Saint-Pierre (BCR 13) and along the Ottawa (BCR 13) and Richelieu (BCR 13 and 14) rivers (Cyr 1995h). Flocks of over 100 individuals are frequently seen in spring and fall around Baie-du-Febvre (BCR 13) (ÉPOQ).

Birds occasionally overwinter in the Eastern Townships (BCR 14) and the Lachine Rapids (BCR 13) (Giroux and Rail 1996; David 1996; Bannon 2008). Recent cases of overwintering in the Lachine Rapids involved 64 individuals in 2001–2002 (Bannon et al. 2002c), over 75 in 2002–2003 (ÉPOQ) and 23 in 2005–2006 (Bannon et al. 2006c).

The area around the Lachine Rapids hosts transient individuals almost every winter (ÉPOQ). According to ÉPOQ records, the species also occurs irregularly in winter in other areas, particularly the Outaouais (BCR 13), Montréal (BCR 13), Montérégie (BCR 13) and Québec City (BCR 13) regions.

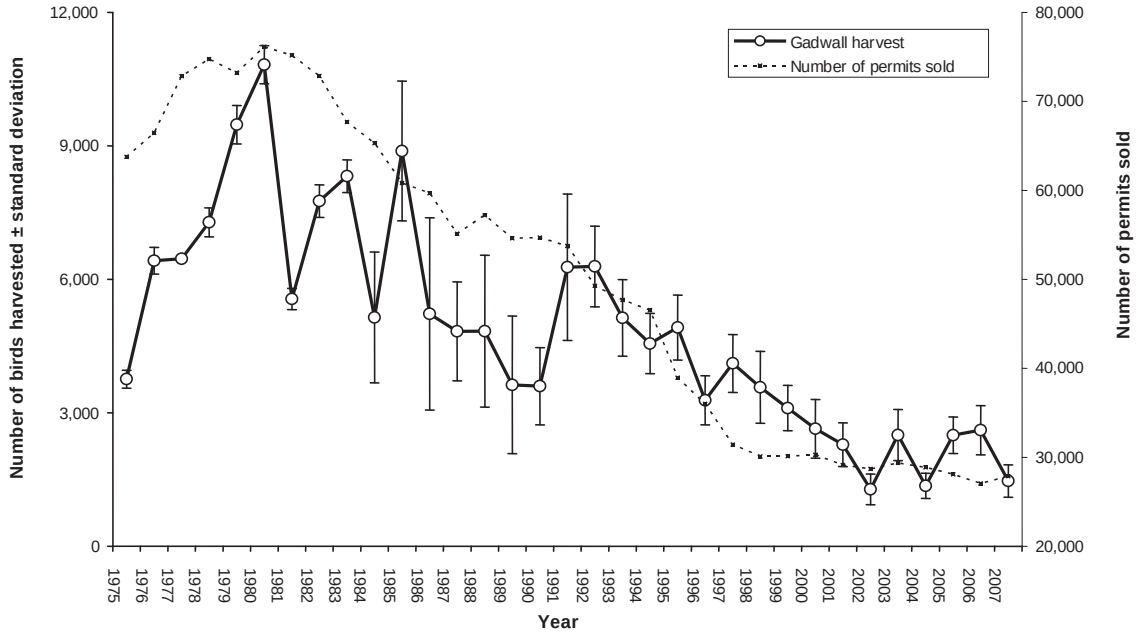
Conservation

According to the most recent update of NAWMP, the North American breeding population of Gadwalls is roughly 3.9 million individuals (Table 2), 3 million of which are found in the Canadian Prairies and U.S. Great Plains. Numbers in North America are thought to be increasing over the long term (Canadian Wildlife Service Waterfowl Committee 2007; U.S. Fish and Wildlife Service 2008; North American Waterfowl Management Plan 2004). A positive trend was also found in Quebec in the 1990s (Cyr 1995h). On the Varennes Islands, Gadwalls represented 37% of the nests found in 2007 compared with 32% in 1994 (Giroux 2007). WSHO surveys have not been carried out long enough to provide reliable estimates of long-term population trends in the St. Lawrence as a whole.

During the 20th century, the Gadwall's range expanded more than that of any other duck in North America. The first breeding record in the eastern part of the continent dates back to 1939 (LeSchack et al. 1997) and, in Quebec, to 1968 (Reed 1969). Since then, this duck, which was originally a denizen of the Prairies, has expanded its range gradually eastward and is now well established in the East. It was not considered a regular local breeder in Quebec until the mid-1970s (Cantin et al. 1976; LeSchack et al. 1997). The species is unlikely to continue its eastward expansion in the province, however, since its preferred breeding habitat—small islands with tall, dense meadows—is rare east of Québec City.

Gadwalls have high rates of breeding success, perhaps one of the highest among the dabbling ducks (Giroux et al. 1995). In addition, with an average harvest of 2,100 individuals in the province in 2003–2007, the Gadwall represents less than 1% of the total waterfowl harvest in Quebec (Table 3; Figure 24). It should be noted that 68% of Gadwalls were shot in the section from Lake Saint-Louis to Lake Saint-Pierre (Lehoux et al. 2003). The estimated harvest seems incorrect when compared with estimates of the Quebec population and migration records. As mentioned earlier, the Quebec population is very likely underestimated. Along the Atlantic Flyway, U.S. hunters bagged 41,400 birds a year on average in 2000–2007, which represents 2.5% of the total duck harvest (Padding and Klimstra 2008). The Atlantic Flyway has the smallest Gadwall harvest of all four North American flyways; indeed, in terms of the total U.S. harvest, the Gadwall ranks third behind only Mallard and Green-winged Teal (LeSchack et al. 1997). It can therefore be concluded that hunting does not pose a problem for the conservation of the species in eastern North America.

Figure 24. Estimated Gadwall sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Other potential conservation issues affecting the Gadwall in Quebec include water levels (spring flooding) and predators (raccoons, skunks, etc.), which may affect breeding success even though the species nests late in the season, mainly on islands. Several of its nesting islands—particularly those in the Îles de Contrecœur NWA—are located near the mainland and, when water levels in spring are low, could be accessed by terrestrial predators. Consequently, predation is probably the main limiting factor on the breeding population in the section between Montréal and the Berthier-Sorel Islands, particularly when water levels are low (D. Lehoux, CWS, pers. comm.). Lastly, since the Gadwall is highly selective about habitat and may nest in high densities in suitable habitat, changes to vegetation cover used by the species on its nesting islands or increased human disturbance could affect breeding in Quebec. There do not appear to be any major concerns involving the species on its wintering grounds (LeSchack et al. 1997).

Although most Gadwalls (75%) breed on the Prairies, with Quebec only hosting 1% of the continental breeding population (Table 2), the province can still play a role in the conservation of the species in North America. Owing to the importance of the stretch of the St. Lawrence from the Boucherville Islands to Lake Saint-Pierre to the species' reproduction, habitat quality should be monitored in this sector to ensure the long-term sustainability of the species in the province.

4.3.3 Eurasian Wigeon *Anas penelope* (Mr) (by Pierre Brousseau)

Originally from Eurasia, the Eurasian Wigeon is regularly sighted along the Pacific and Atlantic coasts of North America (Barrette and Robert 1996). Despite an increasing

number of observations, no breeding records for the species have been obtained yet in Canada. This is probably due to the fact that the hen's plumage is similar to that of the female American Wigeon, and the only way to distinguish the females of the two species is to examine their underwing pattern, which requires having them in the hand.

Migration

Although the first records of Eurasian Wigeons in Quebec date back to the early 1960s, sightings did not occur with any frequency (more than 10 records a year) until the early 1980s (ÉPOQ). Since 1994, the number of sightings has increased markedly, to 32 in 1997. Most records involve one or two individuals only. Although the species is observed between March and December, nearly 70% of sightings come from April or May (ÉPOQ). The majority of sightings occur in southwestern Quebec and the Québec City (BCR 13), Saguenay–Lac-Saint-Jean (BCR 8) and Bas-Saint-Laurent (BCR 14) regions, with a few from the Abitibi region (BCR 8 and 12) and the Magdalen Islands (BCR 14). In fall, most sightings occur in October, primarily in the Montréal (BCR 13) and Outaouais (BCR 13) regions. Since Eurasian Wigeons have been observed annually in Quebec since 1972 (ÉPOQ), they are considered regular migrants in the province.

Conservation

According to the results of the Species Composition Survey, a very small number of birds are harvested annually in almost all Canadian provinces (Gendron and Collins 2007). An examination of the wings received from harvested birds in the Wingbee shows that 80% are immature birds. This suggests that the Eurasian Wigeon could be a rare, but regular, breeder in North America and perhaps in Quebec as well.

4.3.4 American Wigeon *Anas americana* (Mr, Br, We) (by Christine Lepage)

The American Wigeon has a mainly North American distribution, which dips into Central America in winter. It breeds in Yukon and the western and southern portions of the Northwest Territories, in all the provinces from British Columbia east to the Maritimes (including western and southern Quebec), and in the United States from Alaska and the Pacific Northwest to northern Utah and New Mexico, as far east as northern Minnesota (American Ornithologists' Union 1998; Mowbray 1999; Boyd 2005a; Gendron 2007). In winter, the greatest concentrations are found along the Pacific Coast (from southern Alaska to Baja California), Atlantic Coast (from Nova Scotia to Florida) and Gulf of Mexico, particularly Louisiana (American Ornithologists' Union 1998; Mowbray 1999; Boyd 2005a). This species is mainly associated with the Canadian Prairies and U.S. Great Plains, with breeding numbers gradually decreasing eastward.

Breeding

In Quebec, the American Wigeon breeds mainly in agricultural habitats or habitats with a mixture of farmland and woodlots, occurring in the greatest numbers in the St. Lawrence Valley (BCR 13), Abitibi Plains (BCR 8) and in Lac Saint-Jean region (BCR 8). The highest breeding densities have been found in the Abitibi-Témiscamingue region (BCR 8) around Rouyn-Noranda (11–17 IBP/100 km^2 in 1990–2003 [WUPL]; 6–18 IBP/100 km^2 in 1998–2007 [WLOW]) and in the fluvial section of the St. Lawrence (BCR 13; 16.5 IBP/100 km^2 on average in 2004–2007; WSHO). According to WSHO data for 2004–2007 (Figure 25), the fluvial section has about 401 IBP, which is roughly the same order of magnitude as the 450 pairs, nests or broods reported previously in

the region (Lehoux et al. 1996; Titman and Barrette 1996a), but half the number of the 900 IBP estimated from on-the-ground surveys in 1990–1992 (Bordage and Lepage 2002). Roughly 43% of Quebec's American Wigeon population breeds in the fluvial section of the St. Lawrence between Lake Saint-Louis and Lake Saint-Pierre (Lehoux et al. 2003).

Although the species is a confirmed breeder in the Lac Saint-Jean region (BCR 8) (Cyr 1995j; Titman and Barrette 1996a) and it might be expected to frequent the agricultural portions of the region, recent CWS surveys along the shorelines and in the lowlands of the region during breeding season found breeding pairs along shoreline areas only (Figure 26) (WSHO and WLOW). Farther east, densities dropped off rapidly further downstream along the St. Lawrence, with only 2.5 and 2.1 IBP/100 km^2 in the estuary and Gulf respectively (2004–2007; Figure 25) (WSHO). In eastern Quebec, pairs were observed as far east as the Mingan Archipelago National Park Reserve (BCR 8) on the North Shore, as well as in Gaspé Bay and Chaleur Bay (BCR 14) (WSHO). In 2005, what appears to be the first probable breeding record for the species on Anticosti Island (BCR 8) was obtained at Pointe de la Croix (WSHO; CWS, unpubl. data). The American Wigeon also nests on the Magdalen Islands (BCR 14) (Fradette 1992).

Figure 25. Mean number of indicated breeding pairs of American Wigeons along the shoreline of the St. Lawrence and its main tributaries, 2004–2007 (WSHO data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)

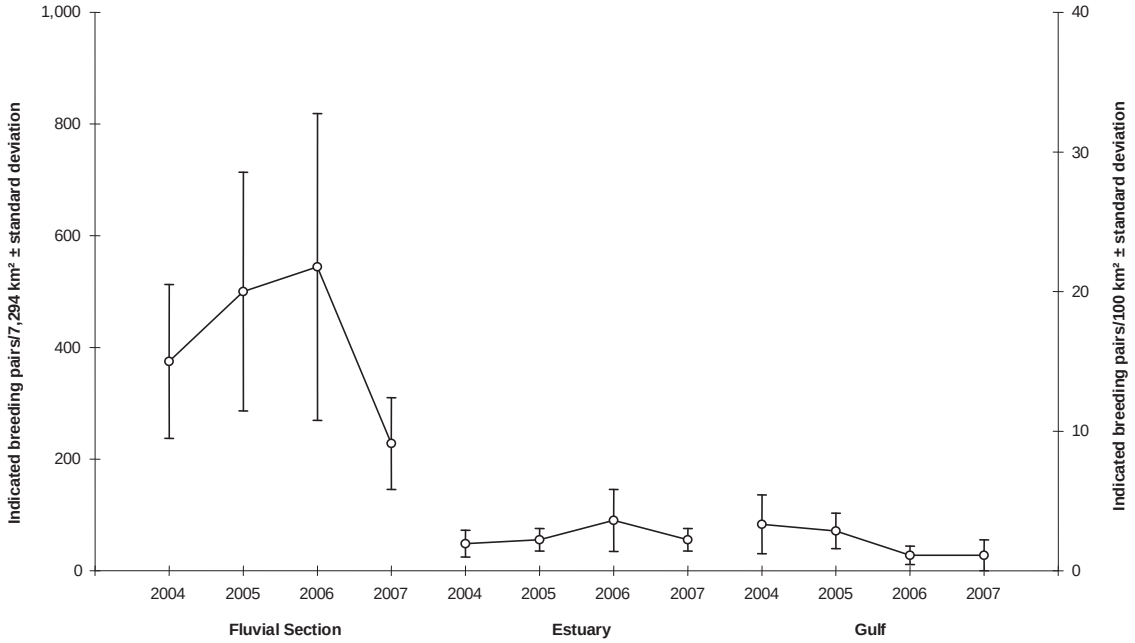
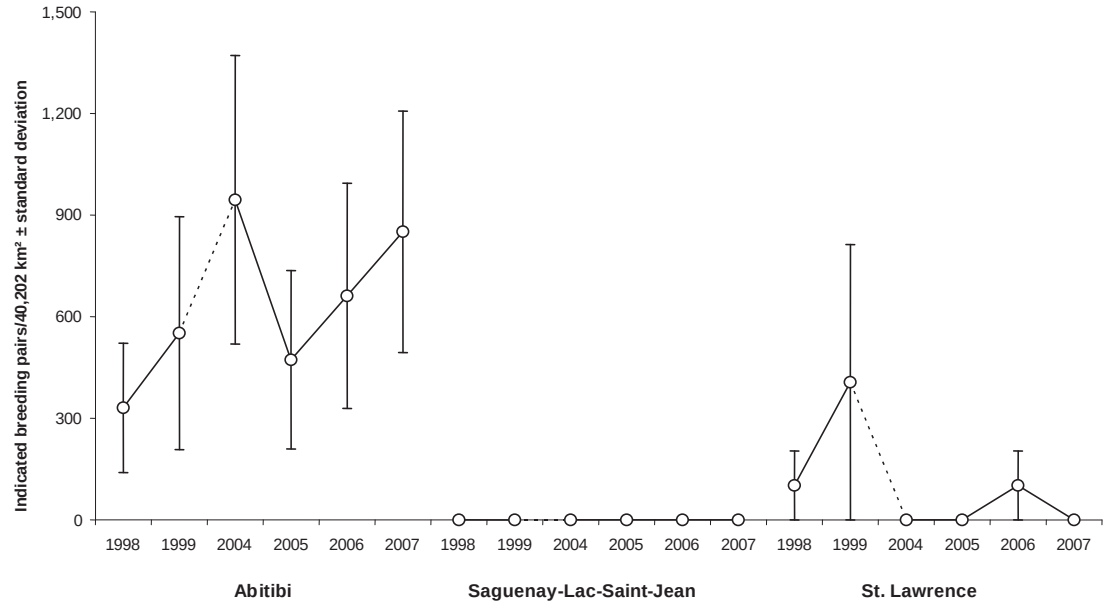


Figure 26. Mean number of indicated breeding pairs of American Wigeons (± standard deviation) in lowlands, in 1998, 1999 and 2004–2007 (WLOW data)

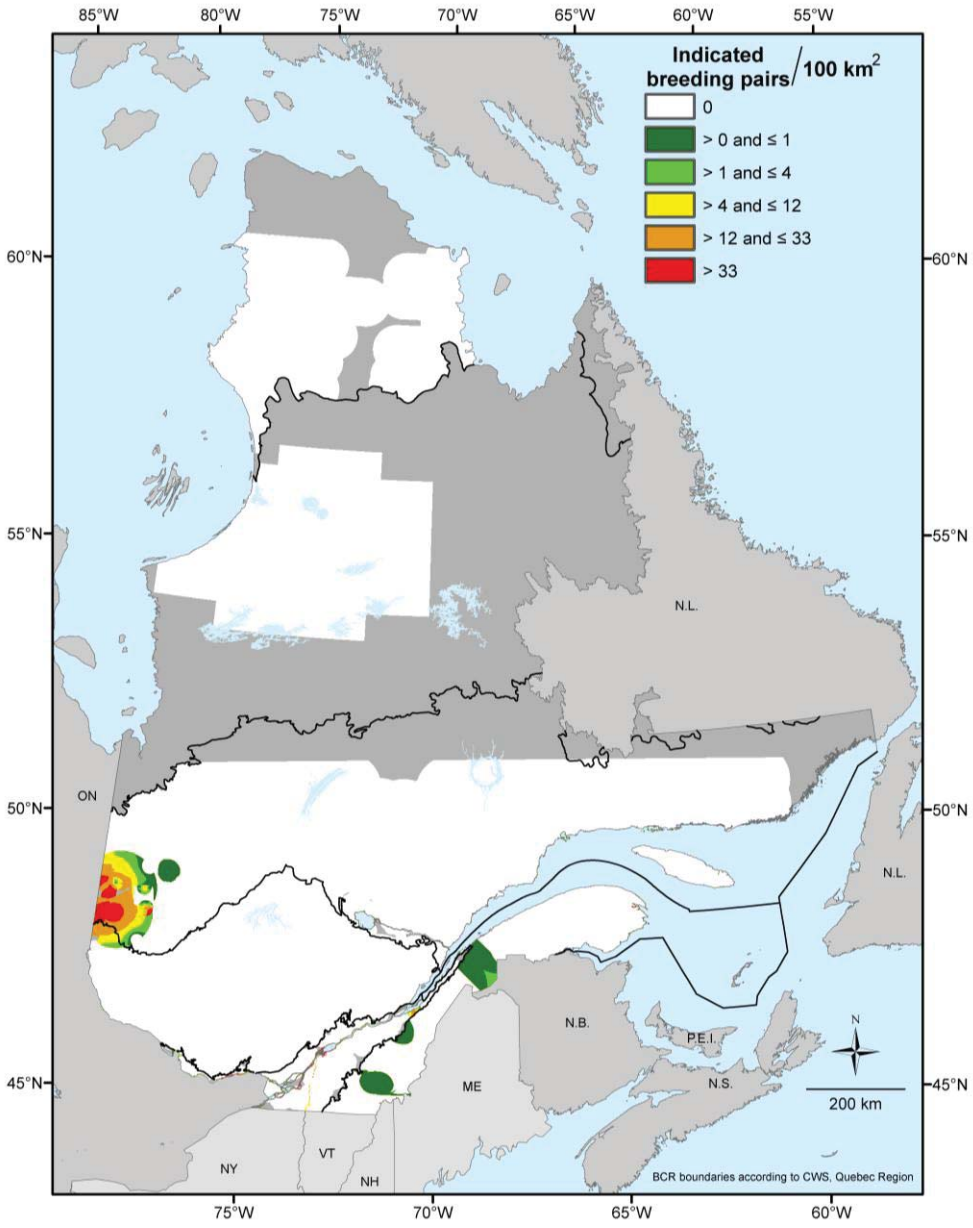


In the northern half of the province, 5 broods were found on the Rupert River in 2005, along with 5 on the Eastmain and 10 on the Opinaca (BCR 7) (Tecsult Inc. 2006). The northern limit of the species' breeding range is probably even farther north, between Rivière au Castor and Pointe Louis-XIV on James Bay, south of the 55th parallel

(BCR 7) (Benoit et al. 1994; 1995; Reed et al. 1996; CWS, unpubl. data). Lastly, individuals have also been observed around Inukjuak (BCR 3) and Kuujjuaq (BCR 7) in June, and a breeding pair was even sighted in June 2006 as far north as Puvirnituq Lake (BCR 3) (ÉPOQ).

Figure 27 shows the distribution of American Wigeon in Quebec by indicated breeding pair density, according to the survey and inventory data analyzed (see Chapter 3). It is difficult to discern the species' distribution in southern Quebec on the map; however, the American Wigeon was spotted in a number of locations along the St. Lawrence shoreline, mainly west of Lake Saint-Pierre where densities greater than 33 IBP/100 km^2 were observed.

Figure 27. Breeding distribution of the American Wigeon in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

During migration, American Wigeons frequent the same regions that they use during the breeding season, but tend to concentrate along the St. Lawrence, particularly the fluvial section (BCR 13) (Cyr 1995j; Lehoux et al. 1996; Titman and Barrette 1996a). Large concentrations of staging birds have been found in Plaisance, Saint-Louis-de-Gonzague, Saint-Étienne-de-Beauharnois, Sainte-Catherine and Baie-du-Febvre (ÉPOQ).

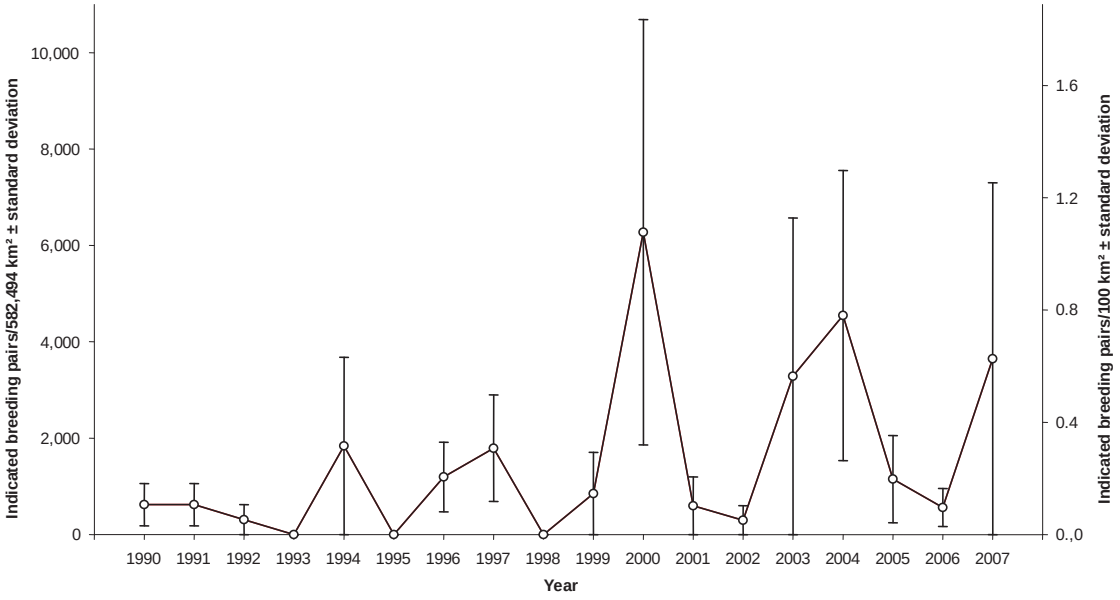
Wintering

The American Wigeon regularly occurs in winter around the Lachine Rapids (between LaSalle and Sainte-Catherine; BCR 13), although not every year; in 2001–2002, 94 individuals successfully overwintered in this location (Bannon et al. 2002c). In 2005–2006, another record of successful overwintering—this time involving a single individual—occurred in the Québec City region (BCR 13) (Bannon et al. 2006c). In addition, a few winter records have been obtained in scattered locations in the southern and eastern portions of the province (ÉPOQ). It should be noted that American Wigeons prefer to overwinter in freshwater marshes, which are generally frozen in winter in Quebec.

Conservation

The North American population of the species has been estimated at 3.1 million birds (Table 2). Medium- and long-term trends in breeding populations in the Prairies show an overall decline (Canadian Wildlife Service Waterfowl Committee 2007; U.S. Fish and Wildlife Service 2008). No significant trends were found in Quebec (1990–2003) in the WUPL study area (Figure 28), but this is outside the species' core breeding grounds in the province. Currently, WSHO and WLOW do not provide enough years of data for population trends to be analyzed. However, ÉPOQ data from 1970 to 1989 shows a decline in the province (Cyr 1995j; ÉPOQ).

Figure 28. Trends in the American Wigeon breeding population in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)

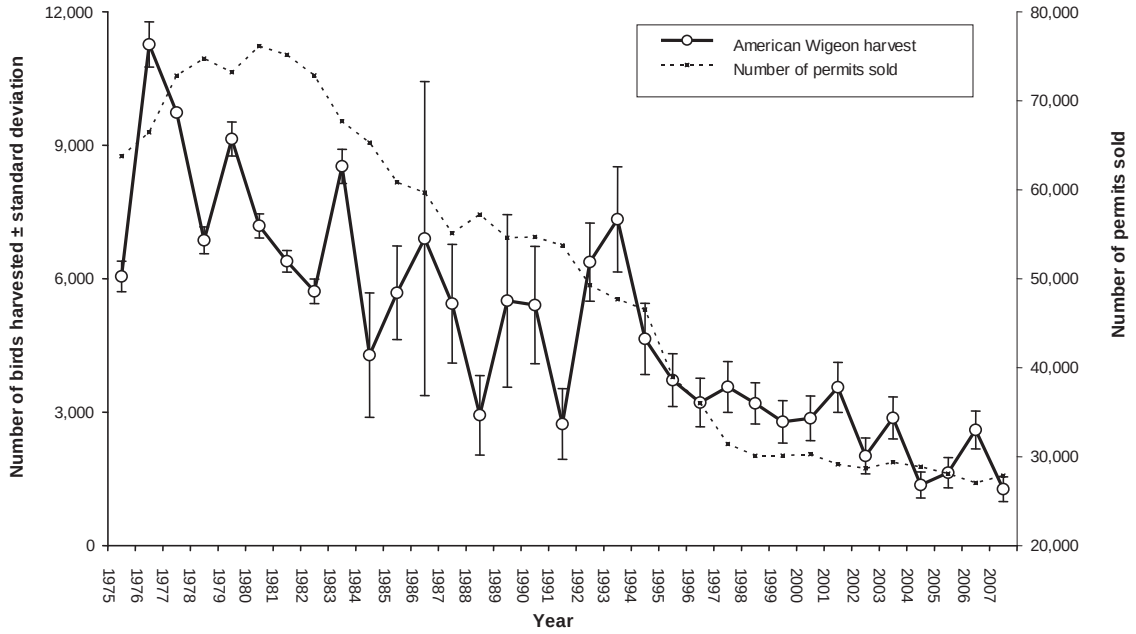


A native of the central and western parts of the continent, the American Wigeon was not recognized as a Quebec breeder until 1950, when the first breeding record was obtained on the coast of James Bay; breeding in the Montréal region was not confirmed until 1965 (Titman and Barrette 1996a). The species expanded its breeding range eastward in the province in the 1970s and 1980s (Cyr 1995j), but has not gained additional ground since then, according to an analysis of ÉPOQ data from the 1990s

and the first decade of the 21st century. Water levels in Prairie wetlands appear to be key for breeding populations in western and central North America (Mowbray 1999), and this factor probably also plays a role to some degree in the fluvial section of the St. Lawrence (Lehoux et al. 2003). The American Wigeon does not depend on this portion of the river for breeding as much as the Gadwall, however, and conditions in aquatic habitats in the rest of the province generally fluctuate much less than they do in the St. Lawrence and therefore do not seem to be a limiting factor in the case of the American Wigeon.

Average annual harvests of the species in the Atlantic Flyway were around 33,800 individuals in 2000–2007, or 2% of the total waterfowl harvest in this corridor (Padding and Klimstra 2008). In Eastern Canada, 11,800 birds were bagged on average annually in 2000–2007, slightly over half in Ontario (Gendron and Collins 2007). Quebec statistics show an annual harvest of close to 2,000 American Wigeons in 2003–2007 (Table 3; Figure 29), with roughly 63% taken in the stretch of the St. Lawrence between Lake Saint-Louis and Lake Saint-Pierre (Lehoux et al. 2003). South of the border, disturbance from hunting is so great that the birds feed mainly at night and take refuge during the day on large bodies of water (Mowbray 1999). In the United States, habitat loss and degradation in stopover sites and wintering areas appears to be a significant problem for the species (Mowbray 1999).

Figure 29. Estimated American Wigeon sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



The American Wigeon, whose numbers are declining in its core breeding range in the Prairies, appears to be able to adapt well to the landscape conditions found in Quebec. Although its distribution in southern Quebec is fairly well delineated, additional work needs to be done on better defining its breeding range north of the WUPL study area in order to obtain an overview of Quebec's contribution to the conservation of the species

on a continental scale. Currently, Quebec's contribution is rather low, with less than 1% of the North American population breeding in the province (Table 2).

4.3.5 American Black Duck *Anas rubripes* (Mr, Br, Wr) (by Daniel Bordage)

The American Black Duck is strictly a North American species. Slightly over half of the world population probably breeds in Quebec (51% according to the estimate of the Quebec population—around 458,000 individuals—used to determine the North American population in 2004 for NAWMP; North American Waterfowl Management Plan 2004). The remainder of the population breeds mainly in Ontario (18%), the Atlantic provinces (22%: Nova Scotia 9%; New Brunswick 8%; Newfoundland and Labrador 4%; Prince Edward Island 1%), Manitoba (5%) and the northeastern United States (4%) (BDJV, unpubl. data). The species' breeding range extends from the Rivière aux Feuilles in Quebec in the north to the Atlantic shore of North Carolina in the south and from the eastern border of Manitoba in the west to the far eastern side (St. John's) of Newfoundland and Labrador in the east. The species winters from the St. Lawrence estuary and eastern Lake Superior in the north to central Florida in the south, and west to Nebraska along the Missouri River. Most of the overwintering population is concentrated in New Jersey and other states along the Eastern Seaboard from Maine to North Carolina (Serie and Raftovich 2005).

Breeding

The American Black Duck is the second most abundant anatid in Quebec (558,000 individuals; Table 2; or a total of 265,600 IBP), surpassed only by the Canada Goose (721,000 individuals in three populations combined; Table 2). In the province, over half of breeding American Black Ducks occur in BCR 8 and 12, with 93,800 and 57,800 IBP respectively (Lepage et al., in prep.). Respectable numbers are also found in the other BCRs in the province: 27,700 IBP in BCR 3, 42,900 IBP in BCR 7, 10,400 IBP in BCR 13 and 14,000 IBP in BCR 14 (Lepage et al., in prep.).

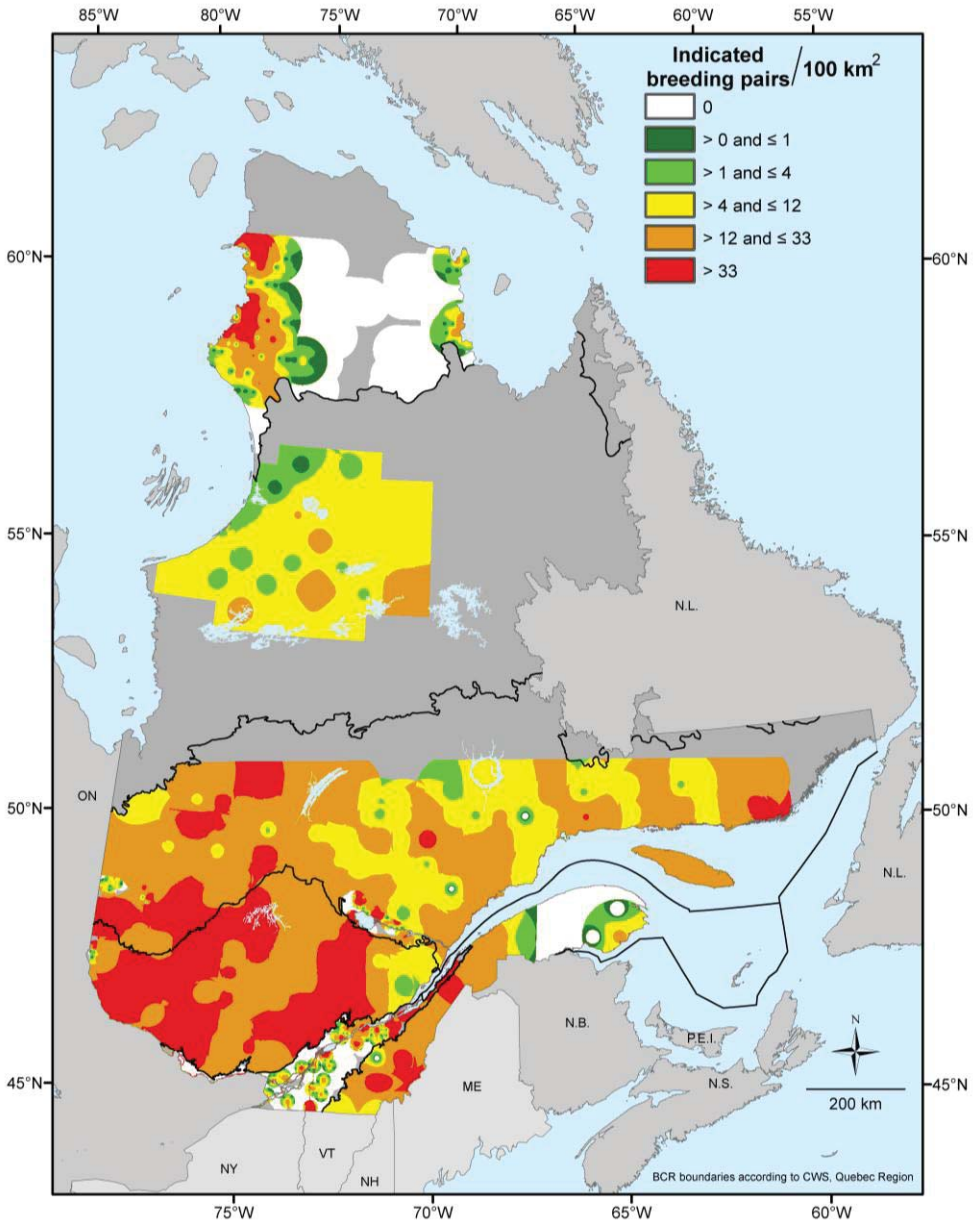
The American Black Duck frequents many different types of habitats, in both freshwater and salt water environments: peatlands, swamps, marshes, farm fields, beaver ponds, streams, rivers and lakes of all sizes. It does, however, prefer certain habitats. In forest environments in Quebec, 42% of Black Duck breeding pairs were observed on small lakes less than 10 ha in size (including beaver ponds) and 23% on streams (Bordage 1987). In lowland areas, the highest densities were found on intensively farmed land dominated by dairy production (forage crops, pastureland) (mean: 49 IBP/100 km²) and forested landscapes (mean: 39 IBP/100 km²) (Maisonneuve et al. 2006). In the L'Isle-Verte area, not only were the highest nest densities observed in bogs (22.5 nests/100 ha), but breeding success was also highest in these habitats (47%) (Bélanger et al. 1994). Here, brood rearing occurs in intertidal *Spartina* marshes, particularly in the Kamouraska region, which has the best brood-rearing habitat in the entire St. Lawrence Valley (Gauthier et al. 1980).

During the breeding season, the highest Black Duck breeding densities are found along the shoreline of the estuary and Gulf of St. Lawrence (~100 IBP/100 km²), particularly on the south shore of the estuary (~145 IBP/100 km²) (BCR 13 and 14; 2004–2007) (WSHO). In forest environments and lowland areas of southern Quebec, mean breeding densities are roughly 22–26 IBP/100 km², with the highest densities occurring in forested habitats in the Outaouais and Mauricie (BCR 12) regions, and the Abitibi-

Témiscamingue lowlands (BCR 8 and 12) (~26 IBP/100 km²) (WUPL and WLOW). Densities decline northward, with a mean density of roughly 8 IBP/100 km² in the Taiga Shield and Hudson Plains BCR (BCR 7) (CWS, unpubl. data). However, there are several enclaves in the North with very high breeding densities, including the Rupert diversion bay sector (BCR 7), where the estimated density was 52 IBP/100 km² in 2002 (Tecsult Environnement Inc. 2004). In the Eastmain, Opinaca and Petite Opinaca river region (BCR 7), estimated breeding density in 2005 was 1.25–2.25 IBP/10 km of shoreline (Tecsult Inc. 2006). Although, as stated earlier, the Rivière aux Feuilles is recognized as roughly the northern boundary of the species' breeding range, there are a few records farther north in BCR 3. For example, a single individual was observed on June 13, 2004, on the Sorehead River (60° 33' N, 77° 30' W), the northernmost record during the breeding season (ÉPOQ). In addition, a brood of five ducklings was seen on August 10, 2002, near the Polemond River (59° 33' N, 77° 45' W) (R. Cotter, CWS, unpubl. data). Several indicated breeding pairs are observed every year in the WNOR study area. The eastern limit of the species' range is currently thought to be Brador, on the Lower North Shore, where broods have been observed (ÉPOQ).

Figure 30 shows the distribution of American Black Ducks in Quebec by indicated breeding pair density, according to various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 30. Breeding distribution of the American Black Duck in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

In spring, although Black Ducks are very abundant everywhere in the province, a few sites host particularly large concentrations: Cap Tourmente NWA (up to 10,000 individuals) and Baie-du-Febvre (up to 3,000 individuals) in BCR 13 and Les Bergeronnes (up to 3,000 individuals) in BCR 8 (ÉPOQ). The shoreline of Rupert Bay (BCR 7) and the Boyd Lake and Opinaca Reservoir sector (BCR 7) are also favourite stopover areas during spring migration (Tecsult Environnement Inc. 2004; Tecsult Inc. 2006). In fall, some sites are frequented by thousands of individuals: Rimouski in BCR 14 (up to 3,000 individuals), Boischatel in BCR 13 (up to 4,000 individuals) and

the north shore of the estuary from Baie-Sainte-Catherine to Les Bergeronnes (up to 7,000 individuals locally) (ÉPOQ).

Moulting

There is very little information on the moult in the American Black Duck. Groups of adults without broods were seen in July 2002 in the Boyd Lake, Sakami Lake and Opinaca Reservoir sectors (3–4 individuals/10 km of shoreline; BCR 7), as well as in Rupert Bay (nearly 13 individuals/10 km of shoreline; BCR 7) (Tecsult Environnement Inc. 2004). These relatively high densities obtained after the breeding season suggest that these large bodies of water may be moulting areas. Birds probably also moult along the northeast coast of James Bay in the area between Rivière au Castor and Pointe Louis-XIV (BCR 7), where estimated densities of 300 and 430 individuals/100 km² were obtained in August 1993 and 1994 respectively (Benoit et al. 1994; 1995). Farther north in Hudson Bay, Manitounuk Sound (BCR 7) may serve as a moulting area for the species since birds remain there for some time (from early summer to early fall) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990b). The observation of 2,500 individuals around Qikirtajuaq Island in Ungava Bay in July 2006 very likely involves moulting birds (ÉPOQ). Lastly, the estuary and Gulf of St. Lawrence are also used as moulting areas by the species although the number of individuals involved and all the specific moulting areas used are not known. Roughly 900 individuals have been seen around La Petite Romaine Island (BCR 8), over 100 at the mouth of Rivière aux Canards (BCR 8), and close to 200 at Grand-Métis (BCR 14) (J.-P.L. Savard, S & T, pers. comm.).

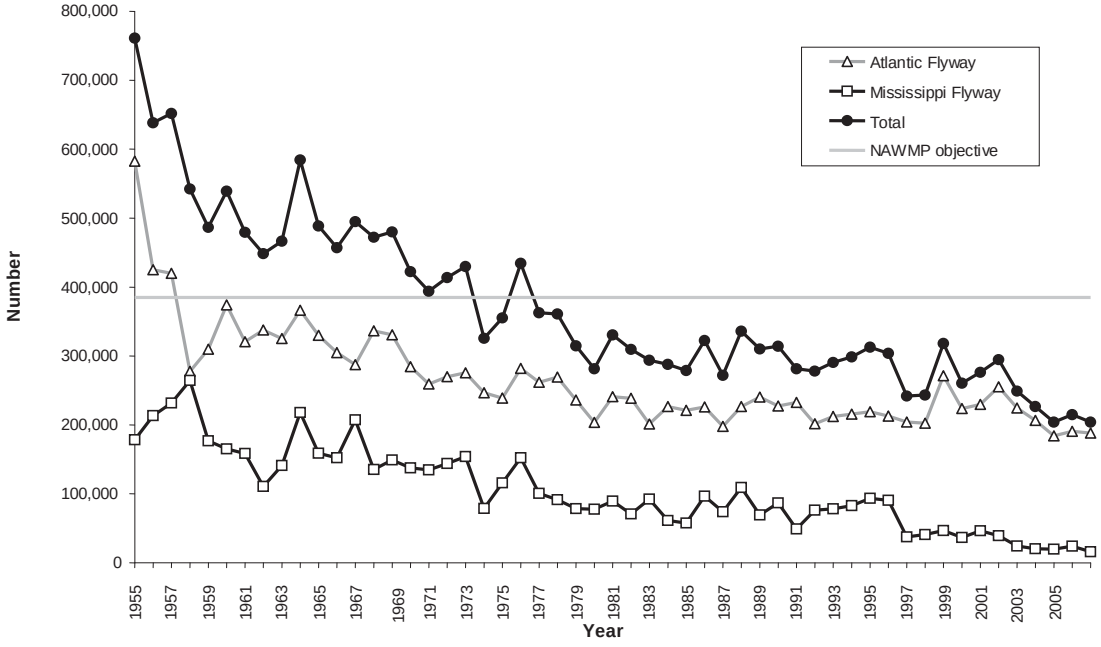
Wintering

According to winter surveys carried out in the upper and lower estuary in 1999 and 2002, Black Ducks frequent mainly the following sections of the estuary in winter: Pointe-au-Pic to Port-au-Saumon (roughly 500 individuals; BCR 12); Saint-Siméon to Chafaud aux Basques Cove (close to 300 individuals; BCR 8); Alouettes flats (800–900 individuals; BCR 8); Tadoussac to Bon Désir Cape (roughly 2,600–3,000 individuals, including a regular group of about 2,000 individuals at Les Bergeronnes; BCR 8) (ÉPOQ and CBC); the area around the Bic and Bicquette islands (roughly 375 individuals; BCR 14); and lastly, Pointe-Lebel to Baie-Comeau (650 individuals; BCR 8) (Robert et al. 2003). During a one-day aerial survey in January 2005, observers estimated 5,452 individuals along the north shore of the upper and lower estuary (BAGOS). In the St. Lawrence estuary as a whole, the number of American Black Ducks in winter increased from 2,600 in 1973 to 3,900 in 1980 (Canadian Wildlife Service and Ministère du Loisir de la Chasse et de la Pêche 1986), with current numbers consisting of around 5,500 birds (CWS, unpubl. data). Farther west, between 400 and 1,000 individuals overwinter every year in the Montréal region (Bannon 2008). The areas around Sainte-Catherine (Montérégie) and Île des Sœurs (Nuns' Island) (Montréal) in BCR 13 may have from several hundred individuals to up to 1,000 and 750 individuals respectively (ÉPOQ).

Conservation

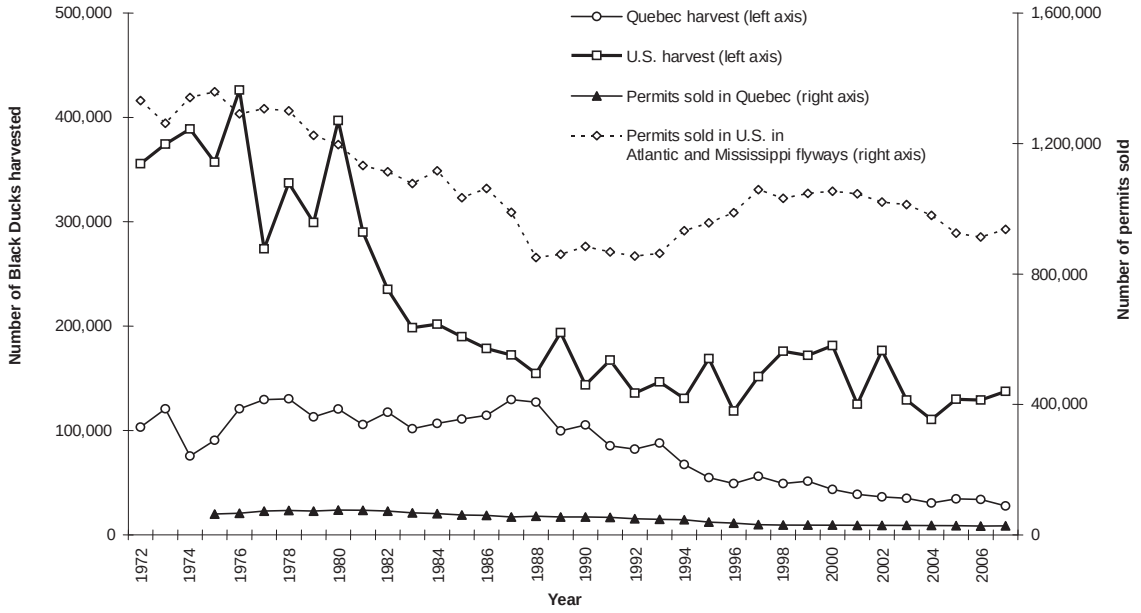
In the second half of the 20th century, American Black Duck numbers plunged to alarmingly low levels according to winter surveys by the USFWS in the U.S. portions of the Atlantic and Mississippi flyways (760,900 individuals in 1955 versus 281,500 individuals in 1980) (Figure 31).

Figure 31. Number of American Black Ducks observed in winter in the United States in the Atlantic and Mississippi flyways, 1955–2007 (taken from Serie and Raftovich 2005). The NAWMP population objective shown is the 1984 number (385,000 individuals on the wintering grounds).



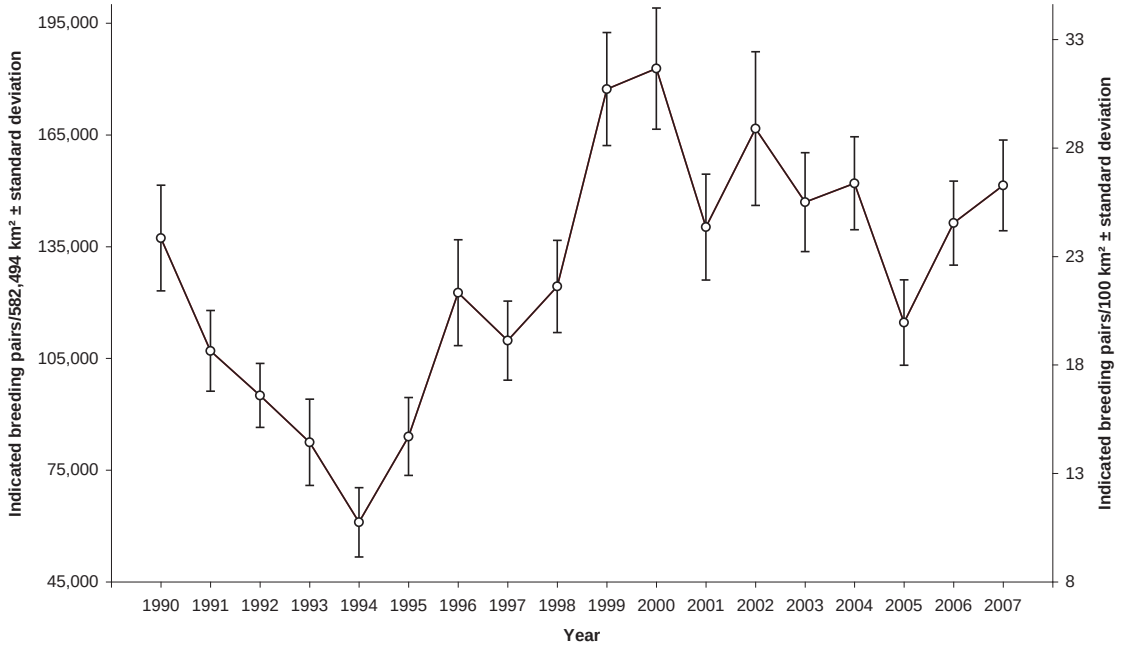
A number of possible causes for this decline have been suggested, particularly habitat loss (on the breeding and wintering grounds), competition with the Mallard, and sport hunting. Owing to this alarming decline, daily bag limits for the species were reduced beginning in 1983 in the U.S. and in 1984 in Canada. To more accurately assess the impact of this measure on American Black Duck populations, experimental surveys were carried out from 1985 to 1989 to monitor the species on its breeding grounds in Quebec, Ontario and the Atlantic provinces. In the 100,000-km² study area in the Gouin Reservoir region west of Lac Saint-Jean, numbers of indicated breeding pairs of the American Black Duck increased significantly ($P < 0.01$), by 8.7% annually, between 1985 and 1989 (Bordage and Plante 1997). This increase was encouraging given the restrictions imposed on hunters; however, during the same period, winter surveys showed that numbers had stabilized at best (Figure 31). A more detailed analysis shows that the reduction in the daily bag limit resulted in a decline in the total harvest in the U.S. from 1985 to 1989, while results were not as evident in Quebec (Figure 32).

Figure 32. Estimated American Black Duck sport harvest in Quebec and the United States and number of Migratory Game Bird Hunting Permits sold in both jurisdictions (Atlantic and Mississippi flyways), 1972–2007 (taken from Padding and Klimstra 2008)



In 1986, the North American Waterfowl Management Plan (NAWMP) was launched (North American Waterfowl Management Plan 1986). Under NAWMP, the American Black Duck was identified as a species of concern, prompting the creation in 1989 of two joint ventures with a direct impact on the management of the species in Quebec: the Black Duck Joint Venture (BDJV) and the Eastern Habitat Joint Venture (EHJV). The BDJV was created to develop a conservation strategy for the species, to achieve the population objective of 385,000 individuals in the Atlantic and Mississippi flyways in winter (North American Waterfowl Management Plan 1994). One of the BDJV's first initiatives was the establishment in 1990 of a program to monitor Black Duck populations in their core breeding range (now called WUPL), which was modeled on a pilot monitoring program in 1985–1989. The WUPL in Quebec, which is carried out mainly in the boreal forest, shows an overall increase in the breeding population (Figure 33; significant mean increase [$P < 0.05$] of 4.8% annually for 1990–2003) (CWS, unpubl. data), despite the decrease in 1990–1994. Regionally, significant increases were observed in BCR 12 (3.1% annually) and BCR 8 (2.9% annually) during the 1990–2007 period (Lepage et al., in prep.).

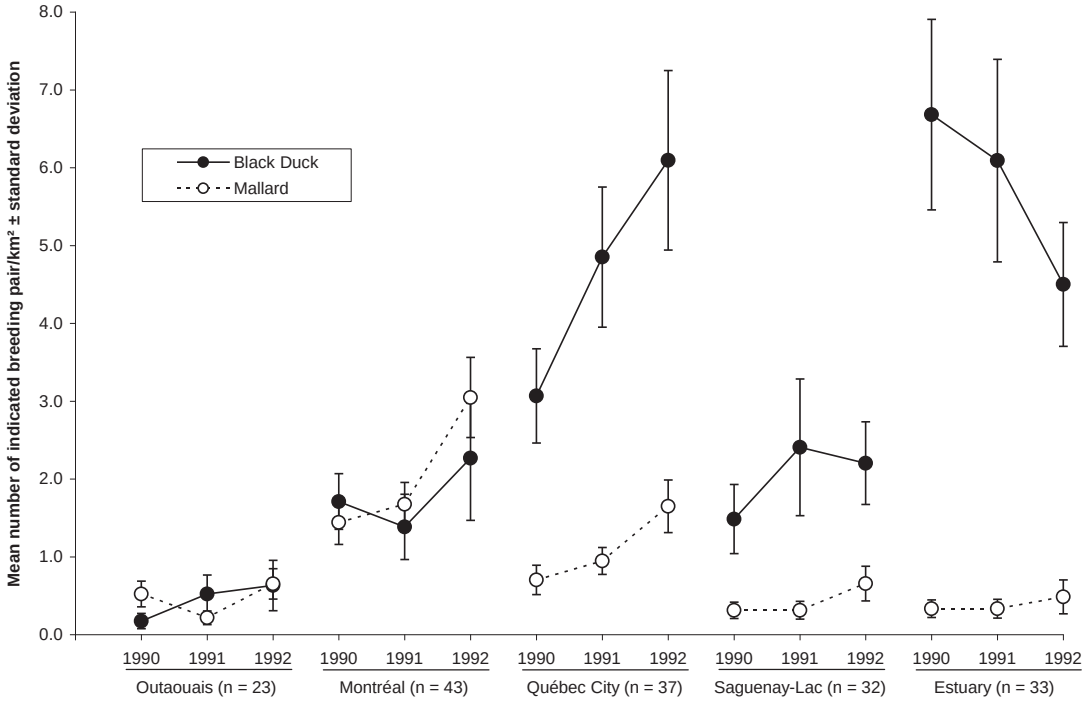
Figure 33. Trends in the American Black Duck breeding population in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



Due to these measures, the new NAWMP population objective of 640,000 individuals in the breeding areas surveyed is on its way to being achieved (North American Waterfowl Management Plan 2004). This objective was based on the predictions of a model that takes account of winter population estimates and recent breeding season estimates (since 1990) in eastern Canada (WUPL in Quebec). Despite a significant increase in breeding populations in Quebec and Canada (3.4% annually in Canada in 1991–2003) (CWS, unpubl. data), the average size of breeding populations in 1994–2003 was 533,000 individuals (North American Waterfowl Management Plan 2004), well below the objective. In addition, long-term trends (1970–2003) in winter populations (204,071 individuals in 2007; Figure 31) continue to be negative. The estimated North American population was 910,000 individuals on average during the 1994–2003 period (Table 2). The most recent estimate of Quebec numbers, revised upward since the 2004 NAWMP, is 558,000 individuals (Table 2).

In the St. Lawrence Valley, the American Black Duck appears to be gradually losing ground to the Mallard, which is now the most abundant waterfowl species west of Trois-Rivières (Figure 34) (Bordage and Lepage 2002). This phenomenon is not totally unrelated to the shift in the region's landscapes to intensive agriculture and field crops (e.g., grains, soybeans, corn), which now dominate (Maisonneuve et al. 2006). The exploitation of peat bogs, dike construction, drainage of farmland, elimination of shelterbelts and hedgerows, and the reduction in the size of woodlots are all limiting factors on the reproduction of the species in the St. Lawrence lowlands.

Figure 34. Mean number of indicated breeding pairs of American Black Ducks and Mallards along the shoreline of the St. Lawrence and its main tributaries, 1990–1992; the number of 1-km² survey plots is shown in parentheses for each region of the x-axis and regions are shown from west to east (taken from Bordage and Lepage 2002)

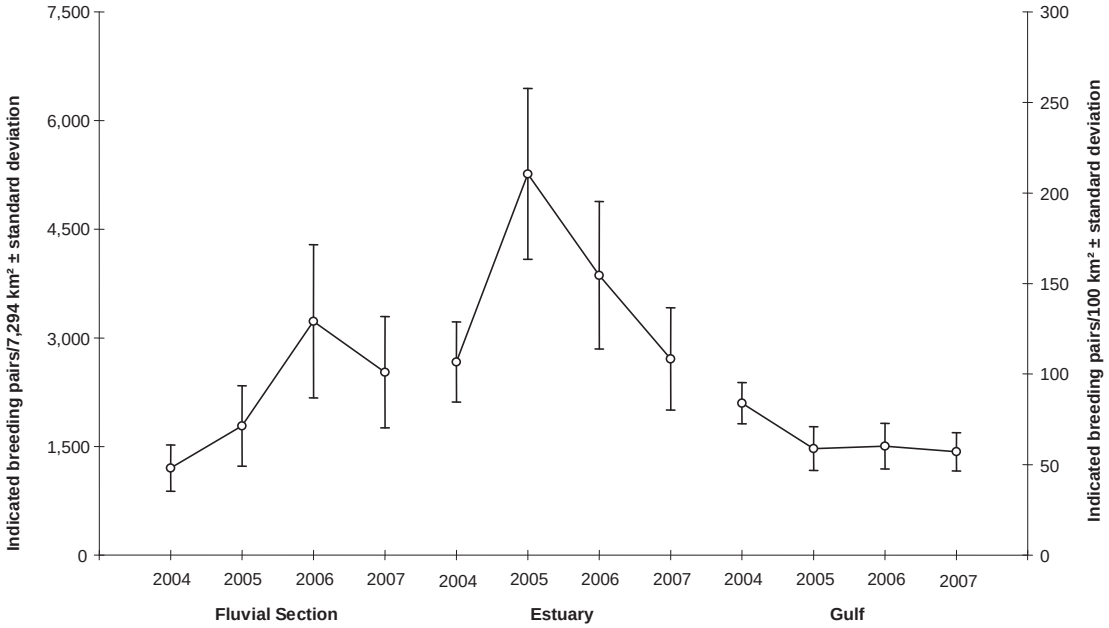


Wetland losses along the St. Lawrence have also contributed to the decline in American Black Duck populations, although the St. Lawrence Action Plan and EHJV have helped to stem these losses and promote the protection and restoration of aquatic habitats for waterfowl. In the Lower St. Lawrence region, peat bog exploitation and the condition of *Spartina* marshes must be monitored, since the peatlands are used for nesting and the marshes, for brood rearing. Farther north, although human occupation is less of a problem, the extent of habitat modification is significant when logging, hydroelectric developments and mining are taken into account. The acidification of lakes should also be looked into since Black Ducks tend to shun acidic lakes during the breeding season (DesGranges and Darveau 1985). WUPL results indicate that breeding populations are doing well overall in BCRs 8 and 12.

It could be hypothesized that sport hunting in Quebec no longer has a significant impact on the American Black Duck population. It is true that the Quebec sport harvest of the species, which peaked at roughly 130,000 individuals in 1977, 1978 and 1987 (respectively 21%, 18% and 28% of the total harvest of the species), has decreased significantly since then, dropping to 27,600 individuals in 2007 (8% of the waterfowl harvest and 16% of the duck harvest in Quebec; see Figure 32 and Table 3). This hypothesis is probably correct in the case of forested landscapes, according to WUPL results. However, the situation may be different in the St. Lawrence Valley, where sport hunting may still constitute a threat to the local Black Duck population (see Longcore et al. 2000). A CWS study using stable isotopes to identify the natal origin of Black Ducks harvested in the Quebec sport hunt should provide more information on this subject. According to the premises of this study, if hunting pressure were concentrated on this

local population, roughly a third of the fall flight and half the production of the St. Lawrence Valley could be harvested annually. Although CWS does not have a long history of surveys in the region, according to WSHO data (Figure 35), the demographics of breeding populations in this region do not appear to be as good as those of boreal forest populations (Figure 33). Since 1992, the Mallard has taken over the top spot from the American Black Duck as the most hunted duck in Quebec (Table 3).

Figure 35. Mean number of indicated breeding pairs of American Black Ducks along the shoreline of the St. Lawrence and its main tributaries, 2004–2007 (WSHO data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



The American Black Duck is the only dabbling duck with a total population below 1 million individuals; all other species of this tribe have populations of over 3 million (Table 2). Consequently, Quebec has a key role to play in conserving breeding populations of the American Black Duck. With over half of the world population of the species breeding in the province (Table 2) and the species' breeding range limited exclusively to eastern North America, Quebec clearly must continue its efforts to monitor and manage the species.

4.3.6 Mallard *Anas platyrhynchos platyrhynchos* (Mr, Br, Wr)
(by Daniel Bordage)

The Mallard's breeding range extends from the Arctic Circle to the Tropic of Cancer (Young 2005). The species has been introduced in many regions around the world, including South Africa, Bermuda, Australia, New Zealand and Mauritius (Young 2005). In North America, the subspecies *platyrhynchos* breeds from northern Alaska, Yukon, Northwest Territories, northeast Manitoba, northern Ontario, central Quebec and the Maritime provinces to northwestern Baja California (Mexico), Arizona, New Mexico, Oklahoma and Virginia (American Ornithologists' Union 1998; Drilling et al. 2002). The species' wintering range includes the southern coast of Alaska, southern British

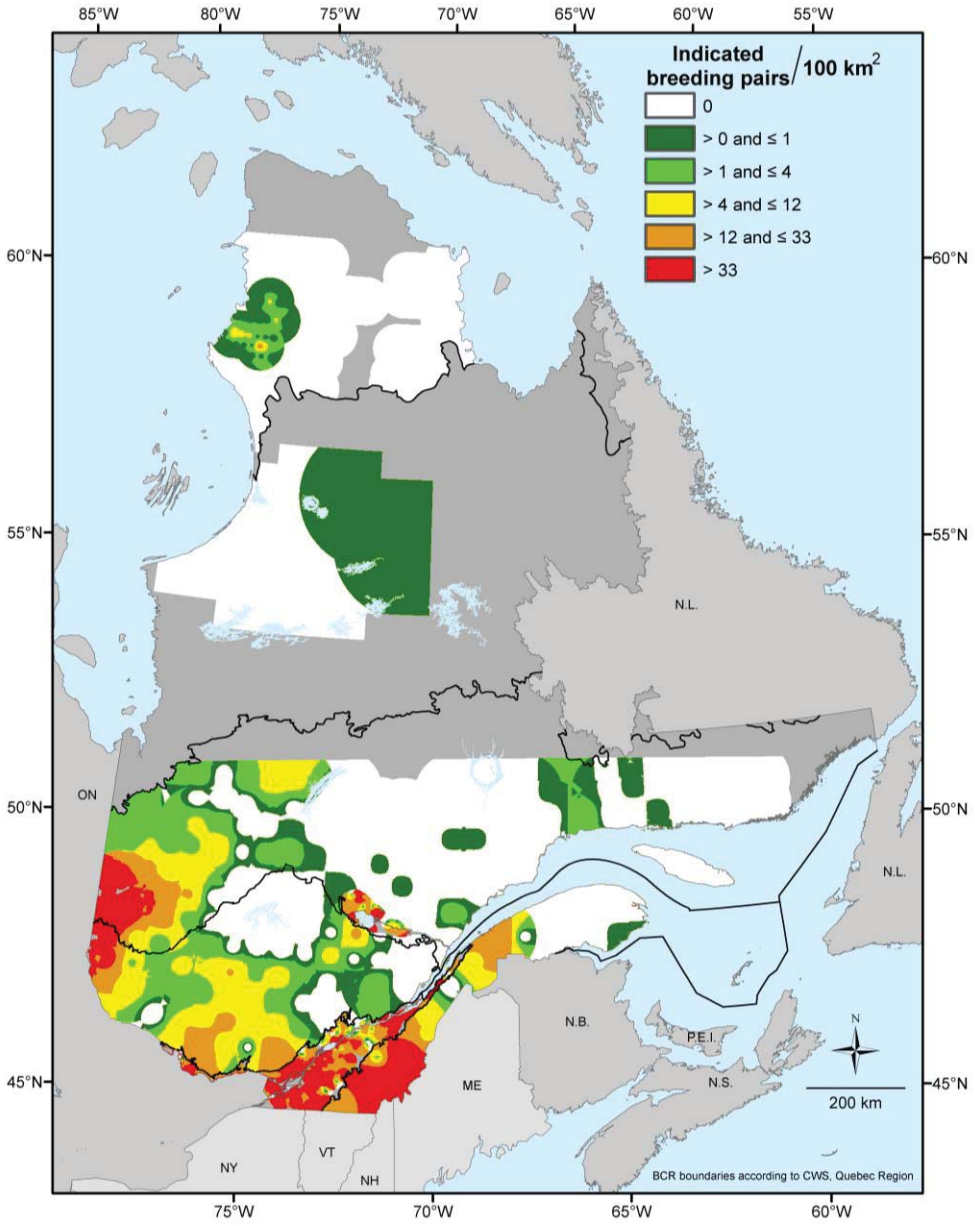
Columbia, southern Alberta and Saskatchewan, southern Ontario, southwestern Quebec (as well as locally in the St. Lawrence estuary), the Maritime Provinces, almost all of the continental United States except for Alaska, northern Mexico and some parts of Central Mexico (American Ornithologists' Union 1998; Drilling et al. 2002).

Breeding

In Quebec, the species breeds mainly on the St. Lawrence Plain (BCR 13), primarily in the Montréal region and along the Richelieu River, and also is a year-round resident in this region (Cyr 1995i). Mallards generally nest on the ground in a variety of open habitats: peatlands, swamps, marshes, agricultural fields, streams, rivers and lakes of all sizes (Cotter et al. 1996a; Drilling et al. 2002). It also frequents forested habitats where it occasionally nests well above the ground, for example, inside the trunk of a dead tree or in an abandoned crow or raptor nest (Cotter et al. 1996a; Drilling et al. 2002). The species also readily uses artificial nest boxes (Drilling et al. 2002). The Mallard's predilection for a wide range of agricultural landscapes has also been observed in Quebec. In the southern Quebec lowlands, breeding density was comparable in various types of agricultural landscapes (30–43 IBP/100 km²) (Maisonneuve et al. 2006). However, the highest densities of Mallards during the breeding season are found along the fluvial section of the St. Lawrence (roughly 87 IBP/100 km²; BCR 13); in addition, the species was the most abundant anatid in this region (WSHO). Densities were very low in forest environments in southern Quebec (roughly 3 IBP/100 km²) and were comparable in BCRs 8, 12 and 14 (WUPL). The species occurs, albeit infrequently, in the Taiga Shield and Hudson Plains BCR (BCR 7; < 0.1 IBP/100 km²) (Lepage et al., in prep.). Lastly, a hen and brood of five ducklings were observed on July 27, 2003, in BCR 3 near the Polemond River, roughly 120 km north of Inukjuak (R. Cotter, CWS, unpubl. data).

Figure 36 shows the distribution of indicated breeding pairs of Mallards in Quebec according to various surveys and inventories, carried out primarily by CWS.

Figure 36. Breeding distribution of the Mallard in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

Mallards are an abundant migrant in the southern part of the province. In spring, the best places to observe the species are Dundee (Montérégie region; up to 2,000 individuals) and Berthierville (Lanaudière region; up to 2,000 individuals) in BCR 13, as well as in North Hatley (Estrie region; up to 1,350 individuals) in BCR 14 (ÉPOQ). In fall, numerous migrants are found at Cap Tourmente NWA (up to 4,000 individuals), around Île aux Grues (up to 3,000 birds) and at Boischatel (Capitale-Nationale region; up to 1,000 individuals) in BCR 13, as well as in Lennoxville (near Sherbrooke; up to 1,500 individuals) in BCR 14 (ÉPOQ).

Moulting
There is little information on moulting in Mallards. Hundreds of individuals observed at certain sites in July and August could be moulting birds: for example, at Île Charron (Montréal region, BCR 13), Roquemaure and Rouyn-Noranda (Abitibi-Témiscamingue region; BCR 8), or Saint-Fulgence and Saint-Gédéon (Saguenay–Lac-Saint-Jean region; BCR 8).

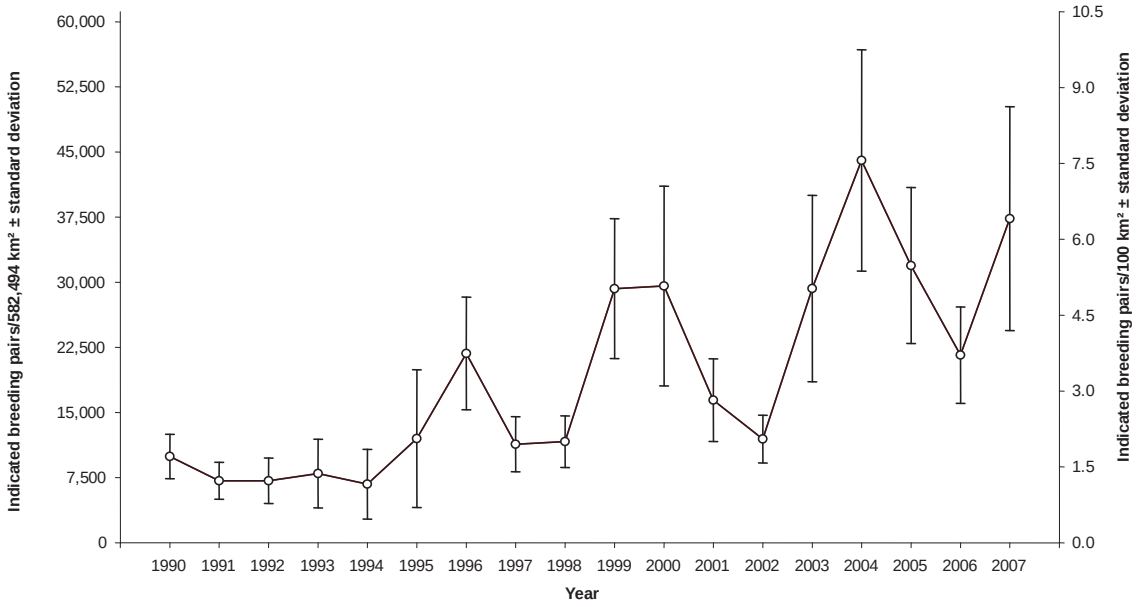
Wintering
The Mallard's winter range is undoubtedly influenced by people, which supplement its diet by providing foods like grain at many urban and periurban locations, where the species is so tame, it can almost be considered a domestic animal (Cyr 1995i). The species regularly overwinters in certain locations in southern Quebec. In the Montréal region (BCR 13), over 1,400 birds have been counted every winter since 1995, with a record of 8,100 individuals in the winter of 2007 (Bannon 2008). Up to 4,000 individuals have been observed near Sainte-Catherine (Montérégie region; BCR 13), up to 800 and 500 individuals respectively in North Hatley and Sherbrooke (Estrie region; BCR 14) and up to 500 individuals at Lac-Beauport (Capitale-Nationale region; BCR 13) (ÉPOQ). Farther east, a few individuals also overwinter in the estuary, around La Malbaie (BCR 12), Baie-des-Rochers (BCR 8), the Alouettes flats (BCR 8) and in the Tadoussac–Bon-Désir section (BCR 8) (Robert et al. 2003; CWS, unpubl. data). A group of 30 Mallards was even found in January 2002 at Maria (Chaleur Bay; BCR 14) (CWS, unpubl. data).

Conservation
The Mallard is by far the most abundant anatid on the planet, with a population of nearly 23 million individuals (Table 2). It is also the most abundant species of waterfowl in North America, with a population of 13 million individuals, accounting for 17% of the continent's waterfowl. In Quebec, Mallard ranks 9th in abundance among waterfowl species, with a population of roughly 134,000 individuals (Table 2). According to USFWS surveys in the U.S. portion of the Atlantic Flyway, the Mallard population in winter was fairly stable between 1955 and 1983, but has been declining since then (Figure 37).

Figure 37. Number of Mallards counted in winter in the U.S. portion of the Atlantic Flyway, 1955–2007 (taken from Serie and Raftovich 2005)

The situation in Quebec is somewhat different. According to data from the Christmas Bird Count, Breeding Bird Survey and ÉPOQ, breeding and wintering populations of Mallards have increased fairly significantly since 1985. In BCR 13, the average number of wintering individuals per day and site ranged between 10 and 20 in 1970–1990 but since the beginning of the 21st century has been over 100 individuals (ÉPOQ). The increase involves not only the number of wintering birds but also the number of sites where Mallards are found at this time of year (ÉPOQ). According to WUPL data, the breeding population of the species increased significantly ($P < 0.05$)—by an average of 11.7% per year—from 1990 to 2003 (Figure 38). At the regional scale, CWS surveys also showed significant annual increases for the period 1990–2007: 11.2% in BCR 12, 8.7% in BCR 8 and 14.4% in BCR 14 (Lepage et al., in prep.). This positive trend was also observed throughout Eastern Canada, where the breeding population increased from 45,650 in 1995 to 95,100 IBP in 2003, which represents a significant annual increase of 5.9% (BWPSEC; CWS, unpubl. data).

Figure 38. Trends in Mallard breeding populations in southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



The increase in Mallard populations can also be observed in the sport harvest when the decrease in the number of hunters is taken into account (Figure 39). This is the only duck species in which harvests have remained stable over the last 30 years despite a significant drop in the number of hunters (Figure 39). Since the full hunting season for Canada Geese was reinstated in 2002, Mallards have ranked third in the sport harvest (66,800 birds harvested per year on average in 2003–2007), after the Canada Goose and Greater Snow Goose (Table 3). In addition, since 1992, the Mallard has surpassed American Black Duck as the most hunted duck in Quebec (Figure 40; Table 3).

Figure 39. Estimated Mallard sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)

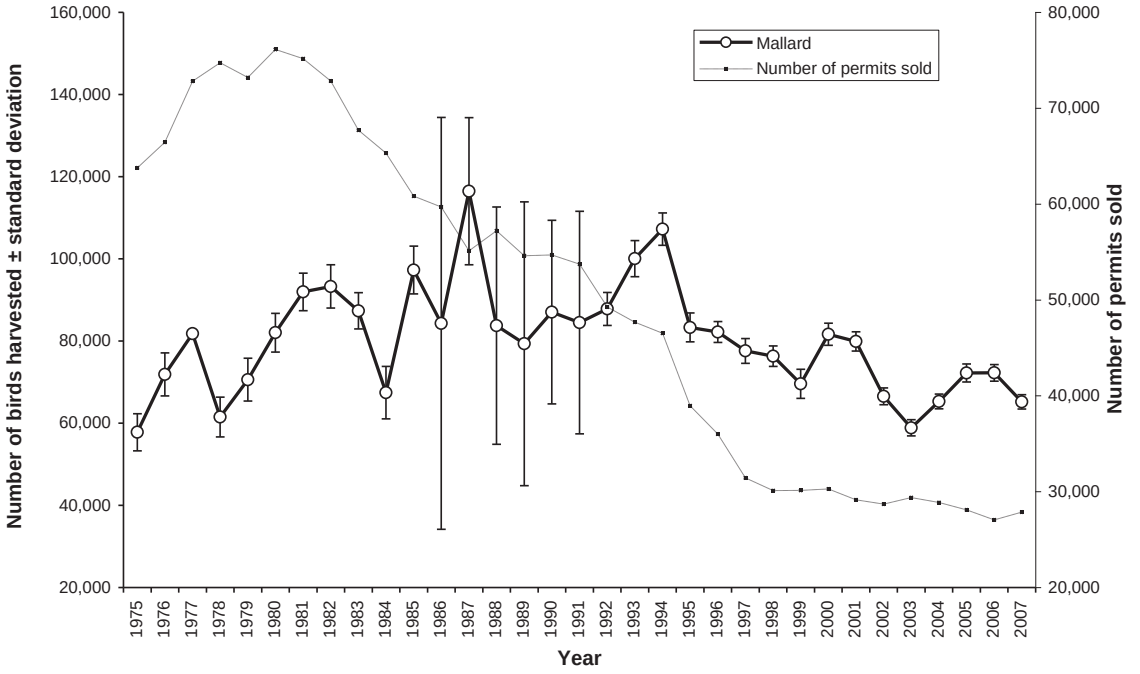
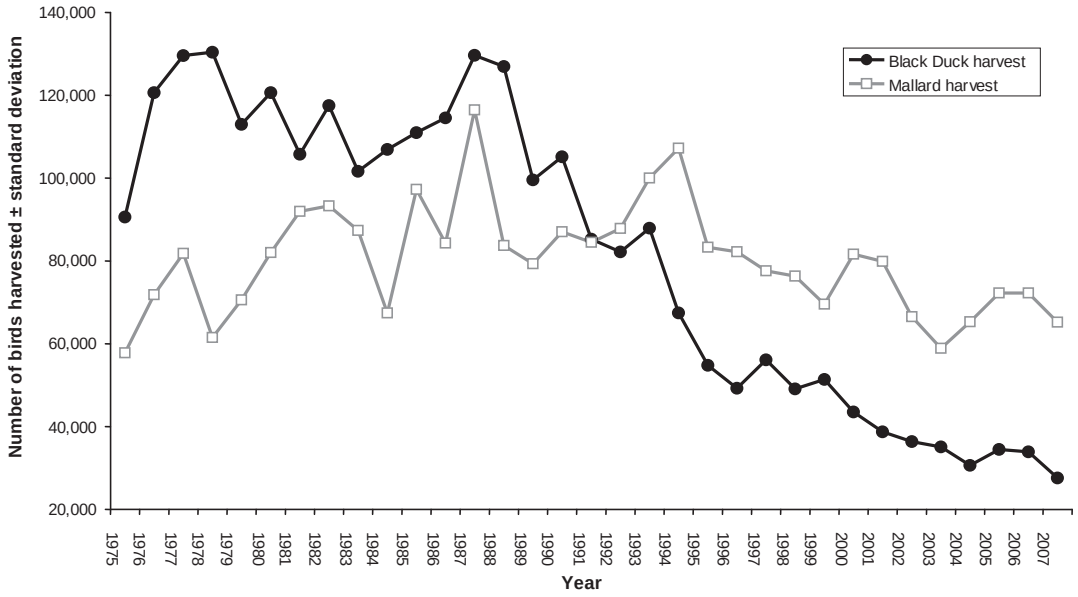


Figure 40. Estimated sport harvest of Mallards and American Black Ducks in Quebec, 1975–2007 (data taken from Gendron and Collins 2007)



In the St. Lawrence Valley, Mallards are now very abundant, particularly west of Trois-Rivières, and have supplanted the American Black Duck as the most abundant species of waterfowl (BCR 13). The mechanisms underlying this change are still poorly understood. In the St. Lawrence lowlands, changes in the agricultural landscape favouring intensive monocultures (e.g. corn), which are less attractive to Black Ducks, may in part account for this situation (Maisonneuve et al. 2006). A similar situation has been reported in British Columbia, where populations increased rapidly inland in winter after grain monocultures were introduced in the 1930s (Munro 1943 in Drilling et al. 2002). The restoration and enhancement of aquatic habitats along the St. Lawrence also appears to have also favoured the Mallard at the expense of the Black Duck, with the former responding quickly to the creation of these new habitats. Another practice that has promoted the Mallard's expansion in eastern North America is the propagation and release of thousands of individuals by U.S. hunting clubs in the Atlantic Flyway, which dates back at least 60 years. The purpose of these releases was to establish local Mallard populations and increase the sport harvest of ducks (Addy 1964). According to WLOW and WSHO survey data, shorelines in BCR 13—most likely the south shore of the estuary in particular—are still being intensively used by breeding pairs of American Black Ducks during the breeding season, while Mallards clearly predominate in lowland habitats (Figure 41). In BCR 14, shoreline habitats appear to be still intensively used by Black Ducks during the breeding season, while in upland habitats, Mallards, which used to be uncommon, have occurred in densities comparable to those of Black Ducks since 2003 (Figure 42).

Figure 41. Mean density of Mallards and American Black Ducks (in indicated breeding pairs) in the St. Lawrence Plain (BCR 13; WLOW and WSHO data)

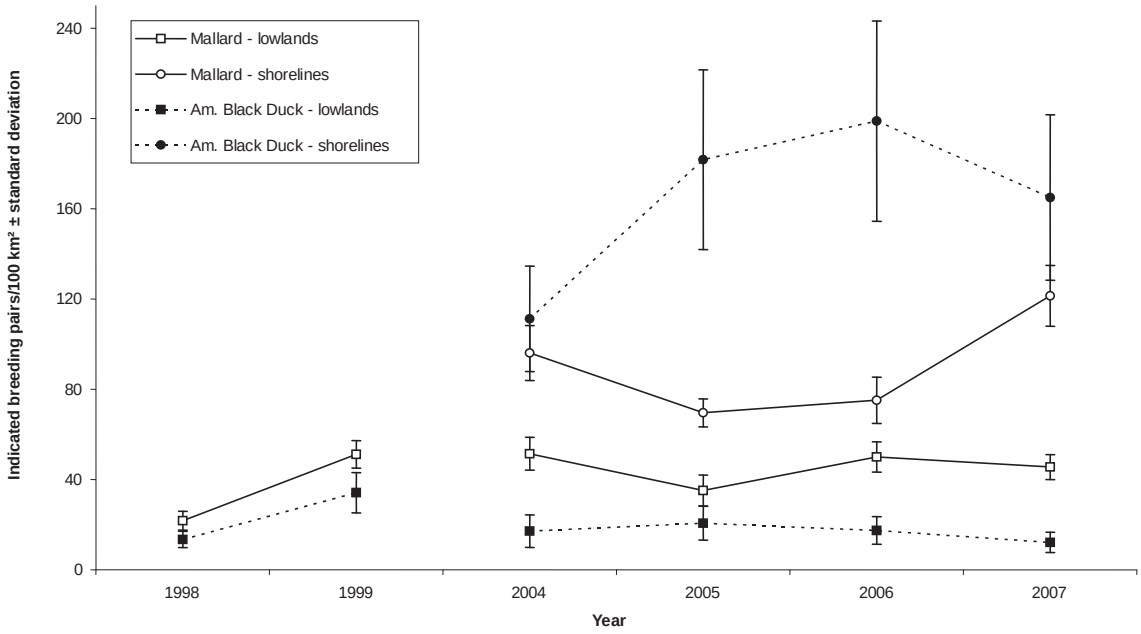
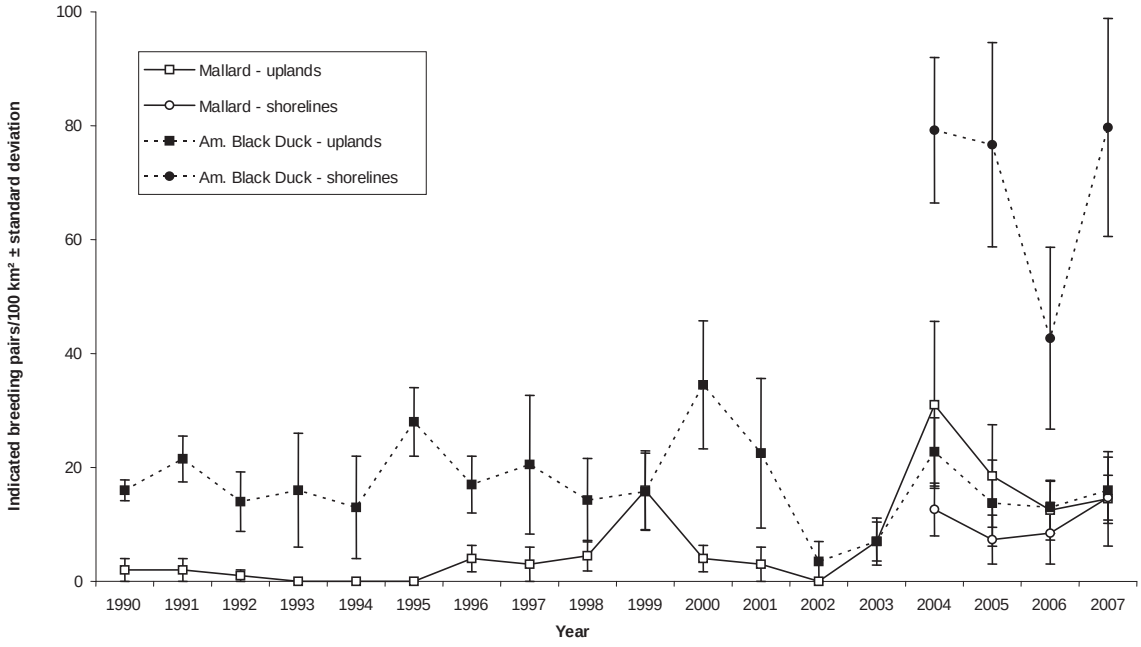


Figure 42. Mean density of Mallards and American Black Ducks (in indicated breeding pairs) in the Atlantic Northern Forest (BCR 14; WUPL and WSHO data)



Quebec does not play a key role in the conservation of Mallard populations in North America, since it hosts only 1% of the breeding population (Table 2). Nevertheless, the species is very important to hunters in Quebec (ranked third in sport harvests; Table 3) and the United States (ranked first in sport harvests in the Atlantic Flyway, with

455,800 individuals bagged on average per year in 2000–2007; Padding and Klimstra 2008). The Mallard also appears to play an important role in the management of American Black Duck populations. Since the BDJV was first established, it has identified the Mallard as one of the possible causes of the decline of the American Black Duck (see Conroy et al. 2002). The management of the populations of both species appears to be intimately linked, which is being taken into account in the work to implement adaptive harvest management for the Black Duck (Black Duck Adaptive Harvest Management Working Group 2004). A controversy arose a few years ago over interactions between the two species, with much written on the subject (Ankney et al. 1987; 1989; Conroy et al. 1989; Merendino et al. 1993).

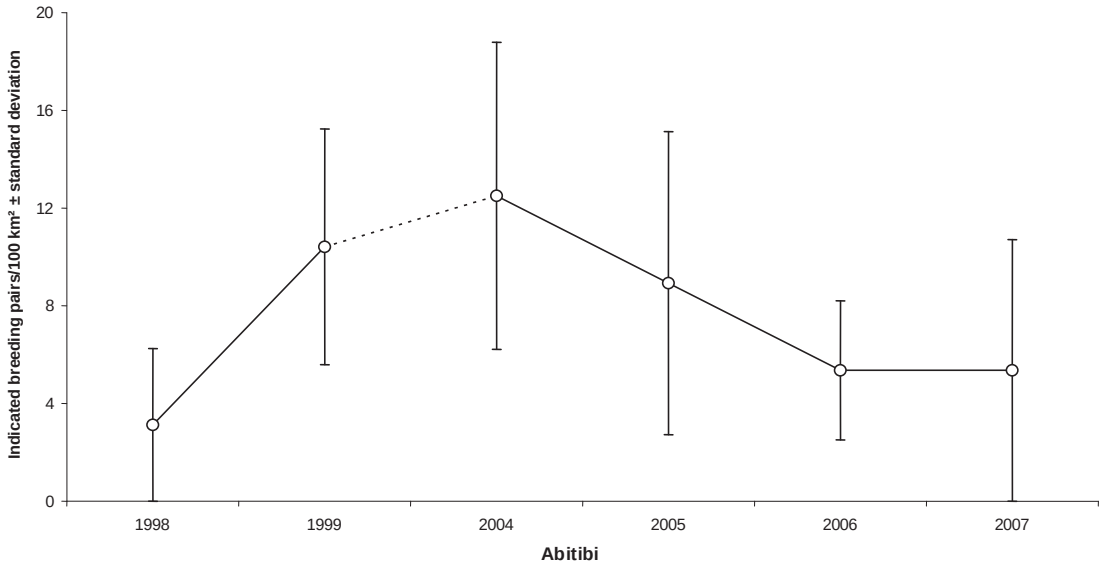
4.3.7 Blue-winged Teal *Anas discors* (Mr, Br)
(by Pierre Brousseau and Christine Lepage)

The Blue-winged Teal is a Nearctic species. Although its core breeding range is in the Canadian Prairies and U.S. Great Plains, it also breeds throughout the southern half of Canada, from British Columbia and southern Yukon in the west to the Atlantic provinces in the east, and in most states in the northern, central and eastern United States (American Ornithologists' Union 1998; Evarts 2005). The species' wintering and breeding ranges overlap only slightly and it winters in the extreme southern United States as well as in Mexico and Central and South America (Evarts 2005).

Breeding

In southern Quebec, the Blue-winged Teal has always been associated with farmland. It breeds in the St. Lawrence lowlands as well as in the lowlands of the Abitibi-Témiscamingue and Saguenay–Lac-Saint-Jean regions. It is also found along the St. Lawrence from the fluvial section to the upper estuary and on the south shore of the lower estuary and Gulf of St. Lawrence, including the shoreline of the Gaspé Peninsula. Despite its fairly extensive breeding range in the province, the breeding population is small according to CWS-led surveys. According to WLOW data, among the lowlands in southern Quebec, only the Abitibi-Témiscamingue lowlands (BCR 8 and 12) have significant breeding densities: 8.0 IBP/100 km² on average in 2004–2007, representing a slight increase over the 1998–1999 number of 6.8 IBP/100 km² (see Figure 43; CWS, unpubl. data). In the St. Lawrence lowlands (BCR 13), the mean breeding density was negligible in 2004–2007 according to WLOW data, although the region is within the species' known breeding range (Benoit and Dauphin 1996; Cyr 1995e).

Figure 43. Mean number of indicated breeding pairs of Blue-winged Teals per 100 km² (± standard deviation) in the Abitibi lowlands in 1998–1999 and 2004–2007 (WLOW data)

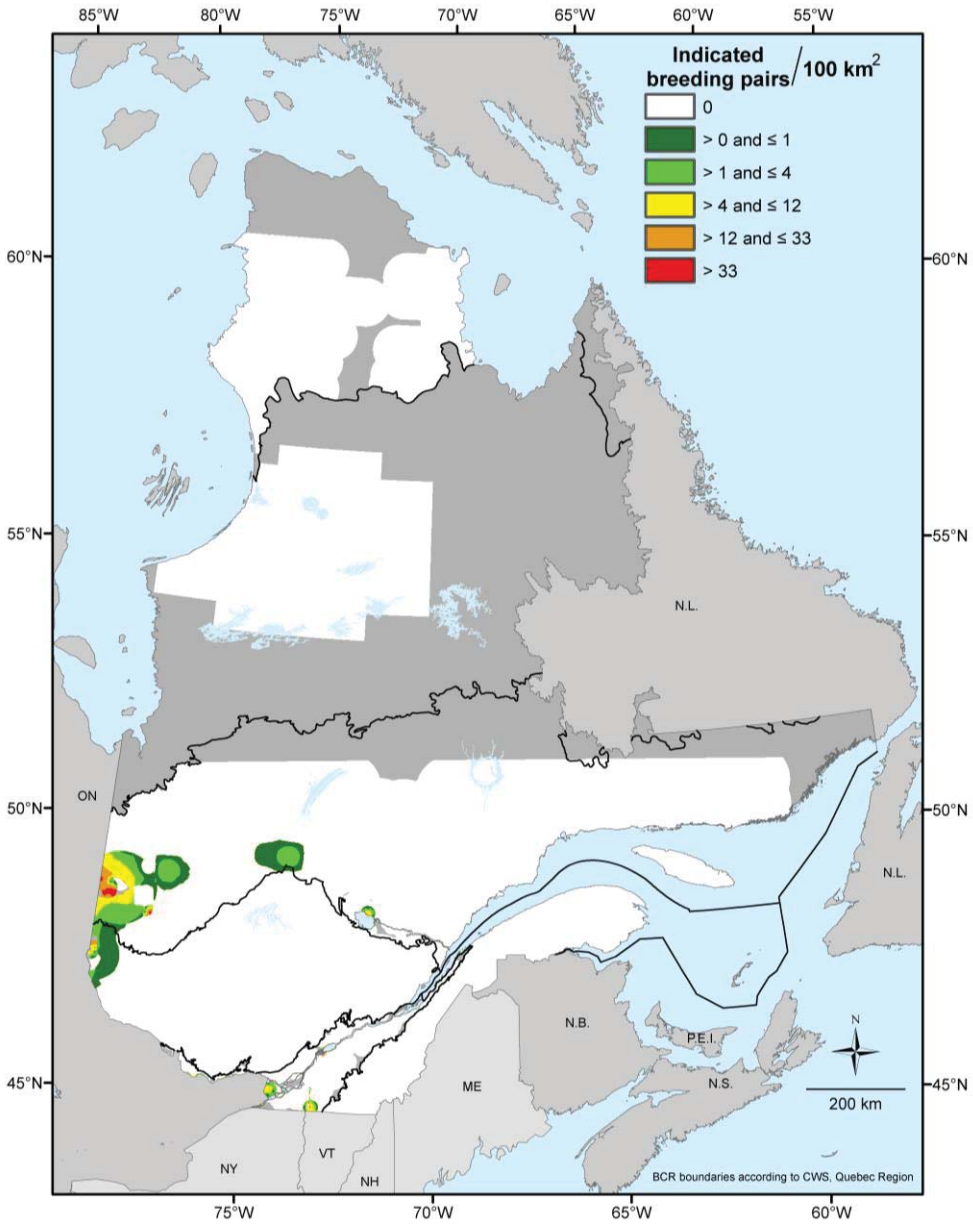


Along the shoreline of the St. Lawrence and its main tributaries, the average annual breeding population was only 80 IBP in 2004–2007, compared with 1,400 IBP in 1990–1992 (Bordage and Lepage 2002) (WSHO). Breeding densities along the St. Lawrence in 2004–2006 were as follows: fluvial section (including the Ottawa and Richelieu rivers), 1.8 IBP/100 km^2; estuary (including the Saguenay River and Lac Saint-Jean), 0.9 IBP/100 km^2 and Gulf, 0.6 IBP/100 km^2 (WSHO). Densities obtained in the Waterfowl Survey of Southern Quebec Uplands (WUPL; mixed and coniferous forests) were generally very low (0.2 IBP/100 km² on average for 2000–2007, or roughly 950 IBP in the 582,494 km² study area). According to WUPL data, only one isolated plot in the Abitibi region had high breeding densities (11 IBP/100 km²), which corroborates the results of WLOW surveys in the lowlands of the same region (CWS, unpubl. data).

Outside of the species' known breeding range, a brood was reported in the Bay of Many Islands in James Bay (Benoit et al. 1991), which is undoubtedly the northernmost breeding record to date. Two records of single individuals were obtained in 1989, northeast of Kuujjuarapik (Manitounuk Sound and Duck Island; BCR 7) (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a) in Hudson Bay, but at this latitude probably involved visitants. Farther east, a sighting of a pair of Blue-winged Teals near the Sainte-Marguerite 2 Reservoir (west of Sept-Îles; BCR 8) in May 1998 (Morneau 2003) is unusual, but is not unique in this region (Benoit and Dauphin 1996; Cyr 1995e).

Figure 44 shows the distribution of indicated breeding pairs of Blue-winged Teals in Quebec, according to data from various surveys and inventories carried out by CWS.

Figure 44. Breeding distribution of the Blue-winged Teal in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

During migration, the Blue-winged Teal frequents the entire St. Lawrence and its lowlands, except the portion of the North Shore east of Pointe-des-Monts, which is visited very rarely by the species. The Blue-winged Teal does not form large flocks at these times of year. In spring, flocks are limited to no more than 10 to 20 birds on average, although up to 100 teal have been observed in the Richelieu Valley (BCR 13) (ÉPOQ). Spring migration in the species occurs later than the average for ducks (ÉPOQ). In August and September, flocks are larger since they consist of family groups. Single records in the Magdalen Islands (BCR 14) and at Cap Tourmente

(BCR 13) involved 2,000 and 1,000 birds respectively (ÉPOQ) but were exceptional, since the largest flocks observed generally only consist of a few hundred birds.

Conservation

An estimated 7.2 million Blue-winged Teals breed in North America (Table 2). The breeding population for Quebec as a whole is difficult to assess, but 4,000 individuals is a rough estimate (Table 2) (WUPL, WLOW and WSHO). In the traditional survey areas for the species (Canadian Prairies and U.S. Great Plains), long-term population trends are positive (U.S. Fish and Wildlife Service 2008). However, in the BWPSEC study area in Eastern Canada (helicopter plots), a significant annual decline of 7.5% was found between 1991 and 2003 (CWS, unpubl. data). In Ontario, the probability of observation of the species decreased by 36% between 1981–1985 and 2001–2005 (Ross 2007a). This downward trend was also observed in southern Quebec uplands (13 plots), with an annual decrease of 11.5% during the same period (CWS, unpubl. data). The WLOW and WSHO surveys have not provided data for long enough to allow population trends to be analyzed in these key areas for the species. ÉPOQ data points to a significant negative trend throughout southern Quebec in 1970–1989 (Cyr 1995e), and more recent ÉPOQ data (1990 to 2004) shows no evidence of a recovery since then.

Changing agricultural practices, an explanation also put forward in Ontario (Ross 2007a), and habitat destruction during the past 30 years are thought to be the main factors in the decline of the Blue-winged Teal population in Quebec, particularly in the St. Lawrence Valley (Benoit and Dauphin 1996). Major changes may also have occurred in the species' wintering range in Mexico and Central and South America.

The results of the National Harvest Survey underline the species' rapid decline. In Quebec, the average annual harvest was only 1,900 birds between 2003 and 2007 (1% of the total duck harvest), compared with 24,000 between 1975 and 1984 (5% of total duck harvest) (Figures 45 and 46; Table 3). Although Figures 45 and 46 only provide a rough indication of population trends since harvests are linked to the number of hunters and their declared activities, they do provide a fairly clear picture of the seriousness of the problem (Dupuis et al. 1996). U.S. hunters harvested over 72,000 teal annually in the Atlantic Flyway on average during the 2000–2007 period (Padding and Klimstra 2008).

Figure 45. Estimated Blue-winged Teal sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)

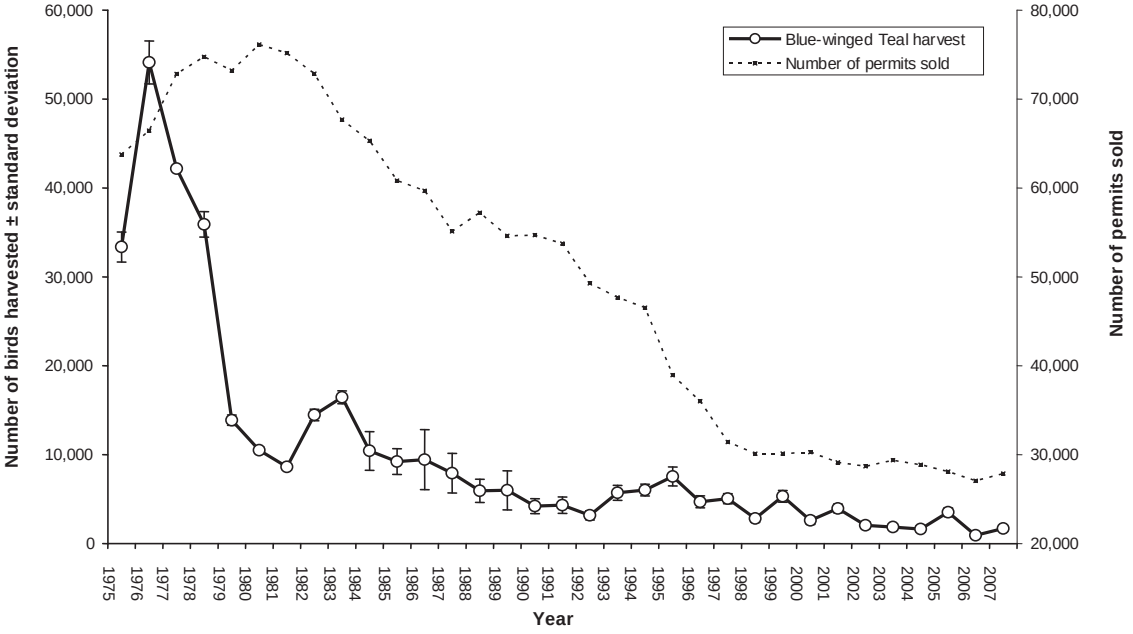
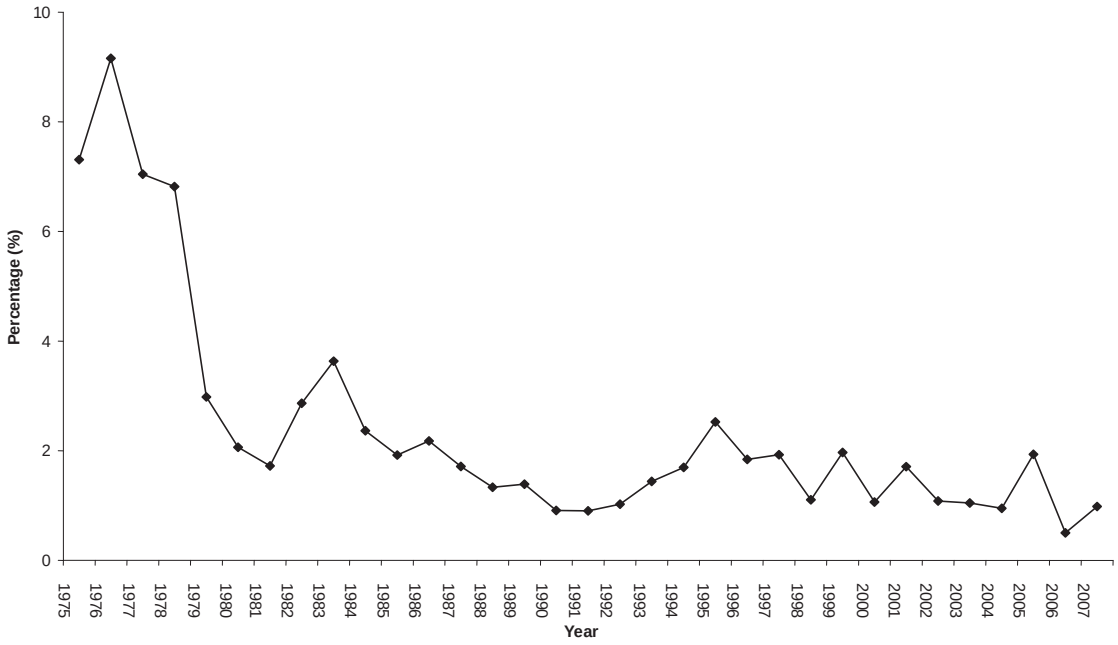


Figure 46. Percentage of Blue-winged Teals in the total duck harvest in Quebec, 1975–2007 (data taken from Gendron and Collins 2007)



Checks of hunters' bags at the opening of the hunting season are another source of information on the species. For example, the species represented roughly 25% of birds harvested in the 1970s in the Lake Saint-Pierre region, compared with only 1.8% during the 2000–2005 period (CWS, unpubl. data).

In view of the decline in the Blue-winged Teal population observed in Quebec in the 1970s and 1980s (Benoit and Dauphin 1996; Cyr 1995e), CWS imposed restrictive regulations on the harvest in 1991, limiting the daily bag limit to one or two birds depending on the hunting district. In 2008, this was reduced to one bird in all districts.

Although Quebec is on the northeast edge of the Blue-winged Teal's breeding range (with most of the population located in the Prairies) and hosts less than 1% of the North American population (Table 2), this duck's situation is worrisome to biologists since the population was much greater in the past.

4.3.8 Northern Shoveler *Anas clypeata* (Mr, Br, We) (by Daniel Bordage)

There are four species of shovelers, ducks with long spatula-shaped bills, in the world: three in the Southern Hemisphere (one each in South America, Africa and Australia–New Zealand) and one in the Northern Hemisphere, which is our Northern Shoveler (Madge and Burn 1988). The Northern Shoveler has a Holarctic distribution and breeds almost exclusively between the 40th and 60th parallels, but overwinters generally between the 20th and 40th parallels (Mitchell 2005). The species breeds in an almost continuous swath throughout western Canada and the western United States (except for the Rockies), while breeding is more localized in eastern North America (DuBowy 1996). The species' main breeding range extends from northern Alaska to northern Ontario; it breeds locally and irregularly in southern Quebec, Prince Edward Island, New Brunswick and Nova Scotia, and from California to northeastern Maryland and Delaware, as well as in southern New Mexico and southeast Texas (American Ornithologists' Union 1998). Its main winter range in North America is in California, along the Gulf of Mexico (Texas and Louisiana) and in inland and coastal wetlands in Mexico (Bellrose 1976).

Breeding

During the breeding season, the Northern Shoveler frequents shallow ponds, lakes and marshes in open areas, with these bodies of water often having a muddy bottom (Titman and Barrette 1996b). This type of habitat is generally rich in aquatic invertebrates, the species' preferred food during the breeding season (particularly cladocerans and chironomids), which it captures by straining the water column and surface with its spatulate bill, which has a series of closely spaced comb-like lamellae around the edges (DuBowy 1996). The species also feeds on plant materials (mainly seeds), particularly in fall and winter (DuBowy 1996).

In Quebec, the Northern Shoveler breeds primarily along the St. Lawrence River between Montréal and Trois-Rivières (BCR 13), but is also found in the Abitibi-Témiscamingue and Saguenay–Lac-Saint-Jean regions and, locally, to Pointe-des-Monts on the North Shore, as well as on Anticosti Island (Côte-Nord region) (BCR 8) (ÉPOQ and WSHO); it also occurs in small numbers in Chaleur Bay and the Magdalen Islands (BCR 14) (Fradette 1992; Cyr 1995k; Titman and Barrette 1996b). Breeding records have also been obtained at a number of other locations, including Qikirtajuaq Island (BCR 7) in Ungava Bay, where a brood was found in August 2006 (P. May, Makivik Corporation, pers. comm.) and Puvirnituq Lake (BCR 3) near the coast of Hudson Bay, where a breeding pair was spotted on June 7, 1999 (CWS, unpubl. data), and a hen and her seven ducklings were observed on August 5, 2002 (Bannon et al.

2002b). The most northerly record is no doubt the sighting of two drakes on a small pond in Kangiqsujuaq (61° 36' N, 71° 58' W) in Ungava Bay, in July 2007 (Robert 2007).

In Quebec, the highest breeding densities of Northern Shovelers occur along the shoreline of the fluvial section of the St. Lawrence, upstream from Pointe-du-Lac (BCR 13) (0.48 IBP/km²). The survey plots with the highest densities were in the Varennes Islands and Sainte-Thérèse Island in the Montréal region and the section stretching from the Contrecœur Islands to Lake Saint-Pierre, including the Berthier-Sorel Islands (Bordage and Lepage 2002; WSHO). With the exception of the Ottawa River (BCR 13), where the species seems less abundant, Northern Shoveler densities increase from east to west (Figure 47). More recent surveys along the St. Lawrence shoreline have provided information on breeding densities farther east, in the Gulf of St. Lawrence, where densities of 1.1 IBP/100 km² were recorded (2004–2007 mean), mainly from Pointe-à-la-Croix to Bonaventure in Chaleur Bay (BCR 14) (WSHO). In the lowlands of southern Quebec, the Abitibi-Témiscamingue lowlands in particular (BCR 8 and 12) had significant breeding densities, 2.7 IBP/100 km² (2004–2007) (WLOW). Such densities cannot be compared, however, with those found in the centre of the continent in mixed prairie and parkland habitats, where densities of over 1.0 IBP/km² and as high as 5.0 IBP/km² have been obtained in locations such as Alberta (DuBowy 1996).

Figure 48 shows the distribution of indicated breeding pairs of Northern Shovelers in Quebec according to various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 47. Mean number of indicated breeding pairs of Northern Shovelers along the shorelines of the St. Lawrence and its main tributaries, 2004–2007 (WSHO data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)

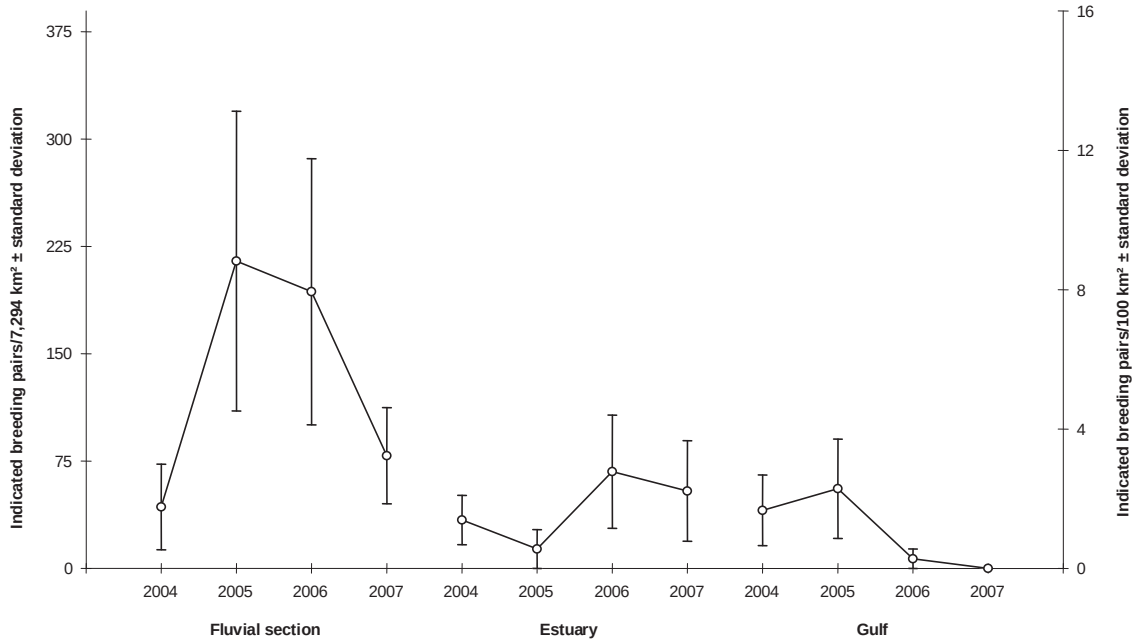
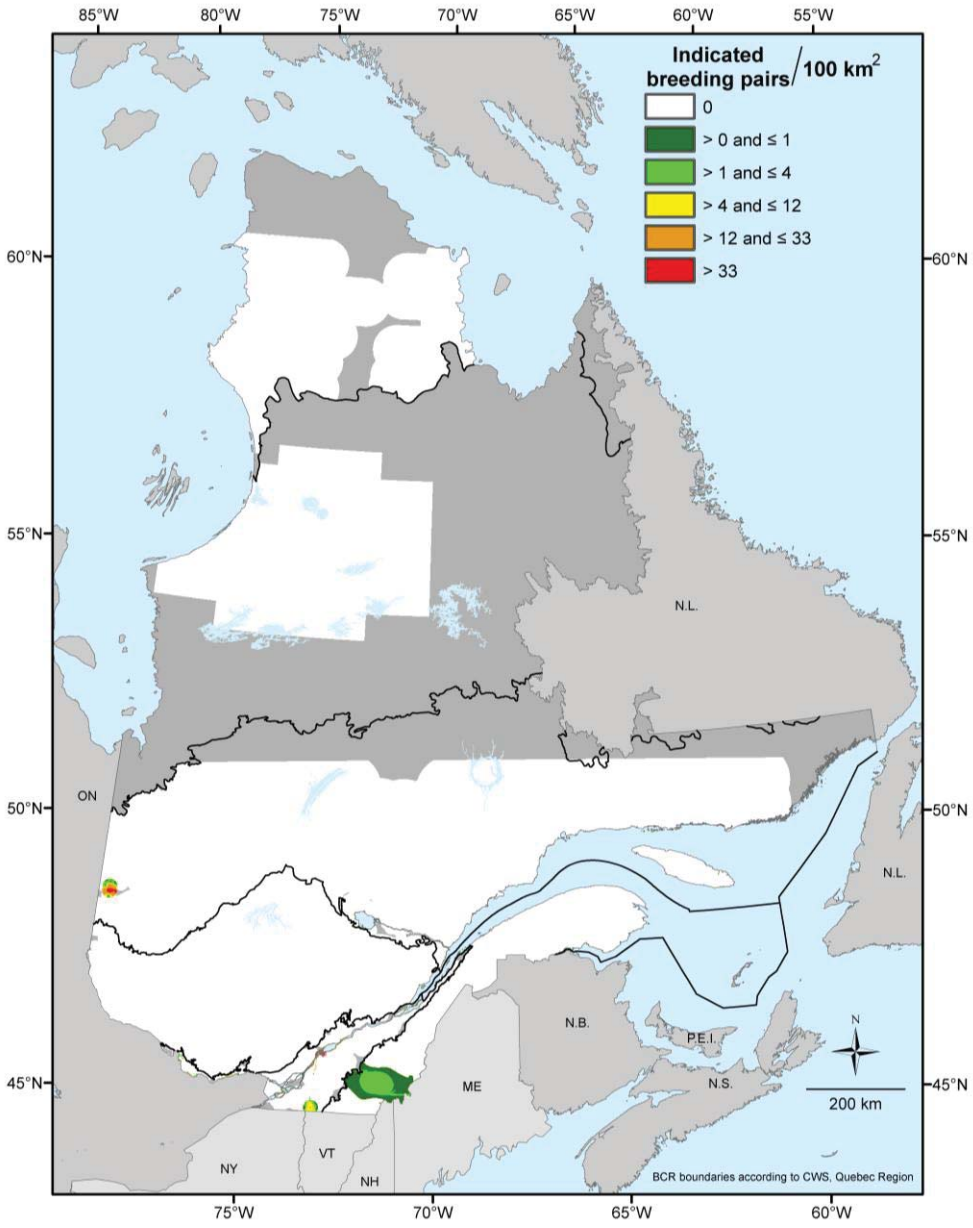


Figure 48. Breeding distribution of the Northern Shoveler in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

In spring, the Northern Shoveler migrates through the St. Lawrence lowlands and along the corridor of the river itself, with the Richelieu River and Lake Saint-Pierre region in particular being favourite stopover areas (Cyr 1995k; ÉPOQ). In fall, the species frequents the same areas, with some flocks consisting of 50–200 individuals (ÉPOQ).

Wintering

Winter records of the species in the province are rare (almost all in BCR 13): Léry in the Montérégie region on January 4, 1995 (Newsl. 37(6): 10 in David 1996); Lachenaie on January 10, 2002; Sherbrooke on January 2, 2006, and a drake in the Québec City

area (Maizerets), January 27–February 21, 2006 (ÉPOQ). Consequently, the Northern Shoveler is considered exceptional in winter in the province based on the criteria used in this document. There are also three CBC records of the species: Lennoxville in 1996 (BCR 14), Montréal in 1999 (BCR 13) and Longueuil in 2000 (BCR 13), but probably involve late migrants.

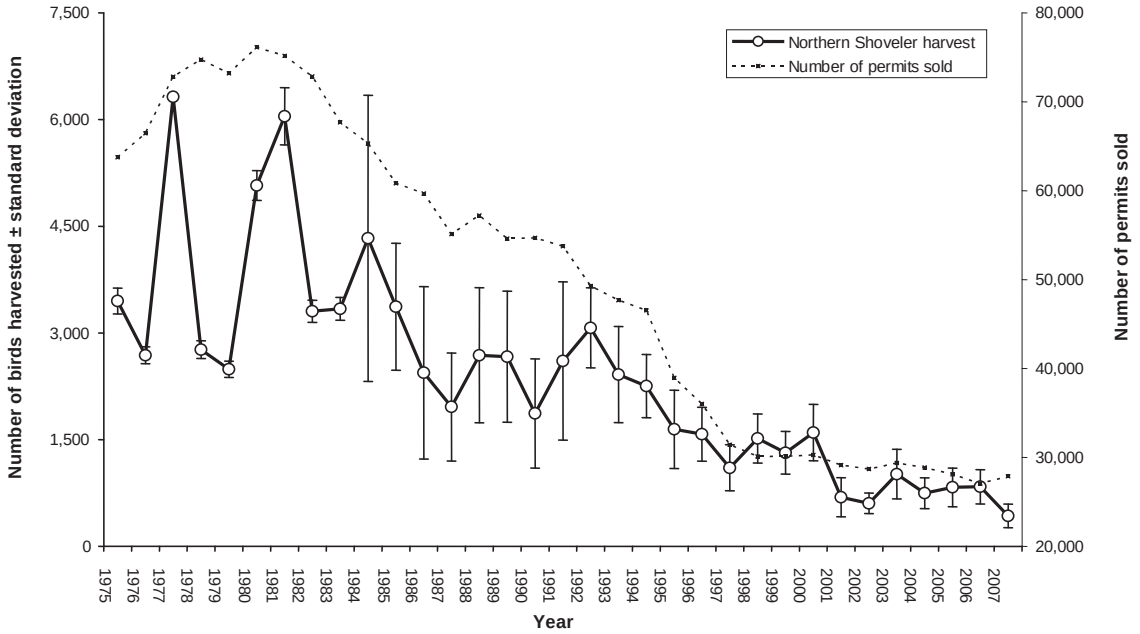
Conservation

Roughly 3.8 million Northern Shovelers breed in North America, or slightly over half the world population, which is estimated at 5.9 million individuals (Table 2). Breeding by the species in eastern Canada is considered to be a fairly recent occurrence, probably favoured by the draining of wetlands in the Prairies, combined with deforestation, agricultural development and the creation of sewage lagoons, which teem with aquatic invertebrates, in the East (Titman and Barrette 1996b; DuBowy 1996). The first breeding record in the Montréal region dates back to 1967 (Ouellet 1974 in Titman and Barrette 1996b). In Quebec, the Northern Shoveler is the least abundant dabbling duck during the breeding season, with an estimated population of roughly 1,100 individuals (Table 2).

The North American population is thought to be increasing according to the data from 1970 to 2003; the average numbers (1990–2003) breeding in the Prairies greatly exceed the NAWMP population objective (North American Waterfowl Management Plan 2004). CWS surveys in Quebec (WSHO and WLOW) have not been carried out long enough to allow population trends to be analyzed. According to a recent survey on the Varennes Islands, the species only made up 8% of breeding ducks on the islands in 2007, compared with 14% in 1994. The species' decline on the islands has been accompanied by increases in two other breeding species, Mallard and Gadwall (Giroux 2007).

The Northern Shoveler only makes up a tiny percentage of the annual waterfowl harvest in Quebec: 0.5% or 2,400 birds (1975–2007 average) (Gendron and Collins 2007). The decline observed since the 1980s is no doubt associated with the decrease in the number of waterfowl hunters, as is the case for a number of other species (Figure 49). On average, nearly 800 Northern Shovelers were bagged in the province every year by sport hunters in 2003–2007 (< 1% of anatids harvested; Table 3), compared with close to 4,000 birds in 1975–1984 (1% of anatids harvested; Table 3). In the United States, 15,600 Northern Shovelers were harvested in the Atlantic Flyway on average in 2000– 2007 (Padding and Klimstra 2008).

Figure 49. Estimated Northern Shoveler sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec's contribution to the conservation of the Northern Shoveler in North America is negligible, particularly since breeding populations in the centre of the continent, where the species is the most abundant, are doing well. The Northern Shoveler is the least abundant dabbling duck in Quebec, however, with slightly over 1,000 individuals during the breeding season, occurring mainly on the islands in the St. Lawrence River between Montréal and Trois-Rivières. Consequently, the Northern Shoveler at least warrants a program of targeted surveys to monitor population trends in the province, which are currently unknown. Furthermore, habitat quality in the breeding areas favoured by the species must be monitored, particularly on Sainte-Thérèse Island and the Varennes, Contrecœur and Berthier islands (Giroux 2007). Lastly, as mentioned by Cyr (1995k), the Northern Shoveler's distinctive diet and foraging style make it a useful indicator species for measuring the quality of aquatic habitats.

4.3.9 Northern Pintail *Anas acuta* (Mr, Br, Wr) **(by Daniel Bordage)**

The Northern Pintail is more widely distributed in the Northern Hemisphere than any other species of waterfowl (Fox 2005). In Eurasia, its breeding range includes Siberia, Russia, the Scandinavian Peninsula and, more locally, from Ireland and Greenland in the north to northern Africa in the south, Hungary and Turkey in the west and Kamchatka Peninsula and Sakhalin Island in the east (Cramp and Simmons 1977). It winters as far south as the Philippines, Borneo, Malaysia, India, Pakistan, southwest Asia, southern and western Europe, and sub-Saharan Africa (Cramp and Simmons 1977). In North America, the Northern Pintail breeds in Alaska, Yukon, western and central Nunavut, British Columbia, the Prairie provinces, northern and southern Ontario

and Quebec, and the Atlantic provinces, as well as in most of the United States, except for parts of the Northeast (Austin and Miller 1995). Its winter range includes the Pacific and Atlantic coasts as far north as the Alaskan Panhandle and southeast Massachusetts, and takes in most of the southern continental United States, the Hawaiian Islands, almost all of Mexico, Central America, Bermuda, the Antilles, northern Colombia, Guyana and northern Venezuela (American Ornithologists' Union 1998; Austin and Miller 1995).

Breeding

Suitable breeding habitat for the species consists of shallow freshwater environments such as floodplains and open marshes with low vegetation (McNicoll and Tardif 1996). The Northern Pintail also frequents agricultural habitats (e.g., grain stubble, uncultivated fields and grain fields) and even roadsides (Bélanger 1991 in McNicoll and Tardif 1996). The Northern Pintail is considered a pioneer species and is one of the first dabbling ducks to move into newly created or restored habitats (McNicoll and Tardif 1996). Similarly, it is also one of the earliest nesting ducks (McNicoll and Tardif 1996). Pintails enjoy a varied diet, made up mainly of grains (e.g., rice, wheat, corn, barley), the seeds of aquatic (sedges, bulrushes and pondweed) and wetland plants (crowberry), aquatic insect larvae (chironomids and caddis flies), crustaceans (cladocerans) and gastropods (snails) (Austin and Miller 1995). Insects, crustaceans and gastropods make up a significant part of the diet of adult females, just before and during incubation, and of ducklings (Austin and Miller 1995).

In Quebec, the Northern Pintail breeds along the St. Lawrence (fluvial section, estuary and Gulf) and in the St. Lawrence Valley, Saguenay–Lac-Saint-Jean, Abitibi-Témiscamingue, James Bay, Hudson Bay and Ungava Bay lowlands; it generally does not breed in forest environments in southern Quebec (McNicoll and Tardif 1996; WSHO, WUPL, WLOW). Pintails also breed on Anticosti Island and the Magdalen Islands (Fradette 1992; McNicoll and Tardif 1996), as well as the inland plateaus of Nunavik, particularly in the Grande rivière de la Baleine (Great Whale River) region (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a; CWS, unpubl. data). Farther north, in the area between the Polemond River in the south and Puvirnituq Lake in the north (BCR 3), which was visited annually in 1996–2003 as part of a Canada Goose breeding ground study, Northern Pintail broods and nests were found almost every year (R. Cotter, CWS, unpubl. data). A sighting of a hen in the Saint-Germain Lake sector of Parc National des Pingualuit (Pingualuit provincial park) (BCR 3) in July 2007, as well as a record of a breeding pair outside the park in June 2007 (Robert 2007), suggest that the species may nest in the area. Lastly, breeding was confirmed in Deception Bay (62° 10' N, 74° 42' W; BCR 3), based on a sighting of a hen with three ducklings in July 2008 (Poulin and Plourde 2010). The species is therefore present in all six of Quebec's BCRs during the breeding season, but is particularly abundant along the St. Lawrence River between Cornwall and Kamouraska (BCR 13) (McNicoll and Tardif 1996; WSHO).

According to WSHO data, Northern Pintail numbers drop off gradually west to east, from the fluvial section (16.2 IBP/100 km²), to the estuary (7.4 IBP/100 km²) and Gulf of St. Lawrence (2.5 IBP/100 km²; Figure 50). Locally, the highest breeding densities according to WSHO data (2004–2007) are on the Verchères, Contrecœur, Berthier and Sorel islands in the Montréal region (BCR 13), the Côte-de-Beaupré shoreline in the Québec City region (BCR 13) and the shoreline between Montmagny and Saint-Jean-Port-Joli in the Chaudière-Appalaches region (BCR 13). While the species was

observed primarily in the St. Lawrence Valley at fairly low mean densities (0.9 IBP/100 km²) during WLOW surveys, breeding was also confirmed in the Abitibi and Saguenay–Lac-Saint-Jean lowlands (McNicoll and Tardif 1996). Mean densities in southern Quebec uplands in 1990–2007 were very low (0.06 IBP/100 km²; WUPL) and most records came from BCR 8. Farther north, in BCR 7, densities were higher, 1.0 IBP/100 km² on average in inland locations (CWS, unpubl. data; Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a) and 2.0 IBP/100 km² in the coastal strip along Hudson Bay (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). High densities were also found in BCR 3: 11.6 IBP/100 km² on average in 2004–2006 (WNOR).

The Northern Pintail population breeding along the shoreline of the St. Lawrence and its main tributaries—mainly in the fluvial section, fluvial estuary and upper estuary (BCR 13)—was estimated at roughly 3,000 breeding pairs in 1990–1992 (Bordage and Lepage 2002), but only 400–600 pairs in 2004–2007 (WSHO). The estimated population breeding in southern Quebec lowlands (St. Lawrence Valley) was roughly 250 pairs (BCR 13) (WLOW). The Northern Pintail is scarce in forest environments in southern Quebec, with total numbers of only around 300 IBP (2000–2007 average) in an area of 582,494 km², mainly BCRs 8 and 12 (WUPL). Farther north, in BCR 7, the inland breeding population was estimated at 5,200 IBP (CWS, unpubl. data), while close to 24,000 IBP are likely present in BCR 3 (WNOR). Figure 51 shows the distribution of indicated breeding pairs of Northern Pintails in Quebec according to various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 50. Mean number of indicated breeding pairs of Northern Pintails along the shorelines of the St. Lawrence and its main tributaries, 2004–2007 (WSHO data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)

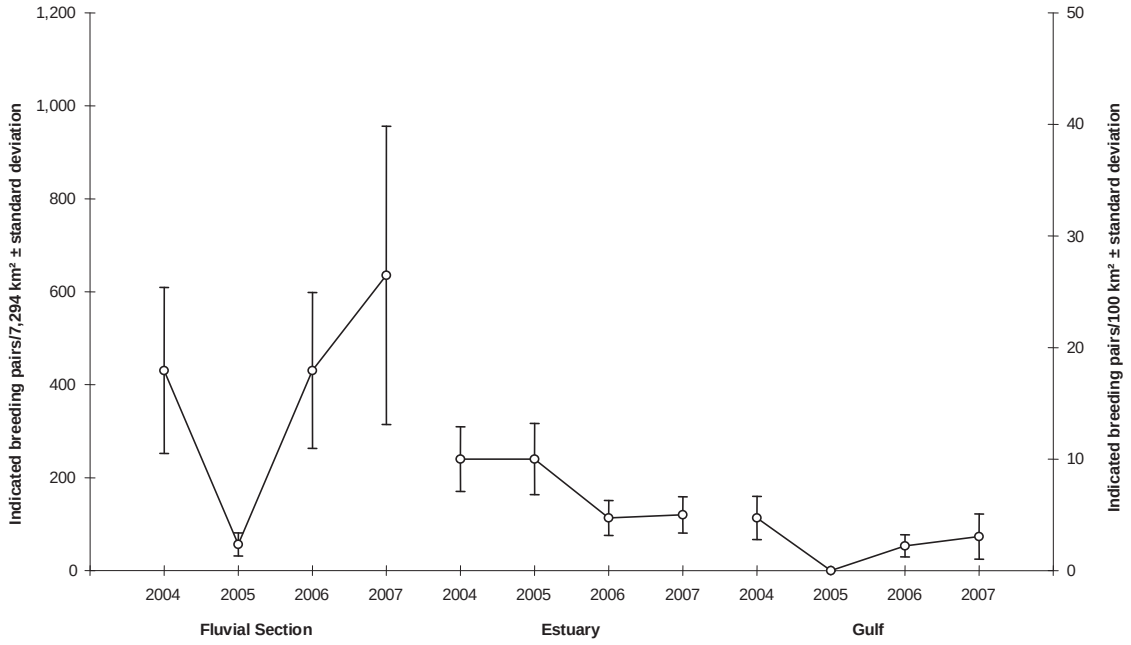
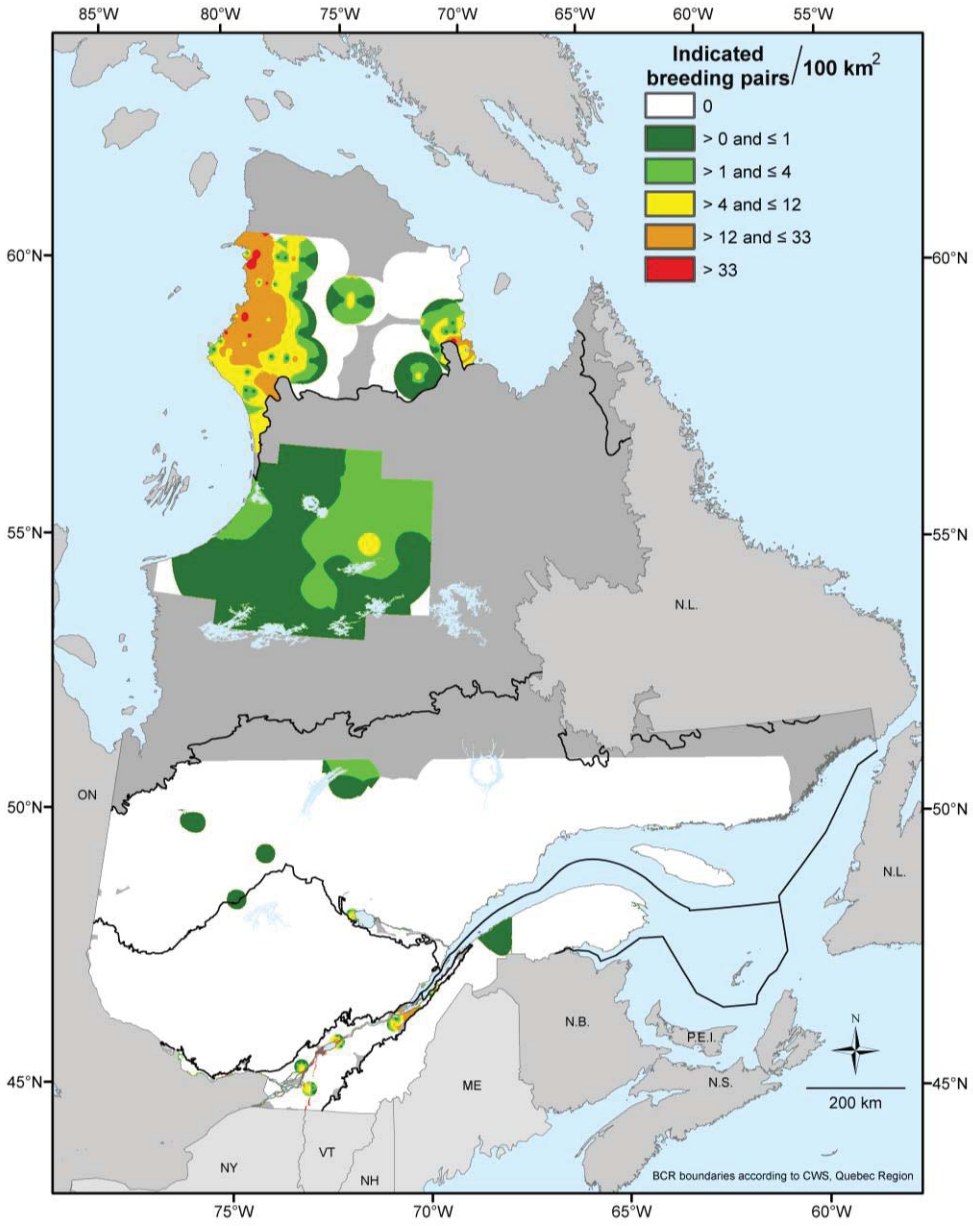


Figure 51. Breeding distribution of the Northern Pintail in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

In spring, flocks of up to 15,000 Northern Pintails can be seen in the flooded fields around Lake Saint-Pierre (Berthierville–Saint-Barthélemy–Maskinongé, BCR 13) (ÉPOQ), while as many as 10,000 birds stop over in Rupert Bay (BCR 7) (Tecsult Environnement Inc. 2004). In fall, flocks of over 10,000 individuals have been observed at Cap Tourmente (BCR 13) (Lehoux et al. 1985), 5,000 individuals around Île aux Grues and 3,500 individuals at Montmagny (BCR 13) (ÉPOQ). These fall staging sites were confirmed using satellite telemetry, which demonstrated in particular the importance of Lake Saint-Pierre as a major stopover site in spring (Malecki et al. 2006). The telemetry studies also identified other spring staging sites farther north in Nunavik, on the west coast of Ungava Bay (particularly on both sides of the Koksoak River)

(BCR 7), along the east coast of Hudson Bay (BCR 3) and also inland, from Minto Lake in the north to the Saindon Lakes farther south (BCR 7) (Malecki et al. 2006).

Wintering

Northern Pintail numbers in Quebec in winter are low. In the CBC, the species was seen for the first time in 1950 in Montréal and, since 1977, has been seen every year (particularly in the Montréal region) (Bannon 2008). Although hundreds of individuals (up to 350) can be observed in the Sainte-Catherine area (Montérégie region; BCR 13) (ÉPOQ), almost all winter records involve 50 individuals or less. The Northern Pintail seems more abundant and widespread in winter now than it was in the past since the estimated winter population along the St. Lawrence from 1974 to 1980 was only 50 individuals annually, all in Lake Saint-Louis (Montérégie region; BCR13) (Lehoux et al. 1985).

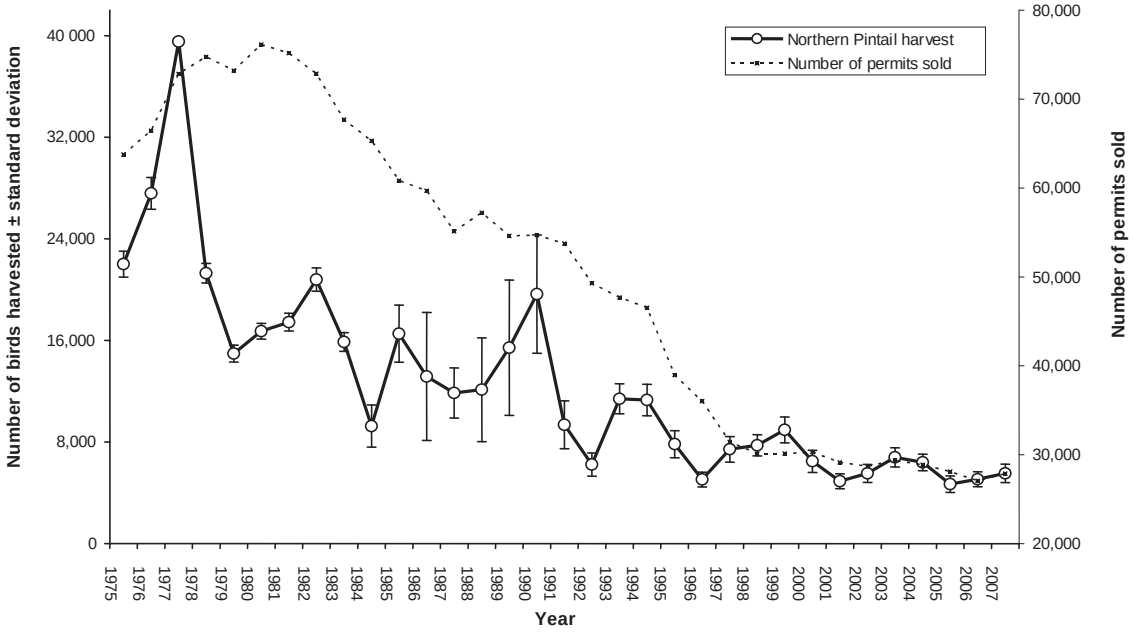
Conservation

There are roughly 3.6 million Northern Pintails in North America, or slightly over half of the estimated world population of 6.4 million individuals. The Quebec population is estimated to be around 72,000 individuals (Table 2). The Northern Pintail is the North American anatid with breeding numbers (average mid-continent breeding population, 1990–2003) that are the furthest below the NAWMP objectives set for the species, except for the Laysan Duck (*Anas laysanensis*), an endangered Hawaiian endemic species (North American Waterfowl Management Plan 2004). In addition, a long-term downward trend (1970–2003) has been found in mid-continent numbers (North American Waterfowl Management Plan 2004). There is not enough survey data in Quebec to determine population trends, but data from along the St. Lawrence shoreline (1990–1992 and 2004–2007) suggests declining numbers (WSHO). A recent survey in the Varennes Islands revealed that Northern Pintails, which represented 18% of the ducks nesting on these islands in 1994, only accounted for 5% in 2007, with the decline in pintails being accompanied by an increase in Mallards and Gadwalls during the same period (Giroux 2007).

Like the Northern Shoveler and Mallard, breeding by the Northern Pintail in Eastern Canada is a relatively recent phenomenon, probably prompted by deforestation and agricultural development. Although the species was already nesting on Anticosti Island at the beginning of the 20th century (Ouellet 1969 in McNicoll and Tardif 1996), the first breeding record in the Montréal region was not obtained until 1946 (Ouellet 1974 in McNicoll and Tardif 1996) and the species' presence on the Magdalen Islands dates back to only 1949 (Hagar 1949 in Fradette 1992).

The Northern Pintail ranked eighth among waterfowl species harvested (and sixth among ducks) in the Quebec sport hunt during the 2003–2007 period (Table 3). The pintail accounted for 1.7% of the Quebec waterfowl harvest (3.2% of ducks), with an annual harvest of 5,700 individuals (2003–2007 average). The decline observed over the years is most likely associated with the parallel decrease in the number of hunters of migratory birds, as is true for most other waterfowl species (Figure 52). On the other hand, the percentage of Northern Pintails in the total duck harvest has changed little from 1975–1999 to 2000–2007 (3.3% versus 2.9%), taking into account the error associated with the estimates (Gendron and Collins 2007). U.S. hunters harvest 18,700 Northern Pintails annually in the Atlantic Flyway (2000–2007 mean) (Padding and Klimstra 2008).

Figure 52. Estimated Northern Pintail sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Quebec's contribution to the conservation of the Northern Pintail in North America during the breeding season is negligible since the province only has 2% of the breeding population (Table 2). However, the species is having difficulties recovering in the centre of the continent and its numbers are far below NAWMP objectives (by roughly 20%). Furthermore, there are no apparent signs of a rebound since the breeding population has been relatively stable for the last 20 years (U.S. Fish and Wildlife Service 2008). Since the population in the Prairies is floundering, Quebec could play a role in conserving the portion of the population that does not use typical Prairie habitats. The situation is different during migration, since Quebec hosts a significant percentage of the population overwintering on the U.S. East Coast and migrating along the Atlantic Flyway (Malecki et al. 2006). Furthermore, it would be prudent to assess Northern Pintail numbers in moulting areas, particularly in northern Quebec. The division of the breeding population in the province into two distinct geographic groups—one southern, using agricultural habitats in the St. Lawrence Valley, and the other northern—makes it possible to carry out a comparative analysis of the species' ecology to determine if the Northern Pintail could serve as a indicator of environmental quality and health. Owing to this split distribution, the species poses significant conservation challenges, which affect both populations: climate change in the north and the industrialization of agriculture and fluctuations in water levels in the St. Lawrence in the south.

4.3.10 Green-winged Teal *Anas crecca carolinensis* (Mr, Br, Wo)

(by Jean Rodrigue and Christine Lepage)

The Green-winged Teal is the smallest dabbling duck in North America. The subspecies found in Quebec is *Anas crecca carolinensis*. There are two other subspecies: *A. c. crecca* in Eurasia and *A. c. nimisa* in the Aleutian Islands; both are very closely related to *A. c. carolinensis* and occasionally occur in North America

(Johnson 1995). Our North American subspecies has a vast breeding range extending from Alaska to Newfoundland and Labrador, including a number of U.S. states along the Canadian border. Unlike many other dabbling ducks, the subspecies' core breeding range is not in the Prairies. The *carolinensis* subspecies winters mainly along the Atlantic and Pacific coasts, in coastal marshes in the Gulf of Mexico, along the Yucatan Peninsula in Mexico, in Cuba, and in the Caribbean (Johnson 1995). It is also found in British Columbia in winter, but rarely in Quebec.

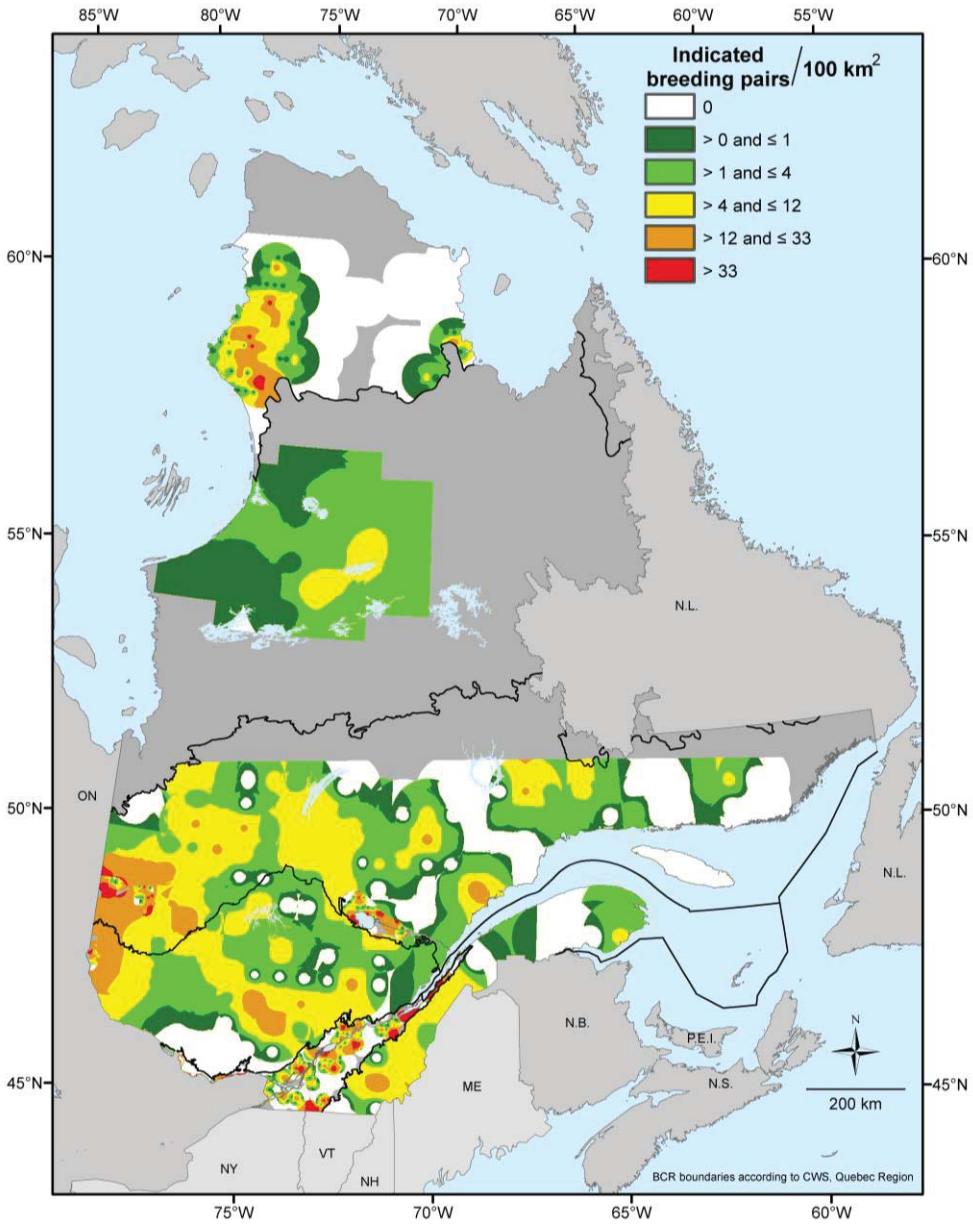
Breeding

The Green-winged Teal has a wide distribution in the province and breeds in all six BCRs, from southern Quebec (BCR 13 and 14) north to Aupaluk (BCR 3) in the east and Akulivik (BCR 3) in the west (Bannon et al. 2002b; ÉPOQ; CWS, unpubl. data). The species is also a common breeder on the Magdalen Islands (BCR 14) (Fradette 1992) and is present on Anticosti Island (BCR 8) (WSHO). Retiring in nature, it seeks out small wetlands with dense vegetation to conceal its nest, including small streams with abundant riparian vegetation, swampy ponds, beaver ponds, marshes and swamps, both in forested and more open areas (Johnson 1995; Moisan 1996). Although the species nests mainly in forest environments, it can also adapt to agricultural environments in southern Quebec, where it frequents farm ponds and ditches.

In the southern part of the province, the highest densities occurred in the Abitibi lowlands (BCR 8) and the fluvial section of the St. Lawrence (BCR 13) (CWS, unpubl. data). Average breeding density in all southern Quebec lowlands was 12.0 IBP/100 km², but 23.0 IBP/100 km² in the Abitibi lowlands (WLOW). In upland areas (WUPL study area = 582,494 km²), average density was roughly 4.0 IBP/100 km², with enclaves of higher density ranging from 12.0 IBP to 30.0 IBP/100 km² in the Abitibi region and the area northwest of Lac Saint-Jean (BCR 8) (CWS, unpubl. data). Average density along the St. Lawrence and its main tributaries was 31.5 IBP/100 km² in the fluvial section (including the Ottawa and Richelieu rivers), with lower values in the estuary and Gulf (10.5 IBP/100 km² and 7.3 IBP/100 km² respectively; 2004–2007) (WSHO).

In the area between the Grande rivière de la Baleine and Petite rivière de la Baleine (Great Whale and Little Whale rivers), breeding densities obtained during surveys in 1989 ranged from 1.0–1.9 broods/100 km² on the inland plateaus to 7.0 broods/100 km² on the coastal strip (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a). In Laforge 1 Reservoir in the centre of the province, breeding densities were estimated at 11.8 broods/25 km² in July 1998 (Morneau 1998), which is quite high. Green-winged Teal broods made up 83% of all the waterfowl broods observed during this survey. The northernmost breeding records are probably nests and broods found between Inukjuak and Akulivik (BCR 3), around the Polemond and Kogaluc rivers, Puvirnituq Lake and Korak River (Bannon et al. 2002b; R. Cotter, CWS, unpubl. data), and also on the coast of Ungava Bay, where a brood was reported at Aupaluk (ÉPOQ). In the eastern part of the province, on the Lower North Shore, two broods were observed on Robertson Reservoir (BCR 8), for an estimated density of 0.3 broods/25 km² (Morneau 1998). Figure 53 shows the distribution of indicated breeding pairs of Green-winged Teals in Quebec according to various surveys and inventories carried out primarily by CWS (see Chapter 3).

Figure 53. Breeding distribution of the Green-winged Teal in Quebec (by indicated breeding pair density); please read the explanatory note at the last paragraph of Section 2.4



Migration

The Green-winged Teal is gregarious outside of breeding season. In both spring and fall, it is sometimes found in considerable numbers (5,000 to 6,000 birds), particularly in the fluvial section (BCR 13) and estuary of the St. Lawrence (BCR 8 and 13), as well as in the Saguenay–Lac-Saint-Jean region (BCR 8) (Cyr 1995f; Moisan 1996; ÉPOQ). In spring, most large flocks are found in the fluvial section (Dundee, Saint-Barthélemy, Baie-du-Febvre), Saguenay–Lac-Saint-Jean region (Saint-Fulgence, Saint-Gédéon, Métabetchouan–Lac-à-la-Croix, Ticouapé River) and along the St. Lawrence estuary, on both the north (Cap Tourmente, Pointe à Boisvert, Sept-Îles Bay) and south

(Cacouna) shores (ÉPOQ). As many as 4,000 birds have been observed during spring migration in Rupert Bay (BCR 7) (Tecsult Environnement Inc. 2004).

In fall, flocks of Green-winged Teals are found in roughly the same areas, but are concentrated in the upper estuary (Cap Tourmente–L'Isle-Verte) and southern part of the lower estuary (L'Isle-Verte–Pointe-au-Père) (ÉPOQ). Although the North Shore region is a little less popular at this time of year, it is not uncommon to see flocks of 1,000–3,000 individuals in the Magdalen Islands (Fradette 1992; ÉPOQ).

Wintering

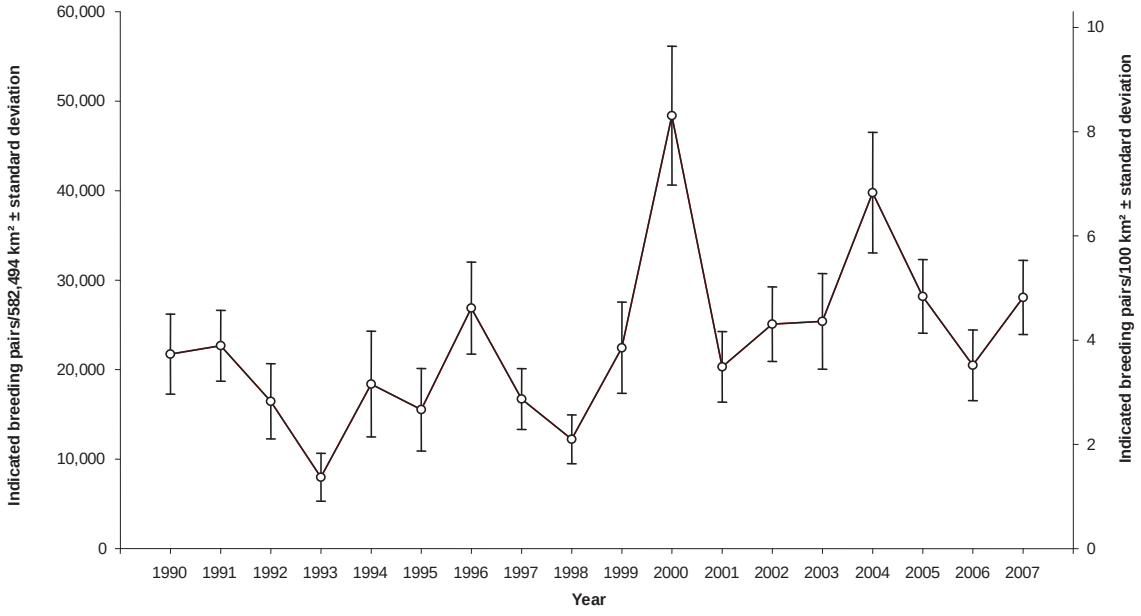
The Green-winged Teal is rarely observed in winter in Quebec, although the number of winter records seems to have been increasing since 1990 (ÉPOQ). Only a few cases of successful overwintering have been reported, involving one or two individuals (BCR 8 and 13): in the Montréal region in 1995 and 1996 (Bannon 2008); in Beauport in 2002 (Bannon et al. 2002c); in Québec City and Laval in 2003 (Bannon et al. 2003b); in Labrecque in the Lac-Saint-Jean region in 2004 (Bannon et al. 2004b); and in Bécancour in 2006 (Bannon et al. 2006c).

Conservation

The estimated size of the Green-winged Teal breeding population in North America is roughly 3.9 million individuals (Table 2) and is on the increase (U.S. Fish and Wildlife Service 2008; North American Waterfowl Management Plan 2004). Nearly 80% of this population breeds in Canada (Johnson 1995). It should be remembered that the species' core breeding range is not in the Prairies as it is for many other dabbling ducks. The southern Quebec population is estimated at around 35,000 breeding pairs (Table 2): 27,300 in the uplands, 4,800 in the lowlands and 2,000–3,000 along the St. Lawrence (WUPL, WLOW and WSHO; Bordage and Lepage 2002). The estimated population in the northern half of the province (BCR 3 and 7) is 27,000 breeding pairs. This makes a total of close to 151,000 individuals in the province as a whole (Table 2).

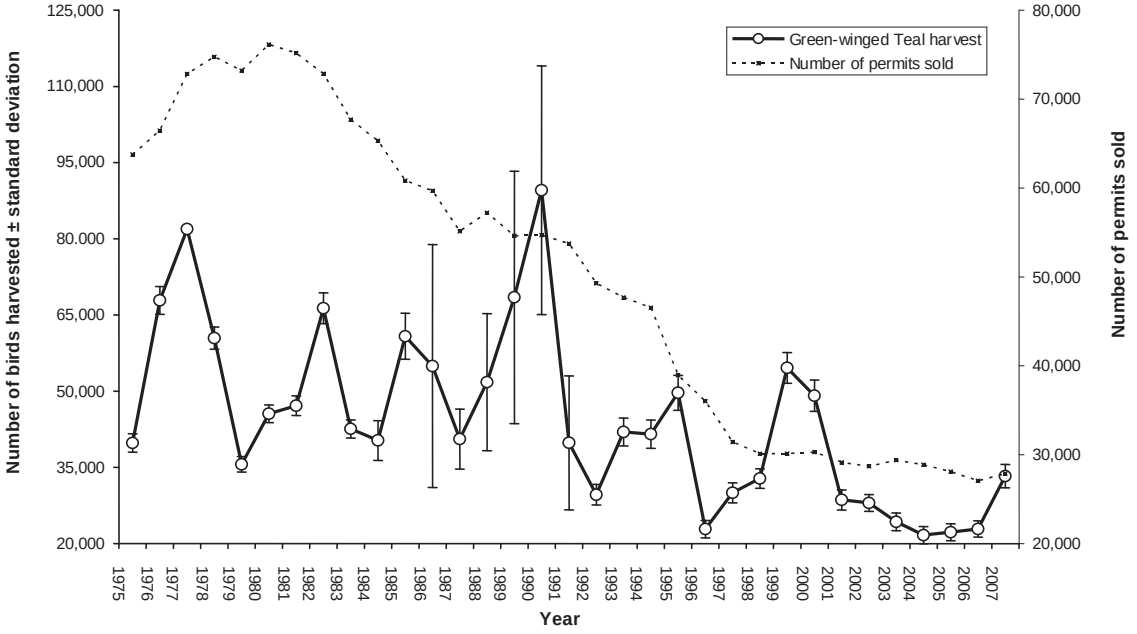
According to long-term data from WUPL, the breeding population in upland areas of southern Quebec increased significantly (average annual increase of 4.7%) between 1990 and 2003 (Figure 54) (BWPSEC; CWS, unpubl. data). On a regional scale, significant increases were observed in BCR 12 (12.0% annually) and BCR 8 (3.2% annually) during the 1990–2007 period (Lepage et al., in prep.). In the Abitibi lowlands, where the species is abundant, the average breeding density increased from 16.4 IBP/100 km² (or roughly 900 breeding pairs) in 1998–1999 to 26.3 IBP/100 km² (nearly 1,400 breeding pairs) in 2004–2007 (WLOW).

Figure 54. Trends in the Green-winged Teal breeding population in Southern Quebec uplands, 1990–2007 (WUPL data); total number of indicated breeding pairs (left axis) and density per 100 km² (right axis)



The Green-winged Teal is the second most commonly harvested duck in North America, with roughly 1.5 million individuals bagged in 2004, outranked only by the Mallard (Serie and Raftovich 2005; Gendron and Collins 2007). In the Atlantic Flyway, hunters shot 158,300 teals a year on average in 2000–2007, compared with 217,400 in 1999–2000 (Serie and Raftovich 2005). Quebec has the largest harvest among the Canadian provinces (Gendron and Collins 2007). The Green-winged Teal ranked third in the sport harvest of ducks in Quebec in 2003–2007 (nearly 25,000 birds killed annually on average), behind Mallard and American Black Duck, accounting for 7% of all waterfowl harvested in the province (Table 3; Figure 55).

Figure 55. Estimated Green-winged Teal sport harvest in Quebec and number of Migratory Game Bird Hunting Permits sold, 1975–2007 (data taken from Gendron and Collins 2007)



Since it is a widespread and fairly uniformly distributed breeder in forest habitats, as well as in wetlands with good vegetation cover, particularly more remote and less accessible ones, populations do not appear to face any specific conservation threats. The species is prized by hunters, but due to the constantly diminishing number of the latter, the harvest is not of concern in Quebec (Figure 55). To conclude, the Quebec population of the Green-winged Teal, which is reasonably abundant and widely distributed in the province, seems to be doing well and consequently does not raise any serious conservation concerns; this population also represents only 4% of the total North American population (Table 2).

4.4 Diving ducks (Aythyini)

(by Christine Lepage)

The Aythyini tribe consists of “freshwater” diving ducks, although most species spend as much time in brackish-water or saltwater habitats as they do in freshwater, particularly during the winter. Members of this tribe feed on plant materials and aquatic invertebrates by diving below the surface. It is represented by five species regularly observed in Quebec (Table 2). All breed in the province except for the Canvasback, which is present mainly during migration. The Canvasback and Redhead are associated with the Prairies and are present only in small numbers in Quebec, while the other three species have a more widespread distribution in the province. Retiring in nature, the Greater Scaup and Lesser Scaup breed mainly in the northern half of Quebec, although they have small populations in the rest of the province, the former in the Magdalen Islands and the latter in southwestern Quebec. The Ring-necked Duck is the only Aythyini that has a fairly continuous and uniform distribution in both the mixed and boreal forests of Quebec, and that is present in large numbers in the province.