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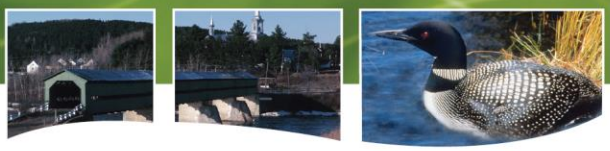

Quebec Waterfowl Conservation Plan, 2011

Christine Lepage, Daniel Bordage, Diane Dauphin, François Bolduc and Benoît Audet

Quebec Region

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QUEBEC WATERFOWL CONSERVATION PLAN, 2011

Christine Lepage, Daniel Bordage, Diane Dauphin, François Bolduc and Benoît Audet[1]

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Abstract

The specific objectives of the *Quebec Waterfowl Conservation Plan, 2011* are to: (1) determine priority species in each Bird Conservation Region (BCR); (2) set population objectives for these species; (3) assess the issues affecting, and the needs of, priority species; (4) set measurable conservation objectives for these species; (5) recommend actions to be taken to conserve these species; and (6) identify the best habitats to be targeted for conservation measures.

In spring, **BCR 13** (Lower Great Lakes/St. Lawrence Plain) is frequented by over **2.3 million** migrating ducks, geese and swans, belonging to 34 different species. A total of 19 species of waterfowl nest here (**43,500 pairs**), including many dabbling ducks associated with the island habitats in the fluvial section of the St. Lawrence. Since this BCR is the most populated one in Quebec, waterfowl living here are affected by many different issues, mainly related to land use and natural resource exploitation. This BCR has 3 high-priority species (**American Black Duck, Blue-winged Teal** and **Brant**), 5 medium-priority species and 2 species that are the target of special management measures.

BCR 14 (Atlantic Northern Forest) is host to 29 waterfowl species during spring migration, with a spring flight of roughly **1.8 million** individuals. A total of 18 species breed here (around **70,000 pairs**), including Common Eider, which nests in numerous colonies in the BCR. Conservation issues here tend to be linked to the marine environment, which makes up a large proportion of the territory. The BCR has 4 high-priority waterfowl species (**Common Eider, American Black Duck, Harlequin Duck** and **Brant**) and 6 medium-priority species.

BCR 12 (Boreal Hardwood Transition), which is predominantly forested, has fewer spring migrants than the 2 BCRs farther south, owing to its small proportion of coastline. Consequently, although 26 species migrate through the BCR, the spring flight consists of **fewer than 1.0 million** individuals. On the other hand, breeding waterfowl are abundant here, with close to **180,000 breeding pairs**. Cavity-nesting species are plentiful, owing to the numerous beaver ponds, among other things. The main conservation issues in BCR 12 are population growth and the exploitation of forest resources. Three (3) high-priority species are found here (**American Black Duck, Hooded Merganser** and **Barrow's Goldeneye**), as well as 2 medium-priority species.

Owing to its large number of breeding species and species diversity, **BCR 8** (Boreal Softwood Shield) is of considerable importance to waterfowl in the province. It hosts close to **3.0 million** migrating individuals in spring, belonging to 31 different species. In terms of breeding ducks and geese, nearly **390,000 pairs** nest here, including 18% of the population of the *dresseri* subspecies of the Common Eider and 90% of the Eastern Population of Barrow's Goldeneye. Conservation issues in this BCR mainly involve natural resource exploitation. Four (4) high-priority species occur here (**Barrow's Goldeneye, American Black Duck, Common Eider** and **Hooded Merganser**) and 8 medium-priority species.

BCR 7 (Taiga Shield and Hudson Plains), with its open forests and myriad ponds, hosts nearly **3.1 million** migrating individuals belonging to 26 different species. Breeding waterfowl species total 21 (around **320,000 pairs**) and include many sea ducks, as well as 75% of the Eastern Population of the Harlequin Duck. The BCR's strong potential for natural resource exploitation is the main issue facing waterfowl. Three (3) species have high conservation priority (**Harlequin Duck, American Black Duck** and **Brant**) and 4have medium priority.

Despite its far-northern location and character and the fact that it has the lowest species diversity of all the BCRs—only 15 species during spring migration (**2.2 million individuals**) and 12 breeding species—**BCR 3** (Arctic Plains and Mountains) has the largest number of breeding pairs of waterfowl in Quebec, around **470,000 pairs**. Nearly 75% of the Atlantic Population of the Canada Goose breeds here along with several species of sea ducks. Climate change and potential natural resource exploitation are the main issues to be monitored in this BCR. Three (3) species are high priority (**Canada Goose, Common Eider** and **Red-breasted Merganser**), while 4 are medium priority.

Résumé

Les objectifs spécifiques du *Plan de conservation de la sauvagine du Québec, 2011* sont de : 1) déterminer les espèces prioritaires de chaque Région de conservation des oiseaux (RCO); 2) établir des objectifs de population pour ces espèces; 3) évaluer les enjeux et les besoins de ces espèces; 4) établir des objectifs de conservation mesurables pour ces espèces; 5) recommander des actions à prendre pour la conservation de ces espèces; et 6) identifier les meilleurs habitats destinés à des mesures de conservation.

La **RCO 13** (Plaine du Saint-Laurent et des lacs Ontario et Érié) est fréquentée par plus de **2,3 millions** d'individus migrateurs de sauvagine provenant de 34 espèces différentes au printemps. Dix-neuf espèces de sauvagine y nichent (**43 500 couples**), dont de nombreux canards barboteurs associés aux milieux insulaires du tronçon fluvial du Saint-Laurent. Cette RCO étant la plus peuplée, la sauvagine qui y vit fait face à de nombreux enjeux, surtout liés à l'aménagement du territoire et à l'exploitation des ressouces naturelles. Trois espèces de sauvagine sont de priorité élevée (**Canard noir, Sarcelle à ailes bleues et Bernache cravant**), cinq de priorité moyenne et deux font l'objet d'une gestion particulière.

La **RCO 14** (Forêt septentrionale de l'Atlantique) est l'hôte de 29 espèces de sauvagine au moment de la migration printanière, pour un contingent d'environ **1,8 millions** d'individus. Dix-huit espèces de sauvagine y nichent (**70 000 couples** environ), dont l'Eider à duvet en nombreuses colonies. Les enjeux de cette RCO sont davantage liés au milieu marin, ce dernier occupant une grande proportion du territoire. Quatre espèces de sauvagine ont une priorité élevée (**Eider à duvet, Canard noir, Arlequin plongeur et Bernache cravant**) et six espèces une priorité moyenne.

La **RCO 12** (Forêt boréale mixte), principalement forestière, accueille moins de migrateurs printaniers que les deux RCO plus au sud, en raison de la faible proportion de côtes. Ainsi, 26 espèces de sauvagine y migrent, mais **moins d'un million** d'individus y transitent. En revanche, la sauvagine nicheuse y est bien présente, avec près de **180 000 couples**. Les espèces cavicoles nicheuses y abondent, entre autres à cause des nombreux étangs de castors. Les enjeux principaux de la RCO 12 sont l'accroissement démographique et l'exploitation des ressources forestières. Trois espèces de sauvagine y ont une priorité élevée (**Canard noir, Harle couronné et Garrot d'Islande**) et deux espèces une priorité moyenne.

Grâce à son grand nombre de nicheurs et à sa diversité d'espèces, la **RCO 8** (Forêt boréale coniférienne) revêt une importance considérable pour la sauvagine du Québec. Elle accueille près de **3 millions** d'individus migrateurs au printemps, qui appartiennent à 31 espèces. Quant aux oies, bernaches et canards nicheurs, c'est près de **390 000 couples** qui y font leur nid, dont 18 % de la sous-espèce d'Eider à duvet *dresseri* et 90 % de la population de l'Est du Garrot d'Islande. Les enjeux de cette RCO touchent surtout l'exploitation des ressources naturelles. Quatre espèces de sauvagine sont de priorité élevée (**Garrot d'Islande, Canard noir, Eider à duvet et Harle couronné**) et huit de priorité moyenne.

La **RCO 7** (Taïga du Bouclier et plaine hudsonienne) présente des forêts claires et de nombreux plans d'eau, qui accueillent près de **3,1 millions** d'individus migrateurs, provenant de 26 espèces de sauvagine. Vingt-et-une espèces y nichent (**320 000 couples** environ), dont plusieurs de canards de mer, et 75 % de la population de l'Est de l'Arlequin plongeur. Le fort potentiel d'exploitation des ressources naturelles est le principal enjeu auquel fait face la sauvagine. Trois espèces de sauvagine y ont une priorité élevée (**Arlequin plongeur, Canard noir et Bernache cravant**) et quatre espèces une priorité moyenne.

Malgré son caractère nordique et le fait qu'elle accueille une plus faible diversité d'espèces, soit 15 au moment de la migration printanière (**2,2 millions** d'individus) et 12 en nidification, la **RCO 3** (Plaine et cordillère arctiques) est l'hôte du plus important nombre de couples nicheurs au Québec, soit **470 000 couples** environ. Près de 75 % de la population de l'Atlantique de la Bernache du Canada y niche, ainsi que plusieurs espèces de canards de mer. Les changements climatiques et le potentiel d'exploitation des ressources naturelles sont les principaux enjeux à surveiller dans cette RCO. Trois espèces de sauvagine sont de priorité élevée (**Bernache du Canada, Eider à duvet et Harle huppé**), quatre de priorité moyenne.

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List of acronyms and abbreviations

AGJV	Arctic Goose Joint Venture
AMEERP	Avian Mortality Events Emergency Response Plan (CWS)
AOU	American Ornithologists' Union
ATLAS	Atlas of the Breeding Birds of Southern Quebec
BBS	Breeding Bird Survey
BCR	Bird conservation region
BDJV	Black Duck Joint Venture
BGTWS	Barrow's Goldeneye Triennial Winter Survey
BIOMQ	Banque informatisée des colonies d'oiseaux de mer du Québec (QC Seabird Database)
BWPSEC	Breeding Waterfowl Plot Survey of Eastern Canada
CBC	Christmas Bird Count
CETWS	Common Eider Triennial Winter Survey
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service, Environment Canada
CWSWC	Canadian Wildlife Service Waterfowl Committee
DFO	Fisheries and Oceans Canada
EC	Environment Canada
EHJV	Eastern Habitat Joint Venture
ENGO	Environmental non-governmental organization
ÉPOQ	Études des populations d'oiseaux du Québec (Study of Bird Populations in Quebec)
GSGOS	Greater Snow Goose Spring Survey
IBP	Indicated breeding pair
IJC	International Joint Commission
MAMROT	Ministère des Affaires municipales, des Régions et de l'Occupation du territoire[2] (Quebec)
MAPAQ	Ministère de l'Agriculture, des Pêcheries et de l'Alimentation (Quebec)
MBS	Migratory Bird Sanctuary
MDDEP	Ministère du Développement durable, de l'Environnement et des Parcs[2] (Quebec)
MDNR	Maryland Department of Natural Resources
MRC	Municipalité régionale de comté (regional county municipality)
MRNF	Ministère des Ressources naturelles et de la Faune[2] (Quebec)
MTQ	Ministère des Transports (Quebec)
NABCI	North American Bird Conservation Initiative
NAWMP	North American Waterfowl Management Plan
NWA	National Wildlife Area
OSERP	Oil Spill Emergency Response Plan (CWS)
SARA	*Species at Risk Act*
SDJV	Sea Duck Joint Venture
SLAP	St. Lawrence Action Plan
SOS-POP	Suivi de l'occupation des stations de nidification – Populations d'oiseaux en péril du Québec (Monitoring Nest Sites of Species at Risk)
S&T	Science and Technology, Environment Canada
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WGA	Waterfowl Gathering Area (Aire de concentration d'oiseaux aquatiques)
WLOW	Waterfowl Survey of Southern Quebec Lowlands
WNOR	Waterfowl Survey of Northern Quebec
WSHO	Waterfowl Survey of the St. Lawrence Shoreline
WUPL	Waterfowl Survey of Southern Quebec Uplands
ZEC	Zone d'exploitation contrôlée (controlled harvesting zone)

[2] At the time of printing, MAMROT has been designated Affaires municipales et Occupation du territoire, MDDEP has been turned into Développement durable, Environnement et Lutte contre les changements climatiques, and MRNF has been renamed Forêts, Faune et Parcs as well as Énergie et Ressources naturelles.

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1. Introduction

1.1 Context

Birds are certainly one of the most visible components of North American biodiversity. Avian biodiversity—as an essential link in the food chain and due to the key role it plays in biological control, pollination, seed dispersal and other activities—actively contributes to the proper functioning of ecosystems. Consequently, owing to their visibility, vital ecological role, and the sheer extent and diversity of the habitats they use, birds are excellent indicators of ecosystem health. Lastly, birds also perform important social, economic and cultural functions (sport hunting, birdwatching and bird feeding, among others).

The North American Bird Conservation Initiative (NABCI) was signed in 1999 by Canada, the United States and Mexico. The objective of this initiative is to preserve the diversity and abundance of all North American birds by strengthening the effectiveness of current and future conservation initiatives, improving the coordination of efforts at different geographical and political scales, and using sound science and effective management programs as the basis of conservation efforts. NABCI integrates and coordinates conservation initiatives for the four bird groups (waterfowl, shorebirds, waterbirds and landbirds) by using bird conservation regions (BCRs) as a geographic framework and as conservation planning units.

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

Because of its legal mandate to conserve migratory birds, Environment Canada plays a vital role within NABCI. Consequently, in 2003, the Quebec Region of the Canadian Wildlife Service (CWS) formulated a five-year action plan (2003–2008) to establish a solid foundation for implementing NABCI in the province (Bélanger et al. 2003). According to the action plan, the first major step in this process is acquiring a sound biological basis; "the achievement of NABCI goals relies largely on the preparation of international, national and regional conservation plans for the four bird groups". Furthermore, "these plans will identify the biological priorities (priority species and geographic zones), the common threats and the conservation strategies". The description of the biological basis ends with the statement that knowledge acquisition and population monitoring requirements will be determined (Bélanger et al. 2003). This is the context and basis of the *Quebec Waterfowl Conservation Plan, 2011.*

The *Quebec Waterfowl Conservation Plan, 2011* is addressed to all those concerned with waterfowl conservation, including:

- government officials responsible for wildlife conservation, and land and resource planning and development authorities
- project proponents, biological consultants and participants in the environmental assessment process
- stakeholders from environmental non-governmental organizations (ENGOs)
- scientists and volunteers (citizen scientists) involved in waterfowl research, management and monitoring projects
- sport hunters, Aboriginal people and members of the public who want to learn more about waterfowl conservation and would like to take concrete action to support waterfowl conservation in their communities

Lastly, the term *waterfowl*, which is used frequently in this document, is synonymous with anatids (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). Waterfowl, or the family Anatidae, include the subfamilies Anserinae (geese and swans) and Anatinae (ducks).

1.2 Objectives of the *Quebec Waterfowl Conservation Plan, 2011*

The *Quebec Waterfowl Conservation Plan, 2011* has the following objectives:

- to determine priority species in each BCR
- to establish population objectives for priority species
- to assess the issues affecting, and the needs of, priority species
- to set measurable conservation objectives to help conserve priority species or groups of species
- to recommend actions to be taken to conserve priority species
- to identify types of habitat where conservation measures will be the most useful

The information provided in the Plan is intended to help guide waterfowl conservation initiatives in Quebec. The goal is to create a genuine synergy between all conservation actions, particularly those undertaken:

- under conservation plans for other bird groups—landbirds, waterbirds (i.e., other than waterfowl) and shorebirds
- by the Quebec government, ENGOs, private enterprise and private citizens
- continental programs, including the North American Waterfowl Management Plan (NAWMP) and NABCI

Birds are excellent indicators of the general health of our environment, and their migrations require us to think globally. Working to achieve sound management of bird populations for future generations will ensure a better environment for everyone.

It should be emphasized, however, that the Plan is not an end in itself but instead part of an ongoing process. The Plan will evolve along with advances in our knowledge, the state of the environment and the status of bird populations, in accordance with the principles of adaptive management, which must be "used right from the start of the biological planning in order to rapidly detect the unforeseen contingencies and regard them as learning opportunities" (Bélanger et al. 2003). We suggest reassessing on a regular basis the status of populations of priority species in relation to the objectives set out in this document.

Lastly, it should be noted that the authors of the Plan have recommended actions in response to conservation issues raised concerning waterfowl, regardless of the areas of authority and capacities of the stakeholders involved. It is up to the individual stakeholders to adapt these measures or use them to inspire their own actions, in accordance with their capacities and as they see fit. Under no circumstances do the authors wish to cast aspersions on the actions, roles or responsibilities of the stakeholders involved in managing and protecting waterfowl and their habitats, but rather to simply provide the information required by all so that they can contribute to the conservation of this group of birds.

1.3 *Status of Quebec Waterfowl Populations, 2009*

To compile all the information required for the *Quebec Waterfowl Conservation Plan, 2011,* we first had to take stock of the current knowledge on geese, swans and ducks, which resulted in the publication of *Status of Quebec Waterfowl Populations, 2009* (Lepage and Bordage 2013). This document, which was drafted before the Plan, provides a detailed picture of each of the 37 species of waterfowl that occur regularly in Quebec during the breeding, migration and wintering seasons. It contains the information that provides the biological basis of the Plan and is an essential complement to the Plan. Therefore, we invite readers interested in the Plan to consult the *Status of Quebec Waterfowl Populations, 2009*.

1.4 North American Waterfowl Management Plan

To allow readers to better understand the context of the *Quebec Waterfowl Conservation Plan, 2011,* a brief introduction to the NAWMP is required. Signed in 1986 by Canada and the United States, and then by Mexico in 1994 (North American Waterfowl Management Plan 1986; Plan nord-américain de gestion de la sauvagine 2002), NAWMP has put waterfowl managers in the forefront of continental conservation initiatives, and its success has inspired efforts involving other bird groups, with managers adopting a similar structure. Since its creation, NAWMP has been updated three times (1994, 1998 and 2004), with the next update planned in 2012.

In the 1998 update of NAWMP, the need to adopt a universal conservation approach for all bird species regardless of group was emphasized, which in turn has changed the way waterfowl is managed. The new approach to waterfowl management is based on landscape-level conservation instead of the previous emphasis on site-specific habitat protection (North American Waterfowl Management Plan 1998). In the most recent update, this *landscape approach* is defined as "a set of conservation strategies, applied at an ecoregional level, that considers the interaction of all relevant sociological, economic, and environmental factors to ensure that conservation investments produce incremental and sustainable accomplishments toward Plan objectives" (North American Waterfowl Management Plan 2004b).

The purpose of the NAWMP is to sustain abundant waterfowl populations by conserving landscapes through partnerships that are guided by sound science.

In its 2004 update, NAWMP set out continental objectives for waterfowl populations and species prioritization (North American Waterfowl Management Plan 2004a). According to the update, population objectives serve three main functions: (1) they move NAWMP beyond the concept of wetland conservation by grounding it in the explicit terms of species conservation; (2) they provide a framework for regional planning and for gauging the success of conservation actions; and (3) they can be compared with monitoring results, thus providing an objective assessment of the status of North American waterfowl. Although population objectives set by NAWMP use a different scale than the one in this document, the organization's species prioritization exercise was carried out at the BCR scale, differing only slightly from the methodology used in this document. The difference between the two methodologies boils down to the number of parameters used. The prioritization of species under NAWMP was based on only two parameters: continental population trends and the harvest rate for the species (North American Waterfowl Management Plan 2004a). For example, although Mallard populations are healthy at the continental scale, the Mallard is a priority species according to NAWMP criteria, based on

the high harvest rate for the species. In this document, we decided to use a set of nine parameters for each species, including harvest rates, but these rates were given no more value than the other parameters used, which we believe are equally important (see section 2.5 for the prioritization method used and Appendix 16.2 for the criteria and scoring system).

NAWMP is implemented through a series of joint ventures, which bring together various partners to tackle specific problems. The joint ventures focus on specific geographic regions (habitat joint ventures) or waterfowl species (or groups of species) requiring special attention (species joint ventures). Four joint ventures are of particular importance in Quebec: the Eastern Habitat Joint Venture (Plan conjoint des habitats de l'Est 2009), Black Duck Joint Venture (Black Duck Joint Venture 2008a), Arctic Goose Joint Venture (Arctic Goose Joint Venture 2008) and Sea Duck Joint Venture (Sea Duck Joint Venture 2009).

1.4.1 Eastern Habitat Joint Venture

The Eastern Habitat Joint Venture (EHJV), which is active in the six eastern provinces (from Ontario to Newfoundland and Labrador), was established in 1989 to address critical issues affecting waterfowl in eastern Canada (Plan conjoint des habitats de l'Est 2009). Although, in the beginning, EHJV activities focused on protecting and restoring habitats used by waterfowl during migration, waterfowl managers observed that the main limiting factor on waterfowl populations in Eastern Canada was the lack of high-quality brood-rearing habitat. EHJV conservation activities are based on the following premises: (1) nesting habitat (including the availability of snags for cavity-nesting species) and the quality and quantity of brood-rearing habitat are the main limiting factors on species recruitment; (2) habitats used during migration and moulting are subject to a wide range of anthropogenic pressures and need protection and restoration; and (3) although wintering habitat is crucial for certain local populations, particularly those of Barrow's Goldeneye[3] and American Black Duck, the conservation issues faced by species at this time of year are rarely linked to habitat characteristics (Eastern Habitat Joint Venture 2007).

The main objective of the EHJV is to preserve and restore wetlands in Eastern Canada.

Current EHJV partners in Quebec include Ducks Unlimited Canada–Quebec Region, Ministère des Ressources naturelles et de la Faune, Environment Canada–Canadian Wildlife Service–Quebec Region, Ministère du Développement durable, de l'Environnement et des Parcs, Nature Conservancy of Canada–Quebec Region and Fondation de la faune du Québec. EHJV objectives in Quebec include: (1) promoting the large-scale conservation of wetlands by changing provincial and municipal land-use, agricultural and forest management policies; (2) protecting, by the strategic acquisition of land and servitudes and the conclusion of protection agreements, remaining wetlands and nearby upland areas threatened by urban, industrial and agricultural development; and (3) restoring and enhancing the most degraded wetlands and those with a high ecological value. Since the launching of the EHJV in Quebec, over 130 projects involving wetlands (involving the restoration of 8,000 ha and the protection of 22,000 ha) have been completed (Eastern Habitat Joint Venture 2008).

In its Quebec Implementation and Evaluation Plan, 2007–2012 (Eastern Habitat Joint Venture 2007), the Quebec Region of the EHJV specified how habitat and waterfowl objectives could be achieved through various conservation programs. The document—which provides an overview and assessment of the changes in habitats and waterfowl populations that have occurred, along with an analysis of priority sites and the status of waterfowl populations and a list of proposed

[3] See Appendix 16.3 for a list of English and scientific names of species cited in this document.

conservation measures—obviously complements the *Quebec Waterfowl Conservation Plan, 2011*. However, the species prioritization and population objectives recommended in our Plan differ from those in the EHJV document (Eastern Habitat Joint Venture 2007) in that a more exhaustive analysis was made of the existing data for each BCR in our Plan. Therefore, even though roughly the same databases were used to set population objectives (see section 2.2.2), the calculation methods differed somewhat. In our opinion, the priority species and population objectives presented in our Plan are based on the most rigorous criteria and consequently should be adopted in future conservation exercises. However, the habitat conservation strategies proposed in the EHJV report (government policies at the provincial level, stewardship at the regional level, and enhancement and management at the local level) are extremely valuable and clearly relevant to the *Quebec Waterfowl Conservation Plan, 2011*, and consequently we will not duplicate the EHJV's efforts in this area. Above all, the main difference between our Plan and the EHJV plan is our overriding emphasis on birds rather than habitats.

1.4.2 Black Duck Joint Venture

The mission of the BDJV is to implement and coordinate a cooperative population monitoring, research and communications program to provide information required to manage the American Black Duck and restore numbers to the NAWMP goal of 640,000 breeding birds in the species' core breeding range.

One of NAWMP's initial findings was that continental American Black Duck populations were declining, despite reductions in daily bag limits for the species in the United States and Canada in the early 1980s. To help counter this decline, the Black Duck Joint Venture (BDJV) was established in 1989 to promote and coordinate the collection of data on the species through surveys and banding and research programs.

According to the Black Duck Joint Venture Strategic Plan 2008–2013, the population monitoring and banding programs are well established and, with a few adjustments over the years, are providing useful data for guiding management measures and research (Black Duck Joint Venture Management Board 2008). The research program emphasizes four priority areas: (1) quantification of regional nutritional carrying capacity on seasonal ranges; (2) development of adaptive harvest management models; (3) identification and quantification of sources of heterogeneity in band reporting rates; and (4) quantification of productivity rates and identification of the causes of the apparent decline in American Black Duck productivity.

The BDJV has had numerous spinoffs in Quebec. For example, the Waterfowl Survey of Southern Quebec Uplands (formerly the BDJV annual survey), a helicopter survey, was implemented in 1990 in response to BDJV recommendations. This survey provides information on population trends, abundance and distribution, not only for the American Black Duck but also for many other species of waterfowl and waterbirds. Secondly, 11 banding stations have been established all over the province, allowing American Black Ducks and other dabbling ducks to be banded. The data obtained is used to determine distribution in relation to harvests and harvest rates by sport hunters, as well as survival rates and age structures in the populations sampled. Lastly, BDJV funds a wide range of ongoing research projects in the province, including a project to assess the importance of certain landscape characteristics in American Black Duck abundance in forested environments and a study on the possibility of using stable isotope analysis to determine individuals' natal area (Black Duck Joint Venture 2008a).

1.4.3 Arctic Goose Joint Venture

The objective of the AGJV is to foster more scientific research on Arctic geese and improve the management of geese populations in the Arctic.

The Arctic Goose Joint Venture (AGJV) was established in 1989 to encourage research on, and the monitoring of, goose populations breeding in the Arctic, subarctic and boreal regions in order to improve population management (Arctic Goose Joint Venture 2008). Like the BDJV, the AGJV supports banding, survey and research programs.

According to the AGJV's 2008–2012 strategic plan, many challenges remain in managing geese populations. Issues that still need to be resolved according to specialists include the degradation of breeding habitats; the effects of climate change; the impacts of resource development, which could very likely intensify in the Arctic; the consequences of changing agricultural practices; and the assessment of the Aboriginal harvest (Arctic Goose Joint Venture Technical Committee 2008). The strategic plan also contains fact sheets on management issues for each of the 28 populations of the 7 species of geese that occur in North America.

In Quebec, AGJV activities focus mainly on three species: Canada Goose (Atlantic Population, North Atlantic Population and Atlantic Flyway Resident Population), Snow Goose (Greater subspecies) and Brant (Atlantic Population). Snow Goose surveys are carried out in the species' spring staging areas (GSGOS), and most individuals are banded on Bylot Island, in Nunavut. In addition, the two populations of Canada Geese that breed in Nunavik are surveyed in June on their breeding grounds (WNOR), and banding is carried out later in the summer. Brant, which breed in the Arctic and pass through Quebec during spring and fall migration (like the Greater Snow Goose), have received less attention than the other two goose species, although a telemetry study on Brant was carried out in 2002 and 2003, and surveys of the species were conducted in the St. Lawrence estuary and along the coast of James Bay (New Jersey Division of Fish and Wildlife 2003). The Greater Snow Goose is considered to be overabundant, requiring the implementation of special management measures (Bélanger and Lefebvre 2006). Various AGJV projects are underway in the province, targeting the Canada Goose as well as the Snow Goose (Arctic Goose Joint Venture 2008).

1.4.4 Sea Duck Joint Venture

The SDJV promotes the conservation of North American sea ducks through partnerships by providing greater knowledge and understanding for effective management.

When the NAWMP was drafted in 1986, no particular attention was paid to sea ducks, probably because of the lack of interest shown in these birds by hunters. Furthermore, information on this group was scarce, and managers believed that populations of the 15 species of sea ducks in North America were stable. However, studies and surveys carried out in the 1990s showed that populations of 10 of these species were declining. In addition, 2 species that occur in eastern North America, Barrow's Goldeneye and Harlequin Duck, were designated species of special concern under the federal *Species at Risk Act*. It was against this backdrop that the Sea Duck Joint Venture (SDJV) was created in 1998 (Sea Duck Joint Venture 2009).

The SDJV's 2008–2012 strategic plan (Sea Duck Joint Venture Management Board 2008) identified the following research priorities for sea ducks to increase our knowledge of this group of birds: development of effective population survey techniques, delineation of populations (geographically and temporally), study of population dynamics, improvement of harvest surveys, identification of important habitats and documentation of biological impacts of contaminants,

parasites and diseases. The document also provides a list of priority conservation actions to be taken for each of the 15 species of sea ducks, some of which have multiple populations.

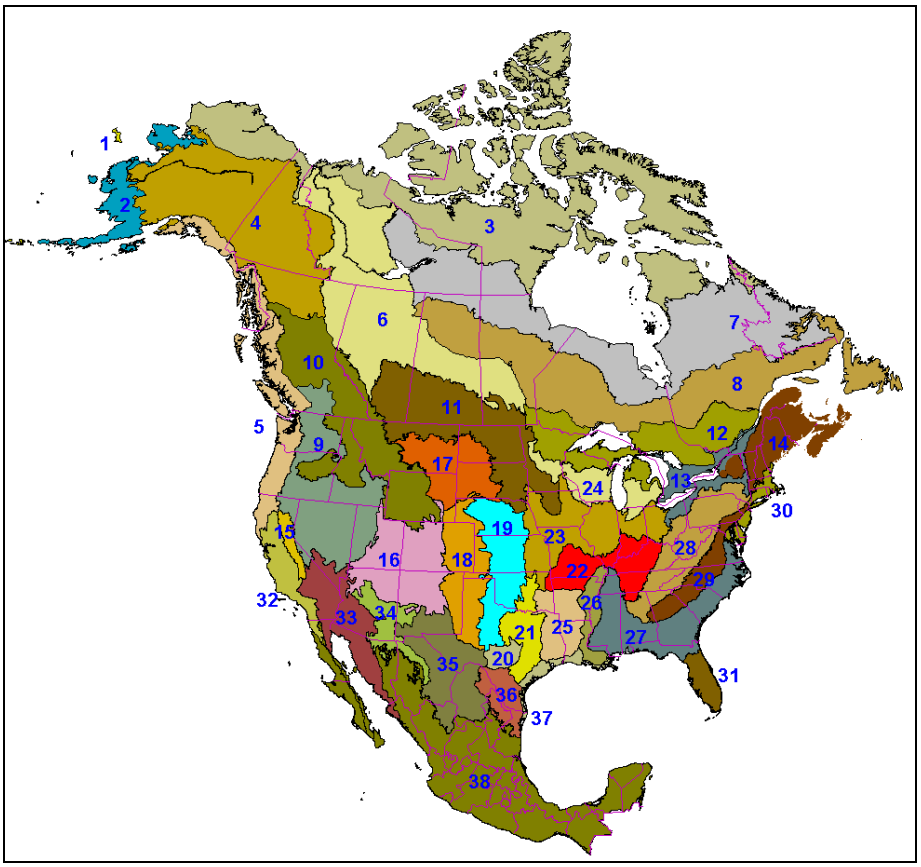
Since 13 of the 15 species targeted by the SDJV occur in Quebec, this strategic plan is of great importance in obtaining a better understanding of sea duck populations in the province and maintaining population levels. Most of the 13 species breeding in Quebec also overwinter here, and in the spring and fall, sea ducks are among the most abundant birds in the estuary and Gulf of St. Lawrence. Under the SDJV, the Barrow's Goldeneye Triennial Winter Survey (BGTWS) and Common Eider Triennial Winter Survey (CETWS) were instituted in the province and Common Eider colonies in the estuary and Gulf continue to be monitored regularly. In addition, the SDJV has provided substantial support in the delineation of the Eastern Population of Barrow's Goldeneye.

2. Methodology

2.1 Bird conservation regions

NABCI uses BCRs as a geographical framework for facilitating the planning of bird conservation efforts. BCRs were drawn up to reflect major ecosystems in North America rather than political boundaries, in order to encourage coordinated conservation efforts in the case of species with distributions that straddle political borders. In Canada, the boundaries of the BCRs generally match those of the ecozones and ecoregions in the federal government's national hierarchical classification system of ecosystems (Ressources naturelles Canada 2009a). There are over 35 BCRs in North America; Canada has 12 and Quebec has 6 (Figure 1).

Figure 1. Bird conservation regions in North America

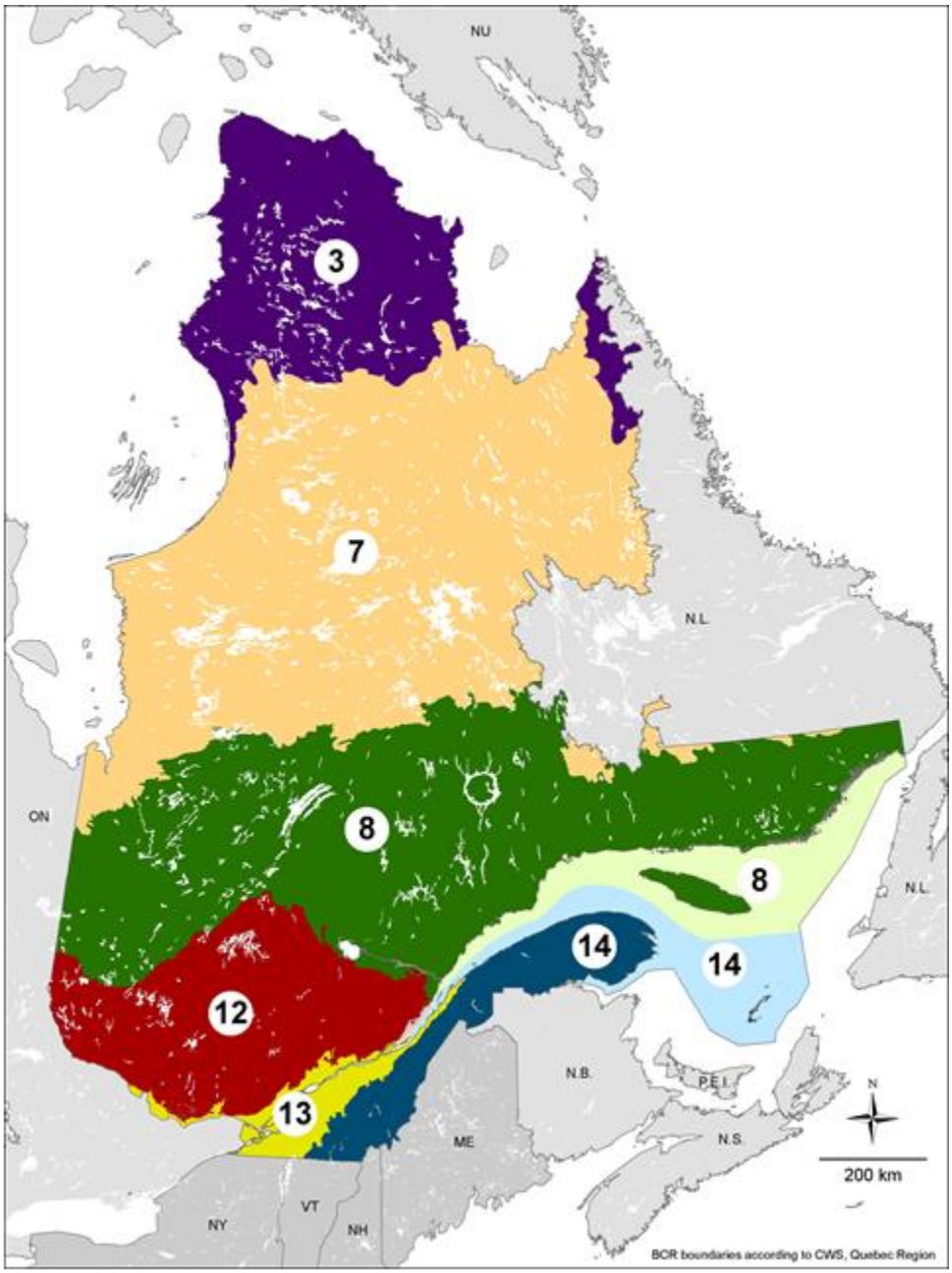


As Figure 1 shows, none of the BCRs in Quebec lies exclusively within the province. Consequently, at the Northern American and Canadian scales, the Quebec portions of the BCRs are considered to be “subregional” units (with each BCR representing a regional unit).

From south to north, the BCRs found in Quebec consist of (Figure 2):

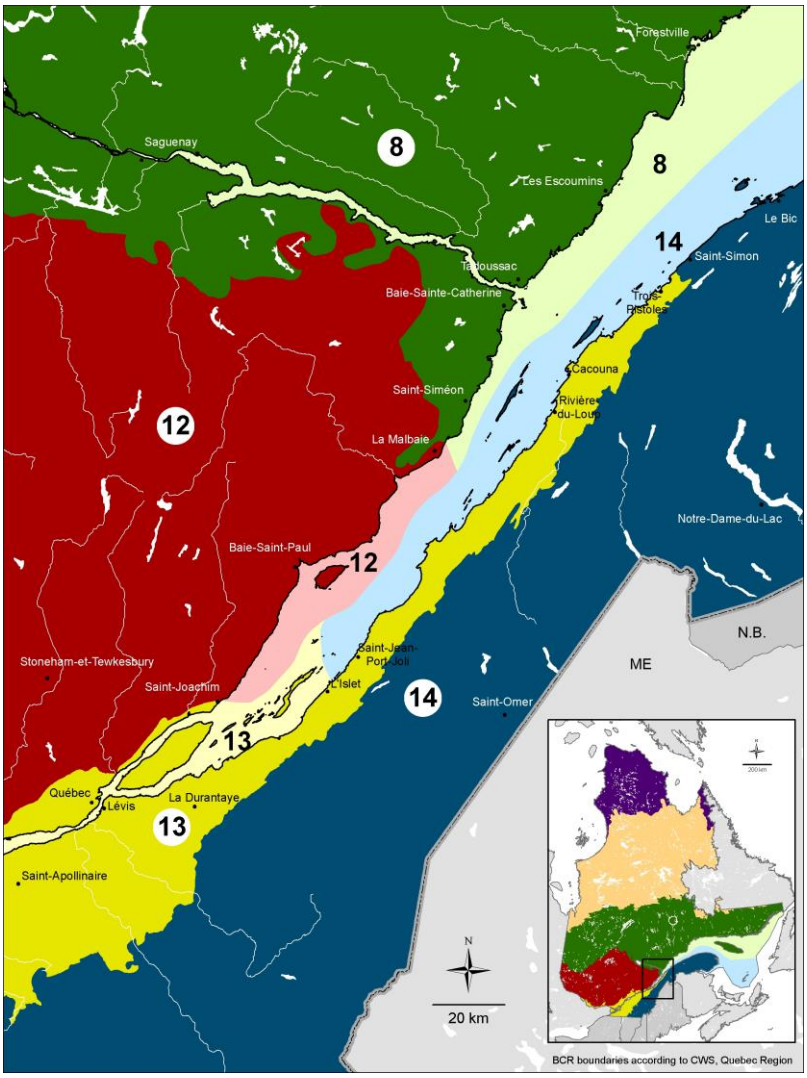
- Lower Great Lakes/St. Lawrence Plain (BCR 13, covered in Chapter 4 of this document)
- Atlantic Northern Forest (BCR 14; Chapter 5)
- Boreal Hardwood Transition (BCR 12; Chapter 6)
- Boreal Softwood Shield (BCR 8; Chapter 7)
- Taiga Shield and Hudson Plains (BCR 7; Chapter 8)
- Arctic Plains and Mountains (BCR 3; Chapter 9).

Figure 2. Bird conservation regions in Quebec



The Quebec Region of the Canadian Wildlife Service reviewed the boundaries of each BCR in the province to ensure that they were as accurate as possible (1:50,000 scale) and were representative of the land within their boundaries. The intersection of four BCRs in the St. Lawrence estuary was particularly problematic, and their boundaries had to be redrawn slightly. We extended the boundary of BCR 13 on land eastward so that it better represented the St. Lawrence lowlands and reassigned the islands in the southern side of the estuary (east of Îles aux Loups Marins) to BCR 14, since their characteristics corresponded more to that BCR than to the lowlands in BCR 13 (Figure 3).

Figure 3. Intersection of BCRs 13, 14, 12 and 8 in the St. Lawrence estuary



The *Quebec Waterfowl Conservation Plan, 2011* provides an analysis of the waterfowl species in each of the province's six BCRs. Chapters 4 to 9 contain a description of the individual BCRs, including an overview of the landscape, the waterfowl species present and their use of the BCR, issues affecting waterfowl, priority waterfowl species and, lastly, proposed conservation objectives and actions for the priority species present.

2.2 Data sources

2.2.1 Species occurrence

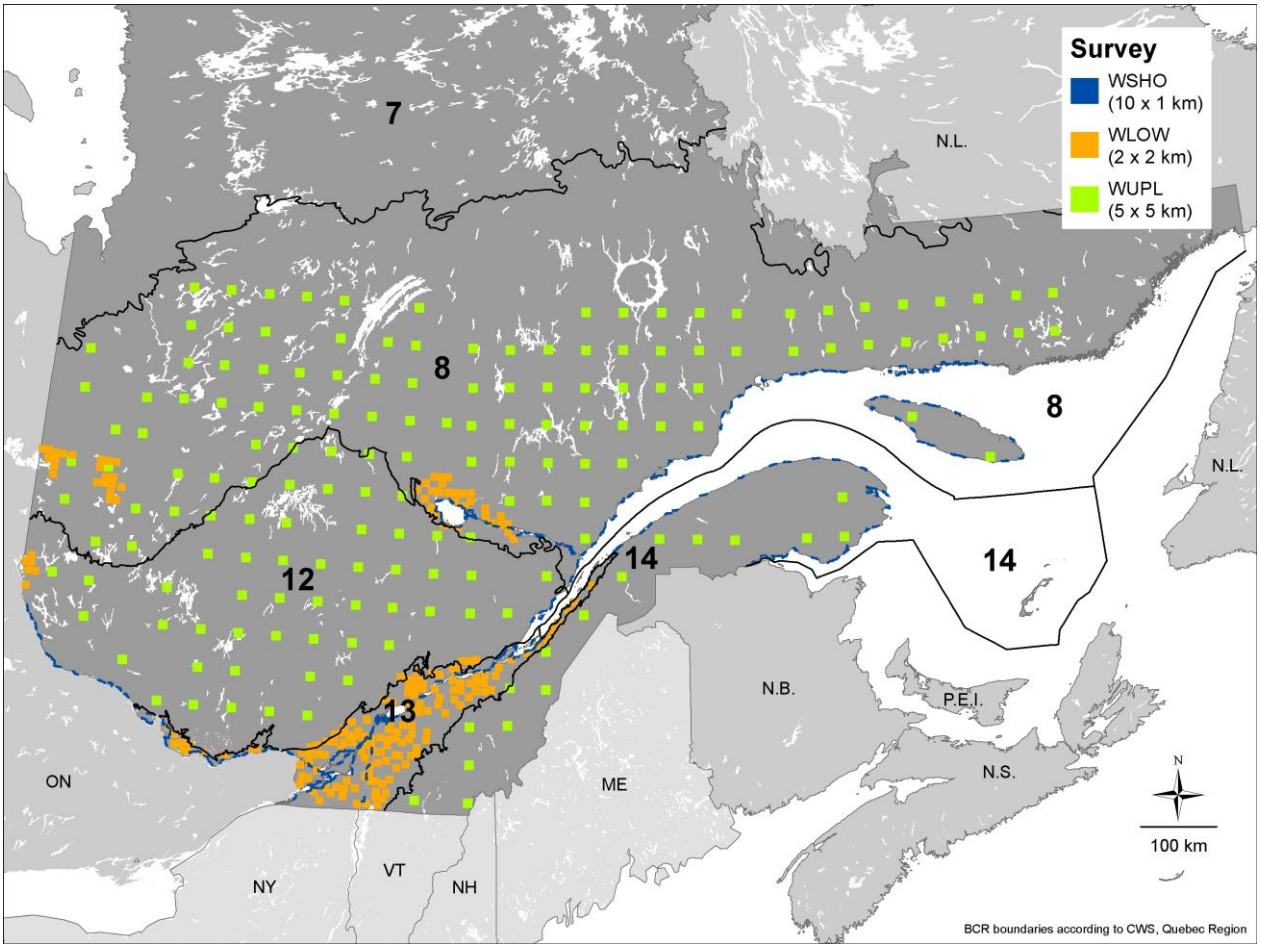
A number of different databases were used to compile the list of waterfowl species that occur regularly (every year) in each BCR by season: ÉPOQ, Waterfowl Survey of Southern Quebec Uplands (WUPL), Waterfowl Survey of Southern Quebec Lowlands (WLOW), Waterfowl Survey of the St. Lawrence Shoreline (WSHO), Waterfowl Survey of Northern Quebec (WNOR), *Atlas of the Breeding Birds of Southern Quebec* (Gauthier and Aubry 1996) and the *Atlas saisonnier des*

oiseaux du Québec (Cyr and Larivée 1995). Other sources used to document species occurrence are listed in the notes at the end of each BCR table (tables 2 to 7).

2.2.2 Breeding populations

Three annual CWS waterfowl surveys, which complement one another, provide coverage of the BCRs in the southern half of Quebec (BCRs 13, 14, 12 and 8) (Figure 4): WUPL (conducted since 1990), WLOW (since 2004) and WSHO[4] (2004–2010). These three surveys are carried out each spring and provide data on population trends, abundance and the distribution of breeding pairs (see *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013] for more information on the surveys). The numbers for breeding populations in the southern BCRs were derived from the data from these surveys, unless otherwise indicated in the BCR tables. Since each BCR was covered by at least two surveys, the total breeding population in each BCR was calculated by totalling the data from all the surveys conducted there (e.g., in BCR 13, WLOW and WSHO).

Figure 4. CWS waterfowl surveys in the southern half of Quebec (figures correspond to BCR numbers)

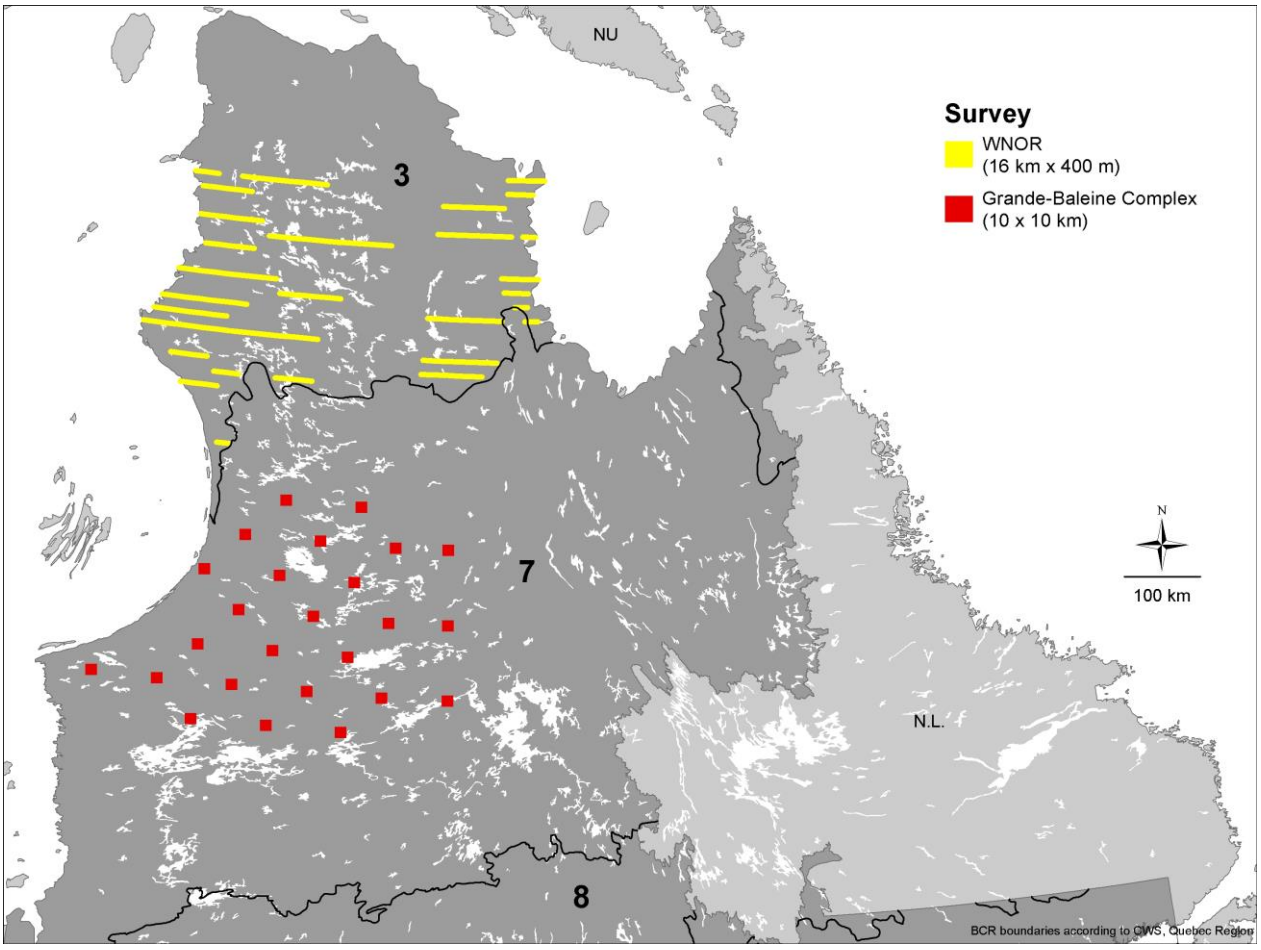


[4] The WSHO was stopped in 2010.

For BCR 7, which is not covered in any regular CWS survey, we decided to use the data from a waterfowl survey carried out in 1991 in the region around the Grande-Baleine Complex (Figure 5; see *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013] for details on this survey), since the methodology used was similar to that of regular CWS surveys and the results are therefore more likely to be comparable with those of other CWS surveys in the southern part of the province. Since the aforementioned survey was only carried out in a single year, it provides information strictly on numbers and distribution in the BCR and cannot be used to obtain information on trends in breeding pair numbers.

Lastly, in BCR 3, data from WNOR (conducted since 1993) were used (Figure 5). The main difference between WNOR and the CWS surveys in southern Quebec is that WNOR involves transects covered by fixed-wing aircraft while the other surveys use plots covered by helicopter (see *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013] for more information on this survey). Consequently, we had to make a few modifications (including the introduction of a visibility correction factor) to ensure that WNOR data were comparable with WUPL, WLOW and WSHO data.

Figure 5. CWS waterfowl monitoring and surveys in the northern half of Quebec (figures correspond to BCR numbers)



2.2.3 Numbers of migrants

The data used to calculate breeding pair numbers (section 2.2.2) (from the five CWS surveys and the Grande-Baleine Complex waterfowl survey) were also used to calculate the number of migrating individuals. Calculation methods are described in section 2.3.3. However, in the case of Snow Geese, data from the GSGOS were used. Other sources of data taken into account are indicated in the footnotes to the BCR tables.

2.2.4 Numbers of moulting birds

Since no regular surveys have targeted moulting waterfowl, data on this group are scarce and very local in nature. A few CWS studies have been carried out on moulting waterfowl: Common Eider (Rail and Savard 2003), scoters (Rail and Savard 2003) and Harlequin Duck (Gilliland et al. 2002). Sources for numbers of moulting waterfowl are indicated in the footnotes to the BCR tables.

2.2.5 Winter numbers

Data on numbers of overwintering waterfowl in the BCRs come mainly from the following sources: *Recensement des canards hivernant dans la région de Montréal* (survey on overwintering ducks in the Montréal region) (BCR 13; Bannon 2008), Common Eider Triennial Winter Survey (CETWS; BCR 14 and BCR 8) and the Barrow's Goldeneye Triennial Winter Survey (BGTWS; BCR 12, 14 and 8). Other data sources for numbers of wintering waterfowl are indicated in the footnotes to the BCR tables.

2.3 Calculation of objectives, breeding populations and populations of migrants

2.3.1 Population objectives

For each BCR, we calculated a population objective for each species in which CWS regularly monitors populations. Population objectives most often involve the species' breeding population, although they may sometimes apply to the population of migrants or wintering birds, depending on the timing of the survey that provides information on the species. Generally, these objectives correspond to the population in 2000, since this was the year that most waterfowl populations in the boreal forest in southern Quebec reached peak abundance (see numbers on species population trends in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]). Since WUPL and WNOR are the only two CWS surveys carried out in 2000, for the other surveys, we chose the year closest to 2000 in which data were available—2004 for WSHO and WLOW. For the BCRs in southern Quebec that are covered by more than one survey (BCR 13, 14, 12 and 8; see Figure 4), objectives were calculated by totalling the numbers from each survey (in the baseline year of 2000 or 2004). Unless indicated otherwise in the footnotes to the BCR table, population objectives are expressed in indicated breeding pairs and were calculated as follows:

- BCR 13: total of breeding numbers obtained in WLOW in 2004 and WSHO in 2004
- BCR 14: total of breeding numbers obtained in WUPL in 2000 and WSHO in 2004
- BCR 12 and 8: total of breeding numbers obtained in WUPL in 2000, WLOW in 2004 and WSHO in 2004
- BCR 7: no objectives, since no regular surveys have been conducted in this BCR
- BCR 3: median of breeding numbers obtained in WNOR during the 2004–2006 period

2.3.2 Breeding populations

For the BCRs in southern Quebec, estimates of breeding populations were calculated independently for WLOW, WUPL and WSHO based on the 2004–2007 means. Then, depending

on the number of surveys covering each BCR, the results of three surveys (BCR 8 and BCR 12) or two surveys (BCR 14: WUPL and WLOW; BCR 13: WLOW and WSHO) were combined. Annual population estimates for most species were calculated using equations allowing a stratified random sample to be analyzed (Cochran 1977: p. 89); in the case of species for which the results of the stratified analysis were unsatisfactory (sample too small, coefficient of variation too high), a simple mean expansion was used.

For BCR 7, we estimated population numbers using a simple mean expansion per km² based on the data from the Grande-Baleine Complex waterfowl survey. For BCR 3, population estimates were based on the mean of the 2004–2006 estimates from WNOR data. Estimates were calculated using a separate stratified ratio estimator (Cochran 1977: p. 164). In addition, numbers for all species (except Tundra Swan, Canada Goose and Snow Goose [Lesser subspecies]) were multiplied by 2.5 to take account of the fixed wing: helicopter correction factor (see section 2.3 in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]). This factor was applied to ensure that population data from WNOR were comparable with data from the other Quebec surveys, which are done by helicopter.

In summary, unless otherwise noted in the footnotes to the BCR tables, breeding populations are expressed in indicated breeding pairs and were calculated as follows:

- BCR 13: total of 2004–2007 means from WLOW and WSHO
- BCR 14: total of 2004–2007 means from WUPL and WSHO
- BCRs 12 and 8: total of 2004–2007 means from WUPL, WLOW and WSHO
- BCR 7: total number from Grande-Baleine Complex waterfowl survey in 1991
- BCR 3: 2004–2006 mean from WNOR

Breeding density was calculated using a simple rule of three based on the breeding population and area of the BCR. Breeding density is expressed as the number of indicated breeding pairs per 100 km² and was calculated as follows:

- BCR 13: average of mean densities in 2004–2007 from WLOW and WSHO
- BCR 14: average of mean densities in 2004–2007 from WUPL and WSHO
- BCRs 12 and 8: average of mean densities in 2004–2007 from WUPL, WLOW and WSHO
- BCR 7: mean densities obtained in the 1991 Grande-Baleine Complex waterfowl survey
- BCR 3: mean density in 2004–2006 from WNOR

Both intra- and interannual variations were taken into account in calculating long-term trends in breeding populations. The trend calculation methodology used is described in detail in section 7.3 of Appendix 7 of the article *Black Duck Joint Venture waterfowl breeding pair survey program in eastern Canada, 1990–2003* (Bateman et al. in prep.). Trends are expressed as a percentage representing the mean annual increase or decrease and were calculated as follows:

- BCR 13: breeding population trends based on 2004–2007 WLOW and WSHO data
- BCRs 14, 12 and 8: breeding population trends based on 1990–2007 WUPL data
- BCR 7: trends were not calculated since regular monitoring was not carried out (only in 1991)
- BCR 3: breeding population trends based on the slope of the trend line for the 1993–2006 WNOR data

2.3.3 Numbers of migrants

The basic premise underlying the calculation of numbers of individual migrants in spring is as follows: a certain proportion of individuals breeding in BCR 3 first migrate through BCR 13, 14,

12, 8 and 7 to reach their breeding grounds, while individuals breeding in BCR 8 pass through BCR 13, 14 and 12, and so on. For example, to calculate the number of individuals migrating through BCR 13, we took 100% of the breeding population in this BCR, along with 100% of the population in BCR 12, 50% of the population in BCR 8, 50% of the population in BCR 7 and 50% of the population in BCR 3; we believe that this is a realistic estimate of the number of birds that pass through BCR 13 in spring. To estimate the numbers in each BCR, we used the breeding population data (in indicated breeding pairs) for the BCR and multiplied it by 2 to obtain the number of individuals and then applied a conversion factor in order to obtain the total number of breeding and nonbreeding individuals present in the BCR at that time of the year. (The conversion factors—0.67 for geese; 0.10 for dabbling ducks; 0.63 for diving ducks; and 0.56 for sea ducks—are based on estimations of the ratio of males to females and the proportion of birds of breeding age in the total population gleaned from a review of the species accounts for waterfowl in *Birds of North America.*) However, if the BCR in question is south of other BCRs, the numbers of birds in the BCRs north of it must also be added since these birds must pass through the more southerly BCR to reach their breeding grounds to the north. Here is an example of how the number of migrating American Black Ducks in BCR 8 is calculated:

(number in BCR 8) + (number in BCR 7) + (number in BCR 3) =
(breeding population in BCR 8 * 2.1) + (breeding population in BCR 7 * 2.1) + (breeding population in BCR 3 * 2.1) =
(93,840 * 2.1) + (42,885 * 2.1) + (27,703 * 2.1) =
(197,064) + (90,059) + (58,176) =
345,000 individual American Black Duck migrants in BCR 8 (rounded off to the closest thousand)

We did not estimate the number of fall migrants. Although this information (often referred to as the fall flight) would be very useful in managing waterfowl for the sport harvest, the lack of valid data for almost all species prevented us from obtaining realistic estimates of numbers of fall migrants. To do this successfully would have required estimating annual productivity in each of the regions surveyed since we do not currently have this information. Then, we would have to calculate the number of migrants in a given BCR based on assumptions made about distribution similar to the ones we used for the spring. However, even in the few species for which fairly reliable indices of productivity are available (e.g., Greater Snow Goose and the Atlantic Population of Canada Goose), significant annual and regional variations in these indices limit their usefulness in providing representative numbers of fall migrants by BCR.

2.4 Use of bird conservation regions by waterfowl

In the sections on the use of each BCR by waterfowl, only species that occur regularly in the BCR are listed. A regular species is defined as one that occurs every year in the BCR during the period in question (migration, breeding, moulting or wintering). For example, although according to ÉPOQ, the Greater Scaup has bred occasionally in BCR 13 (in 1994, 2000 and 2003), the species does not appear on the list of regular breeders for this BCR because it did not breed there every year (see section 4.3.2).

In order to compile as much information as possible at the BCR scale, the BCR tables show not only regular species but also those considered to be occasional (observed every two to five years), exceptional (species that may go unobserved for a number of years) or probable (indicated breeding pairs observed during the breeding season). In the tables, species are listed in descending order according to population size during the breeding season in the case of regular breeders, followed by other breeding species ("yes," occasional, exceptional or probable

breeding status), which, because they do not have a population size, are listed in taxonomic order, and then by non-breeding species ("no" breeding status), also listed in taxonomic order.

2.5 Determination of priority species

One of the main objectives of this conservation plan was to designate priority waterfowl species in each BCR in Quebec, in order to focus conservation efforts on the species needing the most attention. Various attempts have been made at prioritizing species since NABCI was founded. Prioritization was tried at the BCR (regional) scale at international meetings (Canada and the U.S.) held in 2001 and 2002 to begin planning conservation actions in BCR 13 and 14 (Bélanger et al. 2003). However, most of the data required had not yet been compiled and the resulting prioritization was based mainly on expert opinion. Subsequently, NAWMP carried out its own species prioritization effort (on the continental scale) in its 2004 strategic plan (North American Waterfowl Management Plan 2004a), and the EHJV has also prioritized species (at the "subregional" scale of Quebec; Eastern Habitat Joint Venture 2007).

Although presenting a new prioritization of waterfowl species in the Quebec BCRs may be a little awkward in this context, we stand behind our list. Our prioritization is founded on a rigorous analysis of CWS data, allowing us to obtain a list of priority species based on the interpretation, involving largely objective criteria, of scientific data that are comparable across BCRs. Above all, we believe that it is crucial to take account of the distinctive characteristics (abundance, population trends, threats faced and others) of waterfowl species at the Quebec scale, to ensure an accurate result. Prioritization was a two-step process, involving an initial objective interpretation (based on nine criteria), followed by a subjective review of the results by waterfowl experts (expert opinion). The nine criteria used to carry out the initial prioritization of waterfowl species in each BCR comprised:

1) The species' abundance in North America (taken from the North American Waterfowl Management Plan 2004a)
2) The relative proportion of the species' breeding population in the BCR in relation to its total North American breeding population
3) The relative proportion of the species' breeding population in the BCR in relation to its breeding population in Quebec
4) Breeding population trend for the species in the BCR
5) North American distribution of the species and the range of habitats it occupies
6) Size of the harvest of the species in Quebec and in the Atlantic Flyway (United States) in relation to the North American population of the species
7) Number of migrants of the species in the BCR in relation to the North American population of the species
8) Size of the population of the species that moults in the BCR in relation to the North American population of the species
9) Size of the winter population of the species in the BCR in relation to the North American population

Up to 3 points can be awarded per criterion (see Appendix 16.2 for details), for a maximum of 27 total points. Species were ranked according to their final point total (all 9 criteria), with those obtaining the most points considered priority species. We then reviewed the prioritization obtained and made slight modifications in the following 2 cases: (1) to favour certain species that do not breed in the BCR (three of the criteria involve breeding populations and give an advantage to breeding species) but occur in significant numbers in the BCR during migration

(e.g., Brant in BCR 13) or in winter (e.g., Long-tailed Duck in BCR 14); or (2) to penalize species considered to be priority species according to our criteria but that should not be, in our opinion, either because the BCR is not of significant importance to them (e.g., American Black Duck in BCR 3), or because the species raises no conservation concerns in the BCR (e.g., Ring-necked Duck in BCR 8).

2.6 Determination of conservation actions and objectives

Once the priority species were determined, we determined a conservation objective for each species or, in the case of species with the same requirements and concerns, each group of species. In general, the objective is related to the period when the species occurs in the BCR. For example, the conservation objective may be a breeding population objective to be achieved (e.g., Hooded Merganser in BCR 12), a winter population objective to be achieved (e.g., *borealis* subspecies of the Common Eider in BCR 8), maintaining the ecological integrity of a species' staging grounds (e.g., eelgrass beds for Brant in BCR 14) or protecting foraging areas used by the species during migration (e.g., Greater and Lesser scaup in BCR 13). For some priority species, the objective is to institute a survey of the breeding population (e.g., Harlequin Duck in BCR 7), since the size of the population in the BCR is basically unknown.

Conservation actions were determined based on information and recommendations from a number of CWS and Environment Canada–Science and Technology (EC–S&T) biologists. In addition, many management plans (e.g., Harlequin Duck and Barrow's Goldeneye), action plans (e.g., Greater Snow Goose) and strategic plans (e.g., BDJV, SDJV and AGJV) were consulted. It is important to note that the list of actions under each objective is not exhaustive but concentrates on actions with the highest priority that can be realistically achieved.

3. Main issues related to waterfowl conservation

3.1 Introduction

Any human activity that directly or indirectly influences waterfowl reproduction and survival rates will also have an impact on the size of waterfowl populations. This occurs when human activities encroach on waterfowl habitat or affect the way in which these habitats allow waterfowl populations to survive. The greatest issues tend to arise in the most densely populated regions of Quebec, particularly the St. Lawrence Valley. Therefore, it is natural that our knowledge of these issues will be the greatest in these regions, except in the case of natural resource exploitation.

Issues in waterfowl conservation mainly involve the conservation of wetlands, since wetlands are critical for most waterfowl species, particularly for foraging. Wetlands face significant anthropogenic pressures, and wetland losses in some regions of Canada have been estimated at between 65% and 80%, particularly in southern Canada (National Wetlands Working Group 1988). For example, 42% of wetlands along the St. Lawrence River were lost between 1945 and 1975 (Dryade 1981). In addition, from 58% to 88% of wetlands near Quebec's large urban areas have been converted (Kessel-Taylor 1984). Wetland conversion occurs when wetlands are drained for agricultural or urban development, filled in to construct various infrastructures or used for natural resource exploitation, or disappear as a result of the modification of water regimes.

Waterfowl species that are more dependent on marine habitats like sea ducks face issues involving the development of oil, gas or fishery resources. Oil and gas exploitation activities seem destined to become a major issue, particularly in the Gulf of St. Lawrence, as shown by the Quebec government's establishment of a strategic environmental assessment program to provide a framework for oil and gas exploration and development activities in the marine environment (Gouvernement du Québec 2009b).

Lastly, certain issues, which impinge on flying wildlife in general—including bats as well as birds—involve tall structures such as wind turbines, telecommunication towers and transmission lines.

Chapter 3 describes the main conservation issues affecting waterfowl and their associated environmental impacts, as well as recommended mitigation measures. This list is far from exhaustive, and we have limited our discussion to the issues that we believe are the most important. Some of these issues will be brought up again in the texts on the individual BCRs, to provide additional information at the regional level, including descriptions and statistics for the BCR in question.

3.2 Main conservation issues

3.2.1 Urban development

Human population growth has significant repercussions on the environment and wildlife habitats, particularly wetlands, which are often filled in or drained. In addition, industrial and residential development regularly encroaches on wildlife habitat. Urban sprawl (the densification of peri-urban areas) is particularly prevalent in the St. Lawrence Valley.

Housing subdivision in the northern suburbs of Trois-Rivières. Photo: Christine Lepage © CWS

Environmental impacts on waterfowl:
- Loss of wetlands
- Loss of certain key habitat components (e.g., snags)

Recommended mitigation measures:
- Emphasize the importance of wetlands to federal, provincial and municipal government authorities, private developers and other individuals concerned with land-use planning; prevent, minimize or offset the loss of wetlands and review planning to prevent the loss of wetlands
- Establish mechanisms to ensure that the principles of the Federal Policy on Wetland Conservation are applied (promote "compliance")
- Implement the policy to protect riparian buffer strips in development plans and municipal zoning regulations

3.2.2 Agriculture

In 2003, a report by the Ministère de l'Environnement du Québec observed that "in Quebec, as elsewhere around the world, agriculture brings with it environmental problems, including the degradation of soils, contamination of surface water and groundwater, odour and gas emissions, degradation of habitats and the loss of biodiversity" [translation] (Ministère de l'Environnement 2003). Indeed, certain agricultural practices are recognized to be harmful to wetlands and the waterfowl that depend on them. For example, stream straightening and wetland draining are carried out at the expense of numerous small wetlands that benefit many species of ducks. An estimated 25,000 km of watercourses have been altered in this way to discharge water further downstream; this number does not include swampy areas drained to plant crops (Ministère de l'Environnement 2003). Similarly, inadequate fertilizer and pesticide management practices contribute to poor water quality in aquatic habitats.

In the southern part of the province where intensive agriculture is practiced (particularly in BCR 13), the way the agricultural landscape is configured promotes more intense flooding in watercourses further downstream, which in turn hastens the drying up of small streams, thereby reducing the value of these habitats to aquatic wildlife. In addition, due to changes in agricultural markets in the second half of the 20th century, farmers have abandoned perennial forage crops like hay in favour of wide-row annual crops like grain corn (Lachance 2007; Richard and Carignan 2008). These crops not only provide less productive wildlife habitats but often require more pesticides and fertilizers (Lachance 2007). Furthermore, since they require more tillage and the spacing between rows is greater, these crops are also more likely to encourage erosion and leaching (Lachance 2007). If riparian buffer strips are not able to retain soil particles in the fields, particles will go into ditches, where they cause silting and transport pesticides and fertilizers into aquatic environments, contributing to the degradation of downstream aquatic ecosystems and reducing their wildlife potential (Richard and Carignan 2008). In an effort to improve productivity, farmers have also merged a number of small fields into vast continuous plots, every inch of which is cultivated, a practice that has eliminated many small ditches that were previously found along the edge of fields, as well as riparian strips and shelterbelts (Richard and Carignan 2008). These three habitat components are used extensively by waterfowl, particularly as escape cover during the brood-rearing period. Lastly, certain agricultural practices in the Bas-Saint-Laurent (Lower St. Lawrence) region (e.g., aboiteau diking) have had significant impacts on marshes, since they impede exchanges with the surrounding aquatic environment (Environnement Canada 2006a).

Agriculture in the Bas-Saint-Laurent region. Photo: Christine Lepage © CWS

This deep-seated tendency is changing, however, thanks to government efforts, particularly by the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ), which is committed to promoting sustainable agriculture. The Quebec government has chosen a combination of regulation and financial incentives to encourage the adoption of sound agri-environmental practices. Examples include the numerous amendments to the Agricultural Operations Regulation (AOR), the main objective of which is to protect the environment, particularly water and soil, from pollution caused by certain agricultural activities. The AOR does not dictate to farmers which practices to adopt but rather sets standards for managing livestock waste and other fertilizing materials (Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec 2011a). The report by the Pronovost commission on the future of agriculture in Quebec (Commission sur l'avenir de l'agriculture et de l'agroalimentaire québécois), tabled in 2008, has also identified promising avenues that would allow more conservation of waterfowl habitats in Quebec's rural regions.

Some of the resources offered to support and assist farmers in complying with regulations and adopting sound agri-environmental practices include the agri-environmental advisory club program and government initiatives such as MAPAQ's Prime-Vert (green premium) program. A reduction in pesticide use has already been observed to a certain degree, along with the adoption of agri-environmental farm plans resulting in reduced phosphate and potassium fertilizer purchases and the creation of buffer strips and construction of fencing to protect watercourses. On the other hand, the lack of popularity of some practices such as forest corridors, riparian buffer strips and wildlife enhancements can be explained by the fact that they are unprofitable for farmers. To encourage agricultural producers to adopt these practices, which are expensive, some form of compensation should be considered. Interestingly, programs launched by private organizations targeting agricultural environments, including habitat conservation initiatives and programs to encourage sustainable agricultural practices, are slowly but surely gathering steam in Quebec. Examples include the program by the Fondation de la faune du Québec to enhance watercourse biodiversity in agricultural environments (*Programme*

de mise en valeur de la biodiversité des cours d'eau en milieu agricole) and Nature Québec's zero-carbon farm initiative (*Agriculture et climat : Vers des fermes 0 carbone*).

Although most farming in Quebec is carried out in the southern part of the province, the Quebec government also plans to develop northern agriculture (bio-food production), since this part of Quebec has one of the largest reserves of arable land in North America (Gouvernement du Québec 2011a). In the short term, most of this development is expected to occur in the Saguenay–Lac-Saint-Jean (wild blueberries, potatoes, cranberries, serviceberries, dwarf cherries, sea buckthorn and livestock production; Ministère du développement économique de l'innovation et de l'exportation 2010) and Abitibi-Témiscamingue (cattle; Ministère du développement économique de l'innovation et de l'exportation 2011) regions. Aside from the loss of habitats that are converted into farmland, one of the issues for birds will be the presence of hexazinone (a herbicide used to improve blueberry yields) in surface water and groundwater, particularly with the expansion of blueberry production and increase in sales of this herbicide (Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec 2011).

Environmental impacts on waterfowl:
- Loss of wetlands
- Degradation of wetlands and aquatic environments
- Loss of certain key habitat components (e.g., riparian buffer strips, snags)

Recommended mitigation measures:
- Maintain wetlands: prevent, minimize or offset the loss of wetlands
- Encourage the enforcement of the provision of the *Politique de protection des rives, du littoral et des plaines inondables* (Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains) requiring the maintenance of a three-metre-wide strip of vegetation along shorelines in agricultural environments (Gouvernement du Québec 2005)
- Adopt practices that protect the soil and reduce runoff and erosion
- Adopt practices that prevent inorganic fertilizers from entering watercourses
- Comply with standards on phosphorous (in AOR)
- Reduce pesticide use by using integrated pest management and other techniques (in accordance with MAPAQ's Stratégie phytosanitaire [pest control strategy])
- Maintain wooded areas in the agricultural environment (shelterbelts and farm woodlots)
- Maintain areas of natural vegetation on the edges of fields, in woods, hedgerows, riparian strips, roadsides, etc.
- Limit farm animals' access to watercourses to maintain water quality
- Restore the flow of water to old meanders (dried up stretches of watercourses)
- Re-establish exchanges between the St. Lawrence and diked cordgrass marshes in the Bas-Saint-Laurent region whenever possible (i.e., create openings in dikes, block drainage canals, create sills, dismantle structures no longer in use [drainage canals, dikes, aboiteaus, etc.]); consult the *Atlas de restauration des rives du Saint-Laurent* (Environnement Canada 2006a)
- Encourage farmers to adopt good practices that are perhaps less cost-effective but are beneficial to waterfowl (e.g., wildlife enhancements) and put in place mechanisms to compensate them for their efforts

3.2.3 Logging

Before settlement, forests covered most of eastern North America (Bouchard and Domon 1997). In the St. Lawrence lowlands, the clearing of forests did not begin in earnest until the early 19th century (Domon and Bouchard 2007) but then gathered steam during the 19th and 20th centuries, affecting all of the southern half of the province. For a number of waterfowl species,

including Quebec's seven species of cavity-nesting ducks, one particularly crucial forest component is the availability of large-diameter trees (both living and dead) with potential cavities. The loss of forests inevitably leads to the loss of this key habitat component. In addition, legislative provisions for public forests encourage logging companies to harvest trees affected by natural disturbances such as fire, blowdown and insect outbreaks when accessible (Gouvernement du Québec 2009c), which further reduces the availability of large-diameter trees. Lastly, in residual forests, certain forest management practices (such as those promoting timber or maple sugar production) exacerbate the scarcity of large dead trees that are essential to cavity-nesting species (B. Drolet, CWS, pers. comm.).

The time of the year in which logging operations are carried out may also have an impact on waterfowl. When done during the breeding season (i.e., during laying, incubation or brood rearing), these activities are likely to destroy nests or disturb birds. Environment Canada is currently developing guidelines and tools to promote compliance with the *Migratory Birds Convention Act, 1994* (Environnement Canada 2010d), which prohibits harming migratory birds or disturbing or destroying their nests or eggs.

The *Forest Act* was replaced by the *Sustainable Forest Development Act* in April 2013 (Ministère des Ressources naturelles et de la Faune du Québec 2009a). The latter Act, the first version of which was adopted in April 2010, emphasizes ecosystem-based forest management that ensures the preservation of the biodiversity and viability of forest ecosystems by reducing the differences between managed and natural forests.

Logging in a riparian strip. Photo: Christine Lepage © CWS

Environmental impacts on waterfowl:
- Loss of certain key habitat components (e.g., riparian strips, snags)
- Degradation of wetlands and aquatic environments
- Increased predation

Recommended mitigation measures:
- Preserve wider riparian strips (i.e., protect a width of more than 20 m when certain species are present and keep a certain percentage of strips intact by excluding forest management activities)
- In riparian strips where forest management activities are carried out, focus on maintaining the attributes of old-growth forests
- Preserve forest attributes that are important to wildlife in general (e.g., large living trees, snags)
- Do not carry out potentially destructive activities (e.g., logging) during the breeding season for waterfowl
- Offset the loss of large living trees and snags by creating networks of nest boxes

3.2.4 Exploitation of peatlands

Peatlands are the target of various types of commercial exploitation, including peat mining, vegetable and fruit growing, and cranberry production. All three types of development result in losses in, and modifications to, waterfowl habitats and are therefore important issues in waterfowl conservation. However, this industry only affects roughly 6,000 ha in Quebec out of the province's estimated 8 to 12 million hectares of peatlands (Payette and Rochefort 2001).

Peat mining in a bog on the Manicouagan Peninsula, Côte-Nord (North Shore).
Photo: Christine Lepage © CWS

Environmental impacts on waterfowl:
- Loss of wetlands
- Degradation of wetlands
- Loss of certain key habitat components (e.g., strips of residual vegetation)

Recommended mitigation measures:
- Adopt sustainable exploitation practices that take account of breeding avifauna
- Preserve strips of residual vegetation at least 5 m wide

- Emphasize the importance of wetlands to federal, provincial and municipal government authorities, private developers and other individuals concerned with land-use planning; prevent, minimize or offset the loss of wetlands
- Implement the Federal Policy on Wetland Conservation
- Acquire or protect natural peatlands in each BCR in the southern half of Quebec to prevent their exploitation and keep them in a natural state

3.2.5 Mining

With its favourable geological context, Quebec has great appeal to the mining sector and, indeed, ranks among the top 10 mining jurisdictions in the world (Gouvernement du Québec 2011e). Certain regions of the province are experiencing intense mining activity. The main threat posed by mining to waterfowl habitat stems from the presence of mine tailings, or mining waste, which can contaminate the adjacent water table and nearby watercourses due to their significant acid mine drainage potential. If tailings are not properly contained or treated, they can be toxic to receiving ecosystems. Although structures built to contain tailings must be designed to last for hundreds if not thousands of years, there is always a risk that tailings ponds will fail.

The roughly 50 active mines in Quebec, which produce metals and industrial materials such as gold, copper, iron and asbestos, generate close to 100 million tonnes of tailings every year (Aubertin et al. 2002). In addition, roughly 30% of tailings storage areas generate or could potentially generate acid mine drainage (Aubertin et al. 2002). Furthermore, there are 140 abandoned mine sites in Quebec (Ministère des Ressources naturelles et de la Faune du Québec 2011c), which have not been restored and therefore pose a contamination risk. The proper management of mining waste is crucial to prevent tailings from ending up in and contaminating the environment. For example, in the Bourlamarque River in Val-d'Or, which is located near several abandoned mine sites, an increase in suspended solids and metals, a drop in pH, and the absence of fish have been observed along several kilometres of the river (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2005a).

Since the announcement of the Plan Nord by the Government of Quebec in 2011, mining development in northern Quebec has been promoted (Gouvernement du Québec 2011e). In addition, the government's Mineral Strategy recommends that mining development in northern Quebec be accelerated by facilitating access to the territory and also advocates the adoption of new, stricter environmental standards, assurances to guarantee the restoration of mine sites and the promotion of sound mining practices (Ministère des Ressources naturelles et de la Faune du Québec 2009c). Lastly, the *Mining Act* was under review at the time of publishing this plan.

Environmental impacts on waterfowl:
- Loss of wetlands (the storage of tailings often results in this waste leaking into and contaminating wetlands)
- Potential contamination of the water table and soil by mine tailings, leading to the degradation of nearby aquatic habitats
- Tailings ponds pose a danger to migratory birds, particularly waterfowl, since they may land on them

Recommended mitigation measures:
- Establish mechanisms to ensure that mining companies adopt practices that protect the environment (including compliance with MDDEP standards on tailings)
- Emphasize the importance of wetlands to federal, provincial and municipal government authorities, private developers and other individuals concerned with mining; prevent, minimize or offset the loss of wetlands

- Implement the Federal Policy on Wetland Conservation
- Integrate mining activities into MRC (regional county municipality) development and land-use plans
- Install bird-hazing devices to keep waterfowl away from tailings ponds
- Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to waterfowl

3.2.6 Oil and gas development

Although no oil and gas development activities are under way in Quebec, this could change in the years to come. The Quebec government has launched a strategic environmental assessment program aimed at providing a framework for future oil and gas exploration and development in the marine environment (Gouvernement du Québec 2009b). This program covers the entire lower estuary and the Quebec portions of Chaleur Bay and the Gulf of St. Lawrence. One of the major potential impacts of oil and gas industry activities on waterfowl is the contamination of waterfowl habitat during exploration and development activities, whether this occurs on a sporadic basis (during what the industry calls normal leaks) or as a result of a serious accident. In addition, oil and gas development in the estuary and Gulf of St. Lawrence would lead to increased vessel traffic. Heavy vessel traffic is correlated with an increase in chronic oil discharges at sea, likely to affect hundreds of thousands of birds annually (Wiese and Robertson 2004), as well as an increased risk of accidents and consequently of oil spills (see also section 3.2.9 Shipping and shipping infrastructures).

In the natural gas sector, two projects for liquefied natural gas terminals to receive tankers carrying gas from overseas are under study (Gros-Cacouna and Rabaska at Lévis). The terminals will consist of a deep-water wharf and underground cryogenic transfer lines running to storage tanks. If built, these terminals will be linked to pipelines transporting the gas to large urban areas. The construction of these facilities is expected to result in the loss of waterfowl habitat during construction (deforestation and encroachment on wetlands), as well as the risk of habitat contamination from leaks when the facilities become operational.

In addition, the Quebec government has issued numerous exploration permits for shale gas, covering almost all of the inhabited areas in the St. Lawrence Valley. However, the authorities decided to carry out a strategic environmental assessment on the appropriateness of shale gas development, including extraction methods. Shale gas is a form of natural gas that is particularly difficult to extract, requiring the massive use of water and chemicals and potentially resulting in the emission of toxic fumes and the contamination of the soil and groundwater (Association québécoise de lutte contre la pollution atmosphérique 2009). In addition, since from 20% to 40% of the mixture of water, sand and chemicals injected during hydraulic fracturing (fracking, for short) comes back up to the surface, it must be stored in retention ponds. This liquid, referred to as flowback water, is considered toxic since it may contain brine, heavy metals and radioactive contaminants (radium and uranium).

Environmental impacts on waterfowl:
- Loss of wetlands
- Loss of foraging areas
- Possible contamination of groundwater and soils may result in the degradation of nearby aquatic habitats and associated food resources
- Flowback water retention ponds pose a danger to migratory birds, particularly waterfowl, since they may land on them
- Direct mortality (e.g., hypothermia, ingestion of lethal quantities of toxic substances)
- Possible harm to birds' physical condition, reproduction and longevity

Recommended mitigation measures:

- Emphasize the importance of wetlands to federal, provincial and municipal government authorities, private developers and other individuals concerned with oil and gas development; prevent, minimize or offset the loss of wetlands
- Implement the Federal Policy on Wetland Conservation
- Encourage the adoption of the precautionary principle
- Install bird-hazing devices to keep waterfowl from landing on retention ponds at shale gas sites
- Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to waterfowl
- Institute measures necessary to scare birds away from the site of contamination as soon as possible
- Encourage owners and operators of merchant vessels to respect Canadian laws on ballast water discharges and illegal spills
- Ensure the efficacy of the CWS Oil Spill Emergency Response Plan in order to prevent and limit mortality in priority species
- Increase surveillance of leaks at retention ponds and illegal spills

3.2.7 Hydroelectric power generation

Thanks to Quebec's extensive and densely branched system of rivers, it has excellent hydropower potential. As of the end of 2010, the total capacity of Hydro-Québec's hydroelectric facilities was 36,671 MW (Hydro-Québec 2011). The potential impacts of dam construction on waterfowl depend on the natural hydrology of the site and whether existing wetlands are maintained. In general, the creation of hydroelectric reservoirs results in the modification or loss of a multitude of wetlands, lakes and rivers owing to the flooding of the land upstream of dams and reduced flow in the water bodies and watercourses downstream. Flooding also gives rise to the methylation of mercury present in the soil and vegetation, which is released into the aquatic environment (Tremblay et al. 1993). Through the process of bioaccumulation, methylmercury accumulates in the food chain, with potentially toxic effects (Borg and Johansson 1989; Tremblay et al. 1993), and fish-eating waterfowl make up part of this food chain.

The findings of the various waterfowl surveys carried out to monitor the impacts of hydroelectric facilities suggest that these reservoirs and reduced-flow rivers are used mainly by dabbling ducks and Canada Geese, while mergansers and other members of the Mergini tribe are less abundant in these habitats than they were before development, at various stages of their life cycle (Morneau 2005). Hydroelectric development tends to have variable impacts on waterfowl, which depend on the scale of the hydrologic changes and local environmental conditions.

With our increased understanding of the ecological changes caused by reservoir construction and impoundment, a number of mitigation measures that benefit waterfowl and their habitats are now implemented when new reservoirs are constructed, in accordance with local conditions and issues. Such measures include instituting ecological instream flow, planting riparian vegetation on weirs and dikes along reduced-flow rivers, enhancing and creating wetlands, carrying out clearing operations and reservoir flooding in winter, and leaving snags in place for cavity-nesting ducks.

Artificial wetland created by Hydro-Québec in a borrow pit near the Péribonka hydroelectric development. Photo: François Bolduc © CWS

It should also be mentioned that the Quebec government continues to encourage additional energy development in northern Quebec, although a large part of the territory should also be protected.

Environmental impacts on waterfowl:
- Loss of wetlands (e.g., flooding of wetlands)
- Habitat modification (e.g., reduced flow in rivers downstream of dams)
- Loss of certain key habitat components (e.g., snags)
- Possible harm to fish-eating ducks' physical condition (methylmercury bioaccumulation)

Recommended mitigation measures:
- Emphasize the importance of wetlands to authorities responsible for hydroelectric development; prevent, minimize or offset the loss of wetlands; the flooding of large areas of wetlands, lakes and rivers supporting high densities of priority species should be offset ecologically
- Do not carry out activities that would impact priority species' habitat (e.g., clearing) during the breeding season for waterfowl
- Offset the loss of large living trees and snags by creating networks of nest boxes
- Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to waterfowl

3.2.8 Wind power generation

The wind power industry, although relatively new in Quebec, has experienced steady growth as a result of tender calls issued by Hydro-Québec for the purchase of wind power in 2003, 2005 and 2009. Although wind power generation is for the moment limited to southern Quebec, it will eventually be a possibility north of the 49th parallel.

In general, three types of adverse effects have been identified in birds and bats: direct mortality (collisions with structures), habitat loss (construction of wind turbines and outbuildings) and

disturbance (according to Winkelman 1992 and Larsen and Guillemette 2007, migrating birds modify their route when they get close to structures). Wind farms may have impacts on waterfowl populations, particularly if they are located near migration routes or breeding, moulting or wintering grounds. Examples of areas where potential conflicts could occur include the Matapédia Valley, used by a number of waterfowl species as a route from Chaleur Bay to the St. Lawrence estuary, or the south shore of the estuary, where Snow Geese and ducks move daily between their resting and foraging areas. In response to this issue, Environment Canada published a document entitled *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (Environnement Canada 2007c). The following year, MRNF produced a protocol on monitoring mortality in birds of prey and bats for wind power projects (Protocole de suivi des mortalités d'oiseaux de proie et de chiroptères dans le cadre de projets d'implantation d'éoliennes au Québec) (Ministère des Ressources naturelles et de la Faune du Québec 2008); the Department recommends that monitoring be carried out for a minimum of three years using a sample of turbines in each wind farm. Lastly, disruption of birds' behaviour appears to be the most important factor to be taken into account when siting wind turbines near areas used extensively by waterfowl (Kingsley and Whittam 2007).

Small lake near Cap-Chat wind farm. Photo: Christine Lepage © CWS

As noted earlier, since the Quebec government plans to encourage energy development in the northern part of the province, wind power generation can be expected to be included in the plans for the region.

Environmental impacts on waterfowl:
- Mortality (collisions with structures)
- Habitat loss
- Loss of certain key habitat components (e.g., snags)
- Disturbance (disruption of behaviour)

Recommended mitigation measures:

- Choose sites of wind turbines carefully if a planned wind farm is located near key areas for waterfowl
- Do not carry out potentially destructive activities (e.g., clearing) during the breeding season for waterfowl
- Monitor rates of collision-related mortality after the wind farm has been commissioned
- Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to waterfowl

3.2.9 Shipping and shipping infrastructures

The St. Lawrence Seaway has a steady traffic of transiting ships, with 4,267 vessels using the Seaway in 2008 and 3,631 vessels in 2009 (Fisheries and Oceans Canada 2010). Given the heavy volume of shipping traffic, the special navigation conditions on the St. Lawrence (which require pilotage by accredited pilots) and the nature of the cargo carried, the risks of an oil spill from a shipping accident are very real. Although close to 95% of accidental oil spills occur within ports or handling facilities rather than in shipping channels, amounts spilled during a loading or unloading operation are generally less than in a collision between ships (Villeneuve 2001). According to a study of 968 shipping accidents that occurred between 1975 and 1994 in Quebec, over 80% of the volumes spilled were less than a tonne; however, there were six spills involving volumes between 100 and 1,000 tonnes (in Villeneuve 2001). The issue of accidental spills in the estuary and Gulf is particularly worrisome because these bodies of water are frequented by millions of geese and ducks every year. It should be noted that, through its Oil Spill Emergency Response Plan, CWS is committed to providing the necessary information on the presence of birds in the St. Lawrence, and in the event of a spill, to implementing the four components of the plan: conducting surveys, hazing, capturing and rehabilitating oiled birds when appropriate.

Pointe-Noire bulk terminal near Sept-Îles. Photo: Christine Lepage © CWS

Although the main impact of oil spills is the direct mortality of oiled individuals when the spill occurs, indirect, chronic or delayed impacts, which are visible only over the long term, are just as important and harmful, since spilled oil can persist in toxic form in the environment for over 10 years (Petersen et al. 2003). Such secondary impacts include chronic exposure to oil by birds that feed on contaminated benthic organisms; ingestion by birds of sublethal doses of oil that

compromise their health, longevity and reproduction over the long term; and repercussions on the structure of habitats and the food chain (Petersen et al. 2003).

In addition, it is possible that the traffic of liquefied natural gas (LNG) carriers in the St. Lawrence Seaway will happen since feasibility studies have been carried out on two LNG terminals (Gros-Cacouna and Rabaska at Lévis). Although the probability of a shipping accident (e.g., collision and sinking of an LNG carrier) followed by a leak of LNG is low, it could have significant impacts on terrestrial and marine wildlife. Birds could suffer from cryogenic burns or asphyxiation or be exposed to thermal radiation (Bureau d'audiences publiques sur l'environnement 2006).

Environmental impacts on waterfowl:
- Direct mortality (e.g., hypothermia, ingestion of lethal quantities of toxic substances)
- Possible harm to birds' physical condition, reproduction and longevity
- Contamination of habitats and food resources

Recommended mitigation measures:
- Institute measures necessary to scare birds away from the site of contamination as soon as possible
- Encourage owners and operators of merchant vessels to respect Canadian laws on ballast water discharges and illegal spills
- Ensure the efficacy of the CWS Oil Spill Emergency Response Plan in order to prevent and limit mortality in priority species

3.2.10 Road transportation and infrastructure

Quebec's highway network consists of roughly 185,000 km of roads, which are used by an ever-expanding vehicle fleet that increased by 42% between 1985 and 2000 (Ministère des Transports du Québec 2007b). Several major highway projects are under way in the southern half of the province and are described in the chapters on the corresponding BCRs. The Quebec government has announced that it intends to facilitate the construction of a highway network in the boreal forest and Arctic zones (Gouvernement du Québec 2011c). One of the issues expected from this construction is that it will open up virgin territory to resource development.

Aside from the direct loss of habitats, other impacts of highway construction include the degradation of wetlands. Excavation, filling and clearing operations during construction disturb wetlands, and they are also subjected to diversions and bank modification, among other impacts. Once the road is in use, de-icing agents—melters and abrasives—alter water quality and result in increased sedimentation. Moreover, road salts containing inorganic chloride salts are considered toxic under the *Canadian Environmental Protection Act, 1999* (Gouvernement du Canada 2001; Environnement Canada 2001). When large amounts of these salts are used (high density of roads), they migrate into adjacent wetlands when the snow melts, causing the degradation of aquatic habitats and potentially even poisoning birds. Exposure to road salts can cause changes in birds' behaviour as well as toxicological effects (Gouvernement du Canada 2001).

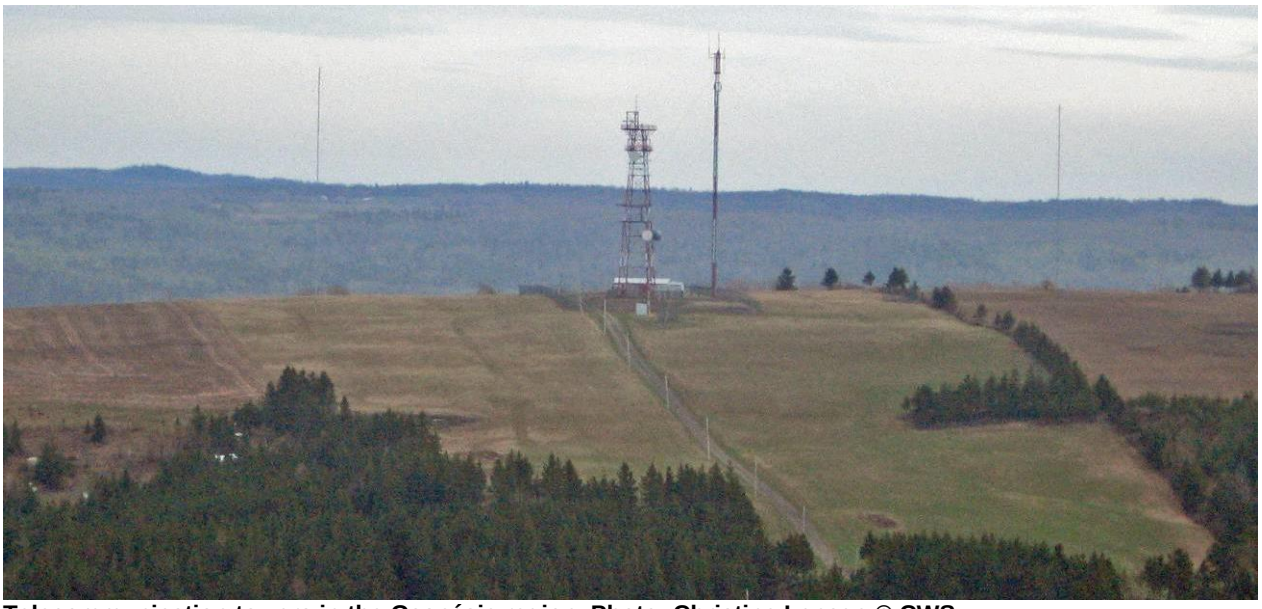
Quebec's strategy on the environmental management of road salts (Stratégie québécoise pour une gestion environnementale des sels de voirie) encourages the adoption of practices that protect the environment without having a negative impact on road safety and traffic flow (Ministère des Transports du Québec 2010). By complying with these practices, road maintenance authorities can help to prevent, mitigate and in some cases, curb the environmental impacts of road salts.

Environmental impacts on waterfowl:
- Loss of wetlands
- Degradation of wetlands
- Loss of certain key habitat components (e.g., snags)
- Possible poisoning of birds by road salts

Recommended mitigation measures:
- Emphasize the importance of wetlands to federal, provincial and municipal government authorities and other individuals concerned with land-use planning; select the route that least encroaches on aquatic habitats and offset wetland losses
- Implement the Federal Policy on Wetland Conservation
- Do not carry out potentially destructive activities (e.g., clearing) during the breeding season for waterfowl
- Ensure that recommended mitigation measures are respected (e.g., those applicable to watercourses choked with sand or other surplus materials from retention and catchment ponds created during road construction work)
- Encourage road maintenance authorities to take action to reduce overall road salt use (compliance with measures in Quebec road salt management strategy)
- Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to waterfowl

3.2.11 Telecommunications infrastructures

During the last 20 years, the use of wireless telecommunications technology has increased significantly, with a corresponding increase in the construction of mobile phone base stations, also known as telecommunication or cell towers. These base stations are composed of one or more relay antennas. In Quebec, the number of towers has risen from 385 in 1998, to 490 in 2004 and 624 in 2010 (Towerkill 2010). Collisions between birds and the antennas and guy wires constitute a potential source of direct mortality (particularly in migrating passerines), and antennas equipped with lights may also cause behavioural disruption in birds (attraction), particularly nocturnal migrants.



Telecommunication towers in the Gaspésie region. Photo: Christine Lepage © CWS

Environmental impacts on waterfowl:
- Mortality (collisions with structures)
- Disturbance (behavioural disruption, i.e., attraction of nocturnal migrants to tower beacons)

Recommended mitigation measures:
- Do not install towers in migration corridors
- Use beacons that do not attract birds
- Avoid using guy wires or minimize their use; if guy wires have to be used, flag them to make them more visible

3.2.12 Aquaculture

Aquaculture is a fairly new industry in Quebec. The first attempts at mussel farming in the province date back to the 1970s (Fournier and Montminy-Munyan 2003). Since sea ducks feed almost exclusively on molluscs, they are strongly drawn to shellfish aquaculture operations (McGilvrey 1967; Stott and Olson 1973; Dionne 2004), either because the birds frequented these sites before they were developed or because they are now more attractive to the ducks. The main effect of shellfish aquaculture on waterfowl is the modification of birds' distribution. Furthermore, this seems to be an acquired behaviour in ducks, and it is difficult to prevent or dissuade birds from frequenting these sites (Burnett et al. 1994; Dionne 2004). Since ducks can consume significant quantities of farmed shellfish, owners of aquaculture operations invest large amounts of time and money in scaring them away to prevent excessive losses (Moisan and Cauvier 2010). To date, the only predation problems reported in the province have been by scoters in Gaspé and Cascapédia bays (Moisan and Cauvier 2010), and by Common Eider in the Magdalen Islands. However, a number of species of ducks eat molluscs, so there is a potentially greater problem. Although the disturbance to birds caused by hazing activities may have an impact on individual survival, there is no indication that local populations are affected.

Another potential impact of aquaculture on sea ducks is the contamination of birds. For example, in certain regions of British Columbia, farmed blue mussels may contain sufficiently toxic cadmium concentrations to pose a risk to reproductive success in Surf Scoters that feed on them (Bendell 2011).

Environmental impacts on waterfowl:
- Loss of foraging sites
- Possible harm to birds' physical condition (individual survival), reproduction and longevity (in the case of prey with toxic concentrations of contaminants)

Recommended mitigation measures:
- Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to waterfowl
- Consider alternate sites for aquaculture operations when sea ducks are already using the resource(s) at the sites envisaged

3.2.13 Water levels and flows on the St. Lawrence

The International Joint Commission (IJC), which has representatives from both Canada and the United States, is the organization in charge of controlling water levels and flows in the Great Lakes–St. Lawrence River system. Fluctuations in flows and water levels in the St. Lawrence are not exclusively natural phenomena but also depend on decisions made by the IJC. In the 2000s, the IJC conducted a study to take greater account of the natural environment and pleasure boating in their decision-making process. Environment Canada's CWS studied different water-

level scenarios and their effects on waterfowl and recommended the most beneficial scenario for waterfowl (Lehoux et al. 2003).

Balancing all the uses of the St. Lawrence and respecting divergent interests requires extensive negotiation, and management scenarios must be acceptable not only to the IJC but also to the federal, provincial and U.S. state governments. Consequently, managing water levels and flows in the system to cater strictly to the needs of waterfowl is unrealistic and utopian given the wide range of uses of the river, particularly for shipping and hydroelectricity. It is clear, however, that water levels on the St. Lawrence are of prime importance to waterfowl.

Environmental impacts on waterfowl:

- Loss of habitats:
  - water levels that are too high during the egg-laying period may result in the loss of riparian and island habitats used for nesting
  - water levels that are too high during the brood-rearing period may result in emergent marshes that are too small to support broods
  - water levels that are too low during the brood-rearing period may result in emergent marshes that are too shallow and too choked with plants to support broods
- Decreased productivity:
  - a sudden rise in water levels may result in flooding and therefore the loss of numerous nests

Recommended mitigation measures:

- Advise the IJC so that it can take the needs of waterfowl into account in water-level management scenarios for the St. Lawrence.

3.2.14 Water quality in the St. Lawrence

Although the water quality in all bodies of water in Quebec is of concern—whether in terms of problems caused by blue-green algae blooms or the acidification or eutrophication of lakes due to acid rain—in this section, we will focus on water quality in the St. Lawrence, which is the largest water body used by waterfowl in the province.

Water quality in the St. Lawrence improved greatly in the early 1990s owing to the establishment of the St. Lawrence Action Plan (see section 11.3). At that time, Plan partners succeeded in reducing toxic effluent discharges in the St. Lawrence from the 50 biggest polluting plants by over 90%, and subsequently, another 56 plants were added to the program. However, the St. Lawrence is still subject to bacterial contamination from numerous municipal wastewater treatment facilities as well as high local turbidity and contamination by toxic substances (metals, organic contaminants, polybrominated diphenyl ethers, substances contained in pharmaceutical and personal-care products, polychlorinated biphenyls [PCBs], furans and dioxins).

In addition, the use of phosphorous, nitrogen and pesticides in agriculture (see 3.2.2) also contributes to the poor quality of the water in the St. Lawrence. Note that one of the three directions of the water quality component of the St. Lawrence Action Plan is reducing agricultural sources of non-point source pollution, and many projects will be carried out in this area.

Two Canada–U.S. agreements, one on water quality in the Great Lakes (Canada–United States Great Lakes Water Quality Agreement, signed in 1972) and one on air quality (Canada–United States Air Quality Agreement, signed in 1991), affect water quality in the St. Lawrence owing to its downstream location. The IJC has been given the mandate to collaborate to clean up sectors affected by pollution problems and to promote sustainable development in the Great Lakes

region. The IJC is also responsible for investigating air pollution problems in boundary regions of the Great Lakes. Since atmospheric pollutants can travel thousands of miles before settling on land or on water, and when they fall on rivers or lakes they can affect the quality of the water, their effects are to be taken into account in the overall picture of water quality in the St. Lawrence.

Environmental impacts on waterfowl:

- Decreased productivity and individual survival rates: toxic and endocrine-disruptive effects in molluscs and fish, passed on to organisms higher up in the food chain, including certain species of ducks

Recommended mitigation measures:

- Continue cooperative efforts and actions to help the St. Lawrence, as promoted by the Canada–Quebec Agreement on the St. Lawrence (St. Lawrence Action Plan)
- Continue cooperative efforts and actions put forward under the Great Lakes Water Quality Agreement and the Great Lakes Air Quality Agreement
- Encourage the responsible authorities to put in place mechanisms so that all effluent discharged in the St. Lawrence is purified and treated
- Adopt sustainable agricultural practices (see section 3.2.2) that take account of breeding birds

3.2.15 Sediment quality in the St. Lawrence

The toxic contamination of sediments in the St. Lawrence is still a concern. Although concentrations of mercury, polycyclic aromatic hydrocarbons (PAHs), metals and polychlorinated biphenyls (PCBs) have declined in general since the 1970s depending on the sector, levels are still high enough to have adverse effects on benthic organisms. Dioxins, furans, butyltins, and new and emerging substances of concern such as polybrominated diphenyl ethers (used as flame retardants), pharmaceutical and personal-care products, and perfluorinated substances (used as oil and water repellant coatings in fabrics and food packaging) are present in the river system. Although these substances are not as well known as contaminants such as PAHs and metals, they can have adverse effects on benthic organisms (Pelletier 2008), which could be transferred by bioaccumulation to organisms higher up in the food chain.

In addition, hundreds of thousands of cubic metres of sediments are dredged annually in Quebec so that vessels can safely navigate (L. Breton, EC, pers. comm.). For example, maintenance dredging is carried out extensively in ports, harbours, marinas and in the St. Lawrence Seaway itself from Cornwall to the Magdalen Islands and Chaleur Bay. Issues raised by dredging and the disposal of dredged materials at sea include the destruction, degradation and disturbance of aquatic and marine habitats as well as sediment resuspension. When sediments are resuspended, there is always a risk of contaminants being released (Pelletier 2002), which may then be taken up by aquatic or marine organisms (invertebrates, molluscs, crustaceans, fish, etc.) and end up in the higher levels of the food chain. Environment Canada administers a system of permits to control the disposal of wastes and other materials at sea; permits are issued only after a detailed review and environmental assessment. Roughly 90% of the volume of waste disposed at sea under this program represents dredged sediments, with the rest consisting of fish wastes from processing plants or excavation materials from activities on land.

Environmental impacts on waterfowl:

- Decreased productivity and individual survival rates: contamination of benthic fauna, which can be transferred to organisms higher up in the food chain, including some species of ducks

Recommended mitigation measures:

- Continue cooperative efforts and actions put forward under the Great Lakes Water Quality Agreement
- Establish mechanisms to ensure that all effluent discharged in the St. Lawrence is purified and treated
- Adopt sustainable agricultural practices (see section 3.2.2) that take account of breeding birds
- Encourage research on new contaminants, their effects on organisms at various levels of the food chain and their interactions (synergistic and antagonistic effects)
- Encourage as much as possible the reuse of dredging sediments (e.g., for beach rebuilding and cover material for sanitary landfills)

3.2.16 Bank erosion and shoreline modification along the St. Lawrence

The St. Lawrence shoreline has been greatly altered by human activities over the years (see also section 3.2.1). This includes 700 km or more of shoreline where riprap or retaining walls have been installed, resulting in a bare substrate that gives diverse vegetation and wildlife almost no chance to get established, as well as thousands of hectares of island habitats where the vegetation is artificially maintained as low meadow by agriculture or grazing. In addition, dozens of hectares of cordgrass marshes have been diked and drained for farming; although they look like real marshes, the absence of regular flooding prevents exchanges with the surrounding environment and prevents the maintenance of ponds that are used by species typical of intertidal marshes (Environnement Canada 2006a). In general, shoreline modification has been detrimental to wetlands and their associated wildlife, while certain methods of bank protection (i.e., retaining walls and riprap) only move the erosion problem to another location on the shoreline.

Shoreline modification encroaching on the barachois (baymouth bar) near Hope Town, in Chaleur Bay. Photo: Christine Lepage © CWS

Along with the direct modification of the shoreline by human activities (wharves, riprap, dikes, embankments, aboiteau diking, etc.), erosion is also a major problem. Erosion is so severe in certain places in the St. Lawrence between Cornwall and Montmagny that banks are receding at a rate of over 3 m per year (Dauphin and Lehoux 2004). An estimated 1,000 ha of island habitats have been lost in this way in the past 35 years (Environnement Canada 2006a). A number of factors have been cited as possible causes of shoreline erosion in the freshwater section, including boat wakes, wind, ice, currents, frost, grazing of livestock near the shoreline and surface drainage. Although commercial shipping is responsible for roughly 15% of bank erosion along the St. Lawrence, pleasure boating also plays a role (Environnement Canada 2006a).

In the brackish and saltwater portion of the St. Lawrence, coastal marshes continue to be lost due to erosion and other causes. Erosion affects nearly 60% of the coastline of the St. Lawrence estuary and Gulf (Ministère des Transports du Québec 2011). The primary causes are storm-generated waves, decreased ice cover and climate change (see section 3.2.19).

Environmental impacts on waterfowl:
- Loss of wetlands, including island and coastal habitats
- Degradation of wetlands

Recommended mitigation measures:
- Using techniques and expertise to tailor protective measures to local conditions, fight erosion and the loss of island habitats along portions of shorelines of the St. Lawrence where bank stabilization is a priority (for priority areas, which have already been identified, see *Bilan de la sévérité de l'érosion dans le Saint-Laurent dulcicole* [Dauphin and Lehoux 2004])
- Restore exchanges between the river and diked marshes (i.e., create openings in dikes, block drainage canals, construct sills, dismantle structures no longer in use [drainage canals, aboiteau dikes, etc.]): see the *Atlas de restauration des rives du Saint-Laurent* for more information (Environnement Canada 2006a)
- Restore disturbed dune habitat
- Plant vegetation on riprapped shoreline

3.2.17 Recreation and tourism

Anatids are very sensitive to human disturbance at all times of the year. During the breeding season, just a single visit to a nest by a passerby may ultimately lead to the destruction of the nest if a predator is lurking nearby. Frequent disturbance may also affect adults by preventing them from storing the energy required for breeding, migration, overwintering and moulting. Fidelity to foraging or resting sites may also be disrupted by frequent disturbance (Bélanger and Bédard 1989; Bélanger and Bédard 1990; Madsen 1995; Béchet et al. 2004). Trespassing in certain protected areas is very harmful, not only because such areas are scarce but particularly because prohibited recreational and tourism activities disturb breeding waterfowl, whether during the egg-laying or brood-rearing period.

In addition, the practice of stocking lakes with fish for sport fishing can have an impact on some waterfowl species, mainly by creating competition for food resources (Ministère des Ressources naturelles et de la Faune du Québec 2008a). The most problematic case is the stocking of fishless lakes since, in some regions of Quebec, these lakes are preferred by Barrow's Goldeneye over lakes with fish owing to the more diverse and abundant invertebrate populations in fishless lakes (Environment Canada 2011b). When fishless lakes are stocked, the introduced fish prey on these invertebrate populations, creating competition with Barrow's Goldeneye when the species is present.

Lastly, logging activities have, to a certain extent, facilitated access to many lakes that were previously unreachable except by air. Although this may be appreciated by anglers, cottagers, outdoor recreation enthusiasts and others, it may also cause disturbance to nesting hens and broods. The possible development of the tourism potential in the area north of the 49th parallel (Gouvernement du Québec 2011d) could have an impact on this region's relative inaccessibility and tranquility, and therefore could have an effect on waterfowl conservation.

Environmental impacts on waterfowl:
- Decreased reproductive success (i.e., disturbance during nesting may even cause the hen to abandon the nest and brood)
- Negative effect on birds' physical condition
- Abandonment of a productive nest site and choice of a less productive site due to chronic disturbance

Recommended mitigation measures:
- Clearly identify protected areas
- Increase awareness among pleasure boaters of the importance of reducing speed near the shoreline to reduce the impact of wakes (Environnement Canada 2006a)
- Increase awareness among outdoor recreation enthusiasts of the importance of not disturbing birds during nesting and moulting
- Increase awareness among outfitters, fishing guides and whitewater guides of not disturbing birds nesting near rivers during the nesting and brood-rearing periods
- Increase awareness among outfitters and land managers—e.g., ZECs (controlled harvesting zones), Quebec national (provincial) parks, ecological reserves—to ensure that fishless lakes in the breeding range of Barrow's Goldeneye are not stocked with fish
- Increase awareness among the authorities involved in natural resource exploitation to avoid the construction of roads near fishless lakes (200 m) to reduce access
- Ensure sufficient surveillance in National Wildlife Areas

3.2.18 Invasive species

Invasive species, whether exotic or native, pose a significant threat to biodiversity. Their impacts on native ecosystems, habitats and species (competition, predation, disease and hybridization) are severe and often irreversible. Although nearly 163 species have been introduced in the Great Lakes–St. Lawrence basin, 85 of which can be observed in the St. Lawrence itself (Environnement Canada 2010b), only species that are known to have a direct or indirect impact on waterfowl will be discussed.

Zebra and quagga mussels rank at the top of the list of exotic animal species that have an impact on waterfowl. These two species of mussels, now considered naturalized and well established in the Great Lakes–St. Lawrence system, occur all along the fluvial section downstream to the Montmagny Islands (Environnement Canada 2007a). Zebra mussels have also colonized the Richelieu River (Costan and de Lafontaine 2000). Even if these species are relatively uncommon in the St. Lawrence, they are extremely abundant in the Great Lakes, which is an issue for waterfowl since several species of ducks have profited from the zebra and quagga mussel "effect." Although Greater and Lesser scaup used to occur in large numbers (up to 50,000 individuals) in the riverine lakes of the St. Lawrence in the 1970s and 1980s (see species accounts for these species in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]), this is no longer the case. It is thought that the two species have modified their migratory behaviour in response to the abundance of the introduced mussels, since they now stage in large numbers on the Great Lakes (Petrie et al. 2006; Ross et al. 2005). In

addition, lakes Ontario, Erie and St. Clair are being increasingly frequented in winter by a number of duck species: Long-tailed Duck, scoters and mergansers, in addition to Greater and Lesser scaup, now overwinter on these lakes in large numbers, probably linked to the abundance of prey (Petrie et al. 2006). Although these changes in ducks' migrating and wintering behaviour seem of little consequence at first glance, they cause profound changes in the structure and functioning of ecosystems. In addition, zebra and quagga mussels appear to accumulate contaminants, particularly selenium, which then accumulate in Lesser and Greater scaup (Ross et al. 2005; Petrie et al. 2007) at levels that could perhaps harm the birds' reproductive success (Long Point Waterfowl and Wetlands Research Fund 2007; Petrie et al. 2007).

In terms of exotic plant species, a survey of wetland vegetation conducted in 2000 and 2001 reported the presence of over 37 non-native species along the St. Lawrence (Jean et al. 2005). Factors promoting the spread of exotic plant species include road maintenance and construction, disturbance of marshes, fluctuating water levels and the use of exotic species as ornamental plants. However, it is thought that tides and salinity could slow the eastward spread of exotic plant species, since 65% of wetlands sampled in the upper estuary had none of the species in question (Lavoie and Jean 2004). In addition, some native plant species are invasive to some degree—examples include speckled alder and common and narrow-leaved cattails—and have pushed out other species more beneficial to wildlife.

Environmental impacts on waterfowl:

- Modification in birds' behaviour (e.g., migration routes, overwintering habits) resulting from the availability of a new food source (exotic animal species)
- Potential toxic contamination and bioaccumulation due to ingestion of contaminated exotic animal species (e.g., zebra and quagga mussels, which accumulate selenium)
- Possible negative impact on birds' physical condition, reproductive success and longevity
- Loss or modification of wetlands following colonization by certain plant species

Recommended mitigation measures:

- Prevent the introduction of new invasive species by establishing strict controls
- Carry out direct control (e.g., manual eradication) or take action to prevent propagation (e.g., control of runners) where possible (consult *Atlas de restauration des rives du Saint-Laurent* [Environnement Canada 2006a])
- Disseminate information on invasive species and measures to control their spread to citizens and private and public organizations
- Encourage the establishment of an invasive plant monitoring network with members from local communities, conservation organizations and governments

3.2.19 Climate change

Climate change is expected to result in a substantial number of environmental disruptions, some of which will irrevocably affect waterfowl and their habitats. In the southern half of Quebec, water levels and flows on the St. Lawrence River are expected to decrease if the climate in the watershed becomes drier overall. A drying trend would also result in a deeper water table and a decrease in surface water (Centre Saint-Laurent 2007; D'Arcy et al. 2005). Wetlands, particularly those fed by the St. Lawrence, would probably be profoundly modified, if not completely dried up and lost. On the other hand, the general rise in sea levels expected around the world as the climate becomes warmer (increase of 75–190 cm by 2100 according to Vermeer and Rahmstorf 2009) is the main effect anticipated from climate change. Under this scenario, coastal wetlands could be profoundly modified, if not completely flooded and lost.

It is also thought that higher temperatures could delay ice formation and reduce the amount of ice along the coastline once winter arrives. Without this ice, winter storms will cause more shoreline erosion (Baillargeon and Crousset 2006; Savard et al. 2008a), which could result in the alteration, if not complete destruction, of some riparian habitats used by waterfowl.

The increase in temperature is expected to be more pronounced in northern and Arctic regions, accompanied by a gradual flooding of coastal habitats and accompanying erosion problems (Environnement Canada 2007b). The expected changes in all habitats along waterfowl migration routes could have significant impacts on species' occurrence and migration, and result in lower productivity. Furthermore, northern species could be forced to compete with species that have traditionally bred farther south, which will probably result in changes to community structures (Wrona et al. 2006).

In addition, with the expected increase in temperatures in northern and Arctic regions, the possibility of the desynchronization of food availability and the timing of brood rearing should be considered. Whether waterfowl species feed on plants or invertebrates, their breeding phenology may become out of sync with the peak in abundance of food resources. For example, a study under way on the Greater Snow Goose on Bylot Island in Nunavut aims to determine if plants' phenological response to global warming is quicker than that of the geese (Doiron 2011). If this study confirms that there is a desynchronization between the resource and the species' breeding phenology, it will illustrate the major impact of climate change on waterfowl, in terms of goslings' growth and survival.

Since the long-term effects of climate change remain uncertain, waterfowl populations must be monitored closely so that managers can react quickly to adapt population management measures if needed.

Environmental impacts on waterfowl:
- Loss of wetlands
- Degradation of wetlands
- Increased interspecific competition
- Decreased productivity

Recommended mitigation measures:
- Support strategies and actions that help to fight climate change (e.g., cut CO_2 emissions)
- Monitor waterfowl populations closely, particularly in the North, where the effects of global warming are expected to be more acute

3.2.20 Sport harvest

Although the sport harvest is a closely regulated activity and has many benefits (i.e., promoting awareness of wildlife conservation, increased knowledge of waterfowl, population management tool), it also has some undesirable "collateral" effects.

These collateral effects include the fact that not all ducks shot are automatically brought down and recovered by hunters. Birds may be hit outside of the "kill zone"; some of these birds can survive for over a year, depending of course on the extent of their wounds. In addition, on average, an estimated 25% of birds brought down are not recovered (hunting losses) (Canadian Wildlife Service and Ministère du Loisir de la Chasse et de la Pêche 1986). Several factors influence the proportion of birds not recovered on a hunting trip, including an inexperienced hunter, inaccurate shot, poorly chosen ammunition, inadequate equipment, hunting too late in the day and poor weather conditions.

The ingestion of lead shot by waterfowl was a significant source of mortality in the past. However, since 1999, the use of lead shot for waterfowl hunting has been banned in Canada, and it has been replaced by shot made from less toxic materials.

Despite the ban on using lead shot, older birds may still have lead shot in their flesh. For example, in Quebec, lead shot was found in 37% of Common Eider hens captured on their nests on Bicquette Island in 1997 (Hicklin and Barrow 2004). However, the presence of lead shot in birds' flesh generally has little impact on their survival since a cyst usually forms around the shot, making it inert.

Environmental impacts on waterfowl:
- In the case of wounded or unrecovered birds, additive mortality that is not accounted for in sport hunting tallies
- Mortality due to poaching (hunting out of season, exceeding daily bag and possession limits)

Recommended mitigation measures:
- Remind hunters that they must make every reasonable effort to retrieve a bird that has been shot
- Make hunters aware of their responsibility for being able to identify the different species of ducks and geese so that they respect the bag and possession limits for each species and to protect species at risk
- Continue the Harvest Questionnaire Survey and the Species Composition Survey (Wingbee) to monitor species' harvest rates
- Increase surveillance of the hunt by wildlife officers

3.2.21 Aboriginal harvest

There is little information on the waterfowl harvest by Aboriginal people in Quebec. However, thanks to the James Bay and Northern Quebec Agreement signed in 1975 with the Crees and Inuit, and the Northeastern Quebec Agreement signed in 1978 with the Naskapi, the harvests by these three nations can be estimated based on the harvesting levels guaranteed to them under these agreements, which were determined from survey data (Table 1). Guaranteed levels—which are based on the principle that the Aboriginal harvest takes priority over any other harvest, subject to the principle of conservation and where populations of waterfowl permit—mean that these nations are entitled to future harvest levels equal to those in the baseline years of 1972–1979 (depending on the species). Canada Goose is the species most often bagged by Aboriginal hunters, representing 43% of the harvest.

Table 1. Harvesting levels of migratory birds guaranteed to the Crees and Inuit under the James Bay and Northern Quebec Agreement

Species	Crees	Inuit
Canada Goose	64,136	19,544[a]
Snow Goose (Lesser)	23,638	8,233
Brant	7,641	975
Ducks	48,716	15,281[a]
Loons	3,577	901

[a] Includes the collection of eggs, converted into the number of birds.

In 2005, 2006 and 2008, under the Northern Ecosystem Initiative, a study carried out in James Bay Cree communities allowed the Aboriginal harvest to be re-assessed (Cree Regional Authority and Cree Trappers Association 2008). The Aboriginal harvest during the 2000s was found to be around the same order of magnitude as that estimated during the 1970s (J. Rodrigue, CWS, pers. comm.), despite demographic and social changes in Cree communities. This information is crucial so that the Aboriginal harvest can be included in the total harvest for each species. In 2009, Environment Canada commissioned the Makivik Corporation to carry out a feasibility study on implementing a survey on the Aboriginal harvest in Inuit communities in Nunavik.

Environmental impacts on waterfowl:

- Mortality from the Aboriginal harvest, which is not surveyed and is therefore not taken into account in population management

Recommended mitigation measures:

- Institute a regular survey of the Aboriginal waterfowl harvest so that it can be monitored and taken into account in population management

3.2.22 Avian diseases

There have been several epizootics (outbreaks of disease affecting an animal species or group of species over a large area) of avian cholera in Quebec, with the first recorded case dating back to 1964 (Reed and Cousineau 1967). This disease is caused by the bacterium *Pasteurella multocida.* It has been reported on numerous occasions in Common Eider colonies on the islands in the St. Lawrence estuary (BCR 14), where it is chronic in some colonies. In 2002, 5,000 to 7,000 eiders died of avian cholera in the estuary; 80% of these were hens, representing roughly 20% of females of breeding age in the region.

Cases of botulism, a disease caused by biotoxins secreted by the bacterium *Clostridium botulinum,* were confirmed for the first time in Lake Saint-Pierre (BCR 13) in 2001. Since then, this disease is suspected of having caused the deaths of ducks in several other regions of the province. The impact of avian botulism epizootics may be very great, and the death of 50,000 birds from this disease is fairly common in North America; outbreaks resulting in the deaths of over 1 million birds have been reported (Rocke and Bollinger 2007).

Avian influenza is a disease caused by the Type A influenza virus. There are several subtypes of the virus depending on the combination of two surface proteins, hemagglutinin (H1–H16) and neuraminidase (N1–N9), hence the name H5N1, for example. The virus is naturally present in wild and domesticated birds, mainly in a low pathogenic form. To date, in North America, no cases of the highly pathogenic form of the virus have been detected in wild bird populations. From 2005 to 2007, detection rates for Type A avian influenza ranged from 25% to 49% in living specimens and from 0% to 10% in recovered dead birds (Canadian Cooperative Wildlife Health Centre 2006).

To conclude the discussion on avian diseases, a relatively unusual one occurred in August 2008, when an algal bloom (proliferation of harmful algae, also called a water bloom or marine bloom) occurred during a three-week period in the estuary and Gulf of St. Lawrence (BCR 14 and 8). This bloom was first detected in the Saguenay–St. Lawrence Marine Park, near the mouth of the Saguenay Fjord, and then moved to the south shore near Sainte-Flavie. It subsequently spread to Sainte-Anne-des-Monts but broke up before arriving at Anticosti Island. When it was located off Sainte-Flavie, the bloom was nearly 60 km long and 5–10 km wide. The algal bloom resulted not only in a ban on shellfish harvesting but also in the deaths of roughly

20 cetaceans (including a dozen belugas), around 50 seals, and thousands of birds and fish. The algae produces a toxin that accumulates in the liver and digestive glands of a number of organisms (copepods, mussels, fish) and can then move up the food chain. In fish, birds and mammals, the toxin acts on the nervous system, causing a generally temporary paralysis, which can result in death in the case of severe poisoning. Among the species of birds found dead or dying, Black-legged Kittiwake, various species of gulls, Northern Gannet and Double-crested Cormorant were the most common (CWS, unpubl. data). Among waterfowl, at least five Common Eider carcasses were found (CWS, unpubl. data). The fact that mortality among eiders was low suggests that the species may have developed resistance to the toxin (S. Lair, Faculté de médecine vétérinaire, Université de Montréal, pers. comm.).

Environmental impacts on waterfowl:
- Mortality

Recommended mitigation measures:
- Ensure the efficacy of the CWS's Avian Mortality Events Emergency Response Plan and make improvements if needed, to prevent and limit mortality of priority species in the event of an outbreak of avian disease (cholera, botulism, etc.)

3.2.23 Parasites

The presence of leeches on waterfowl is frequently reported. Leeches can cause various problems in birds and even result in duckling mortality (Sooter 1937). Serious infestations result in tissue damage that may also cause secondary bacterial infections (Tuggle 1985). The three main species of leeches known to feed while attached to the nasal passages, trachea and eye membranes of North American migratory birds are *Theromyzon rude*, *T. tessulatum* and *T. biannulatum* respectively (Tuggle 1987). Other species of leeches feed while attached to exposed surfaces (e.g., feet) of waterfowl. In Quebec, nasal leeches have been reported in American Black Ducks and Mallards (J. Rodrigue, CWS, pers. comm.).

The tapeworm *Cloacotaenia megalops*, which belongs to the class Cestoda and is found in the cloaca, has been reported at all Quebec banding stations (J. Rodrigue, CWS, pers. comm.). The role of tapeworms as disease agents is difficult to evaluate. Owing to their size, these parasites are obvious, and it is very unlikely that they are of relatively little importance. According to specialists, "under favorable nutritional conditions, the attrition resulting from helminths that derive their nutrients from the contents of their gut is likely to be small" (Cornwell and Cowan 1963). This interpretation seems plausible given the almost ubiquitous presence of tapeworms in the intestines of ducks that otherwise appear to be in good health.

Environmental impacts on waterfowl:
- Mortality or weakened condition

Recommended mitigation measures:
- None

3.2.24 Contaminants

Northern Canada is particularly vulnerable to contamination, owing to the long-range transport (atmospheric and hydraulic) of persistent organic pollutants, among other things (Environnement Canada 2000). These pollutants of anthropogenic origin are volatized in hot regions and are deposited in cold regions, where they may reach surprising high concentrations. This is how PCBs, DDT and other pollutants find their way to the Far North, where local sources are rare.

Fortunately, a number of national and international initiatives aiming to reduce emissions of certain toxic substances—the federal government's Toxic Substances Management Policy is one such example—have had a positive effect. However, continuing world population growth contributes to the increase in emissions of toxic substances, including new emerging substances, the effects of which are still poorly known.

Contaminants have been identified as a potential factor in the declining populations of some species of sea ducks (Canadian Wildlife Service et al. 1998). The paucity of information on these species, and the high concentrations of contaminants reported in sea ducks in various studies, suggests that contaminants have an effect on the birds' health. In Alaska, scoter and eider carcasses were found to have high concentrations of mercury, cadmium and selenium, although a link could not be established between this and mortality (Henny et al. 1995). However, it must be noted that these metals are sometimes found naturally in high concentrations in some parts of the North.

In British Columbia, farmed blue mussels were found to contain levels of cadmium toxic to Surf Scoters feeding on them, with these levels of toxicity probably sufficient to affect reproductive success (Bendell 2011). In Common Eider in Nunavut, a weak relation between biomarkers and concentrations of mercury, selenium and cadmium led researchers to conclude that these metals had no impact on birds' health (Wayland et al. 2001; Wayland et al. 2002). Furthermore, many species hunted in Eastern Canada, particularly in Ontario and Quebec, are exposed to contaminants when they stage or overwinter in the Great Lakes region.

An analysis of contaminants in Barrow's Goldeneye overwintering in the Baie-Comeau area as well as in other locations along the St. Lawrence and in Chaleur Bay showed that PCB concentrations were higher in the livers of birds captured in Baie-Comeau than in other areas, although they were below the adverse effects threshold (Ouellet et al., in prep.). Although high, the selenium levels in birds harvested in Chaleur Bay were comparable to those in other marine species and posed a low risk of adverse effects. All other contaminants measured occurred in concentrations below the toxic effects threshold.

Lastly, lead ingestion by waterfowl was a major source of mortality in the past. In Canada, the deaths of an estimated 250,000 ducks have been attributed to the ingestion of lead shot. Since 1999, the use of lead shot has been banned in waterfowl hunting, and other types of non-toxic shot are now used. However, anglers are still fishing with lead weights even though zinc substitutes are available. In Quebec, lead weights and lures have mainly been found in the digestive tract of Common Loons, although they have also been found in Canada Geese (Scheuhammer et al. 2003). Elsewhere in North America, lead weights have been found in the digestive system of a number of duck species (Scheuhammer et al. 2003). The ingestion of lead weights is usually fatal.

Environmental impacts on waterfowl:
- Mortality
- Possible harm to birds' physical condition (individual survival), productivity and longevity
- Effects on reproduction, development, and immune and nervous systems

Recommended mitigation measures:
- Continue cooperative efforts and actions put forward under the Great Lakes Water Quality Agreement and the Great Lakes Air Quality Agreement

- Encourage continued support and funding of research on contaminants under the Northern Contaminants Program
- Support initiatives to reduce or eliminate emissions and dispersion of persistent organic pollutants and other contaminants in the environment
- Maintain research, monitoring and risk assessment efforts involving chemical substances

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

4.1 General description

BCR 13 straddles the Canadian–U.S. border. In Canada, it extends from the Lower Great Lakes (lakes Erie and Ontario and the eastern shore of Lake Huron) to the St. Lawrence Valley in Ontario and Quebec. It is one of Canada's smallest BCRs (see Figure 1) (Ressources naturelles Canada 2004; Ressources naturelles Canada 2009a; Wiken et al. 1996). In Quebec, BCR 13 covers 33,540 km^2, of which 30,786 km^2 (92%) is terrestrial and 2,754 km^2 (8%) aquatic (Figure 2). Since the terrestrial portion of BCR 13 represents only 2% of Quebec's land mass, it is the smallest of the six BCRs in the province.

In Quebec, BCR 13 extends from the southwestern end of the St. Lawrence lowlands, along both the south and north shores of the St. Lawrence, to the eastern end of Île aux Oies and Îles aux Loups Marins on the north shore; on the south shore, it continues eastward along the St. Lawrence from L'Islet-sur-Mer to Trois-Pistoles. BCR 13 also takes in the Ottawa and Richelieu valleys (Figure 6) (Environnement Canada 2005b).

The landscape in general consists of morainic ridges deposited by the glaciers from the scouring of the Appalachian and Laurentian mountain ranges. The moraines are associated with a bottom layer of clay and silt resulting from the retreat of the Champlain Sea. This impermeable layer accounts for the presence of shallow water tables and numerous bogs and is also responsible for the extremely fertile soils in this BCR (Li and Ducruc 1999).

The terrain tends to be flat, rarely exceeding 152 m in elevation, except for seven of the nine Monteregian Hills (Environnement Canada 2005b). From west to east, these summits include Mount Royal (233 m), Mount Saint-Bruno (218 m), Mount Saint-Hilaire (403 m), Mount Rougemont (390 m), Mount Yamaska (416 m), Mount Shefford (525 m) and Mount Saint-Grégoire (265 m).

Despite the fact that its terrestrial portion only accounts for 2% of the province's territory, BCR 13 ranks first among Quebec's BCRs in human population, with 5.6 million inhabitants, or over three quarters of the province's population. The western part of the BCR is the most densely inhabited, with over 4,300,000 people (adapted from Ministère des Affaires municipales des Régions et de l'Occupation du territoire 2007). The main population centres include Montréal (1,620,693 people), Québec (491,142), Laval (368,709) and Trois-Rivières (126,323) (Environnement Canada 2005b; Eastern Habitat Joint Venture 2007; Statistique Canada 2008). Four First Nations communities are also found with over 10,000 inhabitants, 96% of whom live in Kahnawake and Akwesasne in the western part of the BCR (Ministère des Affaires municipales des Régions et de l'Occupation du territoire 2005; Affaires indiennes et du Nord Canada 2009; Statistique Canada 2009).

The climate in BCR 13 is the mildest in Quebec (Li and Ducruc 1999). Summers are hot and winters are cold and snowy. The mean annual temperature is roughly 5°C, with summer and winter means of 16.5°C and -7°C respectively. Mean annual precipitation ranges from 800 mm to 1,000 mm (Environnement Canada 2005b).

The mild climate and very fertile soils in BCR 13 are favourable to urban and agricultural development, which explains why this BCR is among those experiencing the greatest habitat losses (particularly of wetlands and from forest fragmentation). Despite this, the remaining habitats are highly productive and diversified (Li et al. 2003; Environnement Canada 2006b). BCR 13 has extensive areas of farmland. The three largest administrative regions in BCR 13 (Montérégie, Centre-du-Québec and Chaudière-Appalaches) are also the most important agricultural regions in Quebec. A large portion of the land is planted in intensively cultivated wide-row crops (e.g., corn, soybeans), often on floodplains (Canards Illimités Canada 2006c; Canards Illimités Canada 2006d; Canards Illimités Canada 2006b).

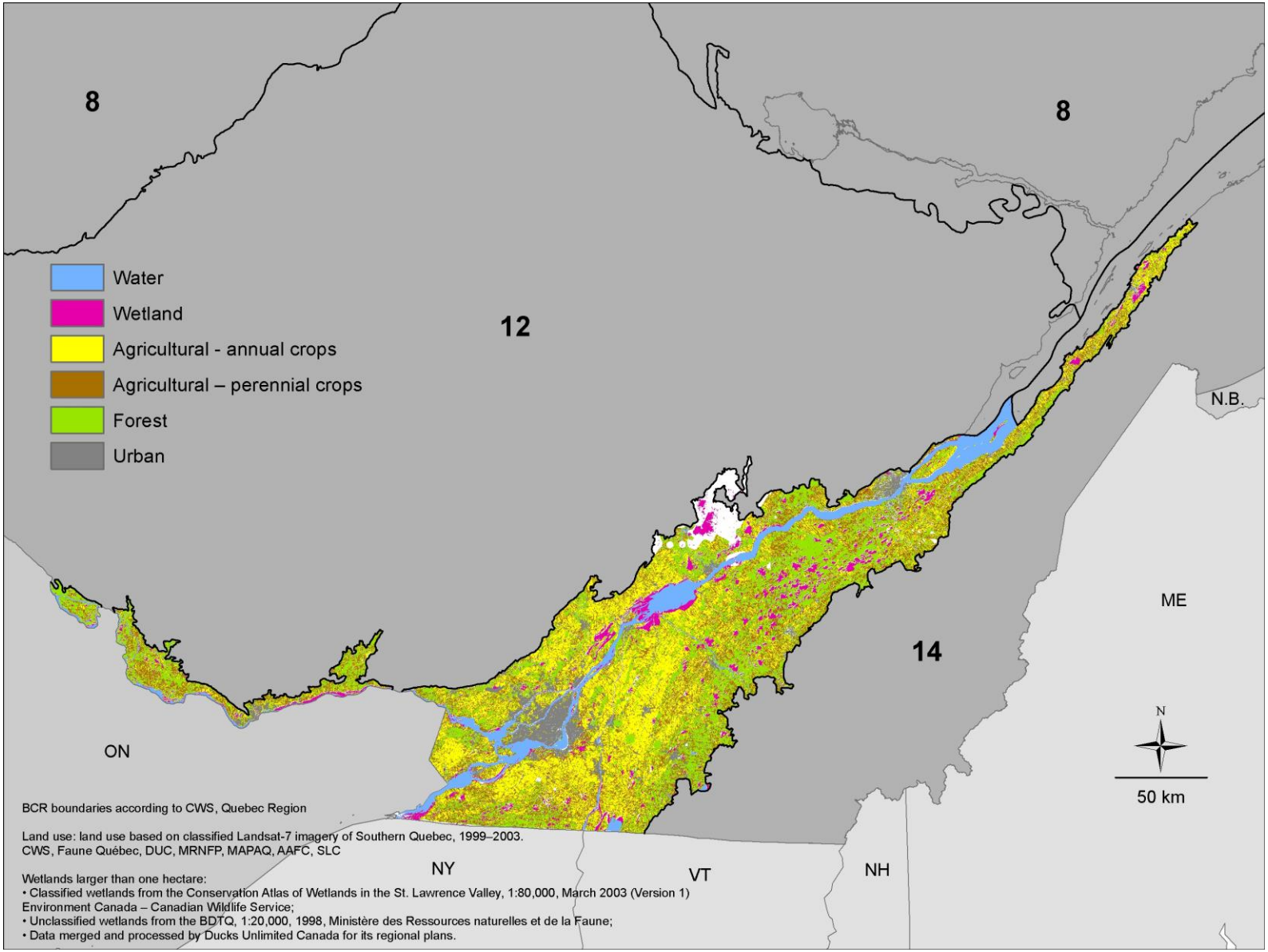
The BCR's forests are highly fragmented and small in size (Bélanger and Grenier 2002). In the early 2000s, they covered roughly one third of the BCR (Li et al. 2003; Jobin et al. 2007). Most are agricultural woodlots, and mixed stands dominate. They are composed mainly of sugar maple, yellow birch, Eastern hemlock and white pine (Environnement Canada 2005b). The vast majority of forests in the BCR are privately owned (90%) (Ministère des Ressources naturelles et de la Faune du Québec 2003d; Ministère des Ressources naturelles et de la Faune du Québec 2003h; Ministère des Ressources naturelles et de la Faune du Québec 2003e; Ministère des Ressources naturelles et de la Faune du Québec 2003g; Ministère des Ressources naturelles et de la Faune du Québec 2003a). Few old-growth forests (exceptional forest ecosystems) remain, totalling only 331 ha (private ownership), 93% of which are in the Montérégie region (MRNF, unpubl. data).

In the Quebec portion of BCR 13, there are an estimated 216,235 ha of wetlands, representing 7% of the territory (both coastal and inland portions, Figure 7). Although BCR 14 is almost four times as large as BCR 13, BCR 13 has more than twice as much wetland area. The dominant wetland types are peatlands (90,855 ha), swamps (56,725 ha) and freshwater marshes (33,860 ha) (Figure 7) (J. Beaulieu, Ducks Unlimited Canada, pers. comm.).

Although peatlands occupy a significant area in BCR 13, many peatlands—particularly in the western part of the BCR—contain few (if any) pools of open water, a vital habitat component for nesting waterfowl, particularly the American Black Duck (Canards Illimités Canada 2006c; Canards Illimités Canada 2006d; Canards Illimités Canada 2006b). An exceptional peatland, the Bois-des-Bel bog, can be found in the eastern part of the BCR, on the L'Isle-Verte plateau. Located on the edge of the Baie de L'Isle-Verte National Wildlife Area, this 200-ha bog is recognized as one of the most important breeding areas for American Black Duck in Quebec. Despite the absence of pools in this bog, the species uses it intensively to nest since the nearby cordgrass marshes, which are sprinkled with pools, provide ideal brood-rearing habitat (Gratton and Grenier 1992; Payette and Rochefort 2001).

The aquatic portion of BCR 13 in Quebec is small in comparison with that of BCR 14 (2,754 km^2 versus 63,154 km^2). It includes the St. Lawrence River, from the fluvial section and fluvial estuary to the upper estuary as far as L'Islet-sur-Mer on the south shore and L'Ange-Gardien on the north shore (Figure 6). The fluvial section, which is located along the Atlantic Flyway, plays a crucial role for waterfowl at various stages of their life cycle. It contains around 75% of all the wetlands in the St. Lawrence (Gratton and Dubreuil 1990; Lehoux et al. 1996), or 63,000 ha. Nearly half of these wetlands consist of extensive aquatic grass beds; swamps and marshes

Figure 6. Location of BCR 13 in Quebec and land use (white = no data)



(freshwater marshes made up of cattails, arrowheads, water-lilies, etc.) occupy roughly 20% of the shoreline (Canards Illimités Canada 2006d), while wet meadows make up around 10% (Gratton and Dubreuil 1990). In addition, the swamps in the fluvial section contain fairly extensive silver maple stands, an increasingly rare ecosystem in Quebec (Canards Illimités Canada 2006c; Canards Illimités Canada 2006d). The fluvial section, with its abundant and diverse wetlands and hundreds of islands, supports numerous duck broods. The Berthier-Sorel Islands, Contrecœur Islands and Varennes Islands are particularly productive in this respect. Dabbling ducks favour the tallgrass meadows on these islands for nesting (Lehoux 2003).

The Lake Saint-Pierre region is also notable for its vast wetlands, totalling 32,282 ha (Figure 7). The extensive floodplains (7,000 ha of flooded area in spring) and fields of cereal crops (in Nicolet, Baie-du-Febvre, Lavallière Bay and Saint-Barthélemy) serve as staging grounds for hundreds of thousands of waterfowl during spring and fall migration (mainly geese and dabbling ducks) (Lehoux et al. 1996). These staging grounds are the second largest in the entire St. Lawrence in terms of the number of individuals found there (Lehoux 2003).

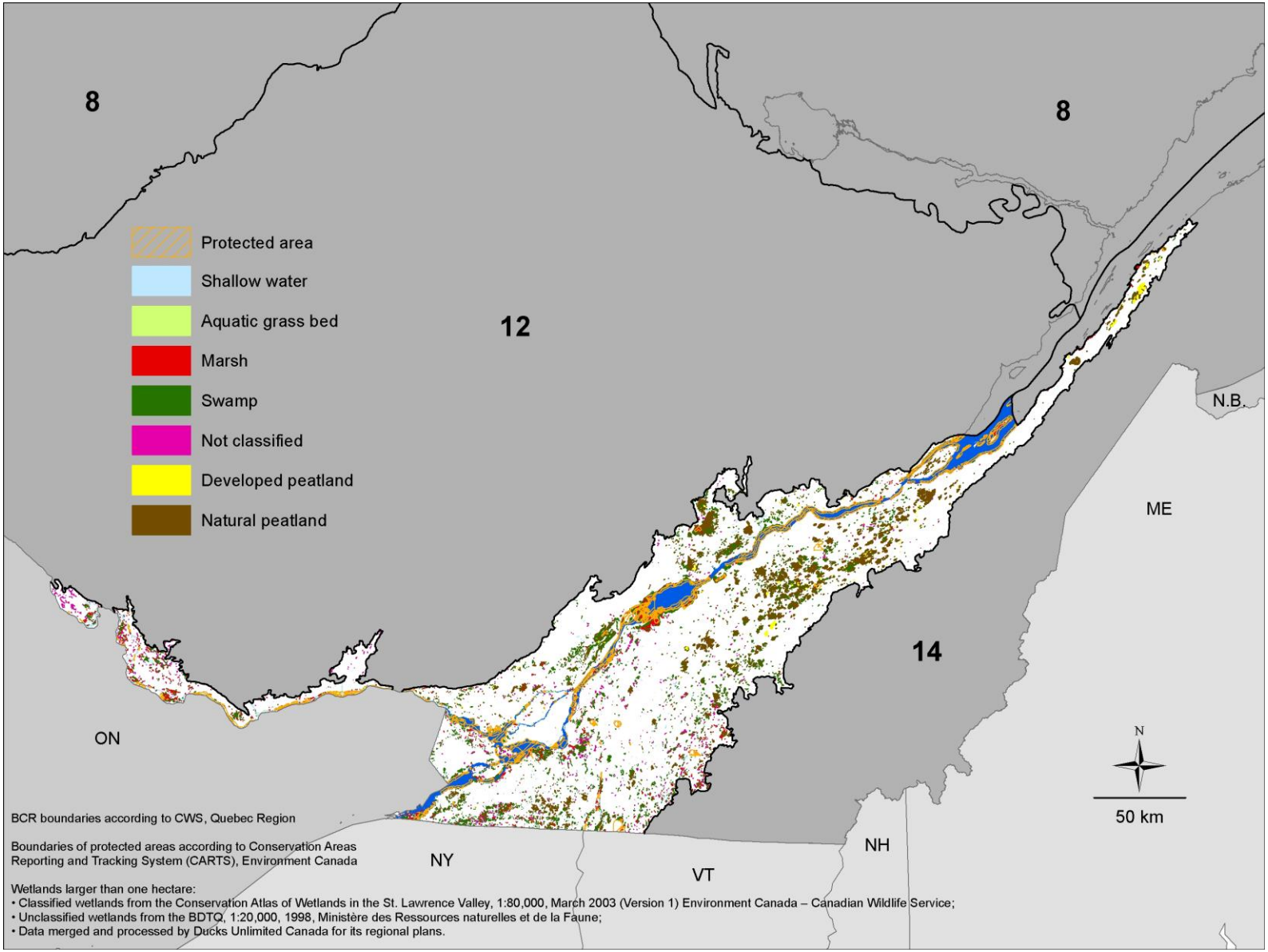
The fluvial section is drained by an extensive river system, with many major tributaries including the Ottawa, Châteauguay, L'Assomption, Richelieu, Yamaska and Saint-François rivers. It also contains four large riverine lakes: Lake Saint-François, Lac des Deux Montagnes (Lake of Two Mountains), Lake Saint-Louis and Lake Saint-Pierre.

Lastly, the fluvial section contains areas of open water in the winter, which attract tens of thousands of ducks. Substantial numbers of overwintering waterfowl can be found around Pointe au Foin and Cornwall Point in Lake Saint-François, and Dixie Island and Pointe du Domaine in Lake Saint-Louis (Lehoux et al. 1996). The Lachine Rapids and Sainte-Marie Current (between the Victoria and Jacques Cartier bridges) are also ice free in winter and attract ducks (Bannon 2008).

Beginning in the fluvial estuary, the tidal influence starts to be felt. Over 5,000 ha of marshes are found in the fluvial estuary (Lehoux et al. 1996). The stretch between Trois-Rivières and Grondines is very similar to the portion of the fluvial section downstream of Montréal (St. Lawrence Centre 1996). A huge submerged aquatic bed (roughly 2,000 ha) can be found across from Bécancour (Lehoux et al. 1996).

Between Grondines (fluvial estuary) and Saint-Jean-Port-Joli (upper estuary), the water changes from fresh to slightly brackish. Bulrush marshes occupy over 70% of the shoreline here, with wet meadows (27%) and swamps (3%) making up the rest. Aquatic grass beds, which are so abundant in the fluvial section, are almost completely absent (Gratton and Dubreuil 1990; St. Lawrence Centre 1996). However, the upper estuary contains roughly 3,000 ha of the richest bulrush marshes in all of Quebec (Lehoux et al. 1996). The largest ones are found at Cap Tourmente (218 ha), in the L'Isle-aux-Grues archipelago (377 ha) and along the south shore at Cap-Saint-Ignace and Montmagny (443 ha), as well as at L'Islet-sur-Mer (275 ha) (St. Lawrence Centre 1996). Staging areas used by geese and dabbling ducks are mainly located downstream of Québec and include the area around Cap Tourmente, the northern channel of the river around Île d'Orléans, L'Isle-aux-Grues archipelago, Bellechasse Cove and Montmagny flats (Lehoux et al. 1996). In addition, a group of islands in this section (Îles aux Loups Marins) house the southernmost Common Eider colony in the St. Lawrence (482 nests in 2009) (CWS, unpubl. data).

Figure 7. General classification of wetlands in BCR 13 (white = does not correspond to wetlands)



From Saint-Jean-Port-Joli onward, the shoreline vegetation becomes much more maritime in character. Cordgrass marshes appear, veritable food factories for wildlife owing to their very high productivity. They consist of a lower marsh dominated by saltwater cordgrass and an upper marsh occupied mainly by salt-meadow cordgrass, freshwater cordgrass and glasswort communities. These marshes contain many pools, often dominated by ditch-grass (Lehoux et al. 1996). In BCR 13, cordgrass marshes total roughly 3,000 ha, nearly half of which are found in L'Isle-Verte Bay (1,350 ha) (Lemieux and Lalumière 1995; Argus inc. 1998). These are the last vestiges of the vast cordgrass marshes that used to be found in the estuary (Service canadien de la faune 2009). Cordgrass marshes are also found near Kamouraska, La Pocatière and Gros-Cacouna (roughly 300 ha each) (Argus inc. 1998). The greatest losses of this habitat have occurred in the Kamouraska and La Pocatière marshes, which have been drained (using aboiteau diking and drainage canals) and converted into farmland. This has led to the disappearance of extensive areas of prime brood-rearing habitat for the American Black Duck (Lehoux 2003).

In the eastern part of the upper estuary, eelgrass beds are sometimes found along the shoreline instead of bare mudflats (Gratton and Dubreuil 1990). There are three known eelgrass beds in BCR 13 (roughly 1,140 ha in all) (Lemieux and Lalumière 1995; Argus inc. 1998), in Cacouna Bay, Baie de L'Isle-Verte National Wildlife Area and at the mouth of Trois-Pistoles River. L'Isle-Verte Bay has the greatest concentration of eelgrass beds along the entire south shore of the St. Lawrence (Lemieux and Lalumière 1995). Algal communities, dominated by rockweed, also become more frequent in this portion of the St. Lawrence (Gratton and Dubreuil 1990).

Protected areas in BCR 13 that provide suitable habitat for waterfowl include 121,400 ha designated as Waterfowl Gathering Areas, 7,670 ha designated as Migratory Bird Sanctuaries and 3,780 ha designated as National Wildlife Areas (NWAs). Indeed, five of Quebec's eight NWAs are located in BCR 13: Lac Saint-François NWA, Îles de la Paix NWA, Îles de Contrecœur NWA, Cap Tourmente NWA and Baie de L'Isle-Verte NWA. With this concentration of NWAs, which were created primarily to protect crucial wetland habitat for waterfowl, it is easy to understand the importance of BCR 13 to waterfowl. In addition, four Ramsar sites have been designated in Quebec under the Convention on Wetlands of International Importance, all located in BCR 13: Lake Saint-François, Lake Saint-Pierre, Cap Tourmente and L'Isle-Verte (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002j).

4.2 Characteristics of conservation issues in BCR 13

The issues discussed below are those for which we were able to provide additional information in BCR 13. The environmental impacts of these issues on waterfowl and recommended mitigation measures are discussed in Chapter 3.

4.2.1 Urban development

BCR 13 has the largest amount of inhabited area of all the BCRs in Quebec. According to a study published in the early 1990s, built-up areas (urban areas) and bare substrate (roads, gravel pits and bare soil) accounted for 11% of the land mass in the 10-km-wide strip along both sides of the St. Lawrence between Cornwall and Tadoussac (Grenier 1991). BCR 13 is home to roughly 80% of the province's population, which is primarily concentrated in the major metropolitan areas of Montréal and Québec (Gouvernement du Québec 2006). These metropolitan areas are not only large, but overall they are experiencing greater sustained demographic growth than their respective urban cores (between 2001 and 2006, the Montréal

census metropolitan area had a population increase of 4.3% versus 2.3% for the city of Montréal and the Québec census metropolitan area had a 3.3% increase versus 3.1% for Québec proper; Institut de la statistique du Québec 2009b). These statistics indicate that, in both cities, urban sprawl is occurring (i.e., increased population density in peri-urban areas), generally at the expense of wildlife habitat.

Recent subdivision north of Boisbriand. Photo: Christine Lepage © CWS

Human activities have also profoundly transformed the shoreline of the St. Lawrence in BCR 13; an estimated 45% of the 1,507 km of shoreline surveyed between Cornwall and Île d'Orléans is no longer in a natural state (Argus inc. 1996). Similarly, developed shoreline (houses, docks or other structures) represents 56% of all the shoreline in the Cornwall–Québec section (Picard et al. 1997), and furthermore, it is nearly three times greater in this section than further downstream, in the estuary and Gulf (Picard et al. 1997). Near the major urban centres, natural shoreline is rare, with 60% to 81% of the shoreline in the Lake Saint-François, Montréal, Trois-Rivières, Portneuf and Québec regions modified by humans (Picard et al. 1997).

4.2.2 Agriculture

In Quebec, conservation issues involving agriculture are most acute in BCR 13. The reason for this is simple: agricultural land occupies a greater percentage of the land mass in this BCR than in the other BCRs (roughly half of the Quebec portion of BCR 13) (Jobin et al. 2007). In addition, agriculture is more intensive here; field crops dominate the landscape in BCR 13, unlike the other BCRs (Jobin et al. 2003). Some of the main factors allowing the development of intensive agriculture in BCR 13 include the extensive drainage of fields (over 1.5 million hectares) and stream straightening (45,000 km of watercourses straightened in the St. Lawrence lowlands) (Richard and Carignan 2008), which affect virtually all the agricultural landscape in the BCR.

Agricultural landscape in the southwest portion of BCR 13. Photo: Christine Lepage © CWS

In addition, certain farming practices in the sector between La Pocatière and L'Isle-Verte have had significant impacts on the region's cordgrass marshes. Roughly 35% of these marshes (around 1,500 ha) have been diked for agricultural purposes (Environnement Canada 2006a). The length of aboiteau dikes in the region totals nearly 40 km, with more than 40 drainage canals crisscrossing most of the remaining marshland (Argus inc. 1998).

Another concrete example of the degradation of wetlands owing to agricultural practices in BCR 13 is the Lavallière Bay marsh. The water quality in the Pot-au-Beurre River, its tributaries and in the marsh itself is very poor (presence of pesticides, large amounts of suspended solids and nutrients, etc.), which has adverse effects on the health of the animal populations that occur here, among other things (Brodeur et al. 2008a). In addition, the marsh's potential to support duck broods is estimated to be only 50% of what it could be (Brodeur et al. 2008a).

4.2.3 Logging

The landscape in BCR 13 shows a high degree of forest fragmentation, with a forest that has been considerably reduced in size. In the early 2000s, forests covered roughly one third of the BCR (Li et al. 2003; Jobin et al. 2007), and this proportion has continued to decline.

Recent logging in an already fragmented landscape. Photo: Christine Lepage © CWS

4.2.4 Exploitation of peatlands

According to data from Ducks Unlimited's regional wetland conservation plans (see Canards Illimités Canada 2007f), roughly 5% of peatlands in the Quebec portion of BCR 13 are commercially exploited (however, this is a very approximate estimate, owing to the difficulty of distinguishing some types of peatlands in remote sensing images and the paucity of information on the area of peatlands already lost in relation to the pre-settlement landscape). Peatland exploitation in the BCR takes various forms depending on the location: in the western portion (in such locations as the MRC Les Jardins-de-Napierville), peatlands are developed primarily for commercial produce crops; in the central part of the BCR (roughly the Centre-du-Québec administrative region), for cranberry production; and in the eastern part of the BCR, in the thin strip along the St. Lawrence, for peat extraction.

Cranberry production in BCR 13. Photo: Christine Lepage © CWS

4.2.5 Oil and gas development

The exploitation of oil and gas deposits is an important issue in BCR 13. The Quebec portion of this BCR contains significant shale gas deposits, mainly on the south shore of the St. Lawrence between Montréal and Lévis. As of March 2011, 29 exploration wells for potential shale-gas fracturing projects had been drilled in the St. Lawrence lowlands.

In addition, the risk of oil spills in natural habitats in BCR 13 now exists, owing to the construction of Ultramar's 240-km St. Lawrence Pipeline, which was completed in 2012. The underground pipeline, which runs between Montréal and Lévis, cuts across 32 municipalities and substantial numbers of natural habitats (Ultramar 2009). Lastly, two projects for LNG terminals are under study in BCR 13: Gros-Cacouna and Rabaska (Lévis).

4.2.6 Wind power generation

BCR 13, at the time of publishing this document, has two wind farm development projects under study (Saint-Cyprien and Pierre-De Saurel), both in the Montérégie region, as well as another project already in service since 2012 (Saint-Rémi) (Ministère des Ressources naturelles et de la Faune du Québec 2014).

4.2.7 Shipping and shipping infrastructures

Since nearly 95% of accidental oil spills occur in a port or handling facility rather than in a shipping channel (Villeneuve 2001), it is worth noting that BCR 13 has a number of major ports: Montréal (1,241 vessels in 2009), Québec (1,206 vessels in 2009), Sorel-Tracy, Bécancour and Trois-Rivières (Fisheries and Oceans Canada 2010). Over 99% of hazardous materials handled in the Port of Québec consist of crude oil, gasoline and fuel oil (Villeneuve 2001).

In addition, two planned LNG terminals in BCR 13 (Gros-Cacouna and Rabaska in Lévis) may result in increased LNG tanker traffic in the St. Lawrence Seaway.

4.2.8 Road transportation and infrastructures

Numerous highway construction and extension projects are under way in BCR 13. Major projects by the Ministère des Transports du Québec include the extension of Highway 5 (10 km in the Outaouais region), the extension of Highway 50 (90 km between Gatineau and Lachute; two lanes), the completion of Highway 30 (over 54 km between Candiac and Vaudreuil-Dorion; four-lane divided highway) and the completion of Highway 35 (38 km between Saint-Jean-sur-Richelieu and the U.S. border; four lanes), as well as a number of projects in the greater Montréal region (completion of Highways 20 and 25, among others) (Ministère des Transports du Québec 2007a). These projects have all undergone environmental assessments owing to their potential impacts on the environment.

Highway 35 under construction. Photo: Christine Lepage © CWS

4.2.9 Water levels and flows on the St. Lawrence

The stretch of the St. Lawrence between Lake Saint-Louis and Trois-Rivières contains breeding habitats highly sought after by waterfowl, with nearly 50% of breeding pairs of dabbling ducks in the St. Lawrence system nesting there (Lehoux et al. 1996). Water levels are a key factor in the reproductive success of these species. If levels are too high when it is time to nest, habitats sought by hens along the shoreline and on the islands in this section—mainly tallgrass meadows (Bélanger 1989; Lehoux et al. 1996)—may become unavailable (Lehoux et al. 2003). Furthermore, a rise in water levels during laying and incubation could result in the flooding and loss of many established nests. Lastly, during the brood-rearing period, excessively high water

levels could reduce the size of the emergent marshes used by broods; water levels that are too low may result in wetlands that are too shallow and too choked with vegetation to support broods (Lehoux et al. 2003). For example, at a water level of 5.4 m, there will be roughly 2,200 ha of emergent marshes between Lake Saint-Louis and Lake Saint-Pierre, but this increases to 10,100 ha when the water level drops to 4.0 m (Lehoux et al. 2003), which illustrates how much the size of the available habitat can vary depending on the water level.

4.2.10 Water quality in the St. Lawrence

According to recent analyses, water quality in the fluvial section of the St. Lawrence is good upstream of Montréal, fair in the section between Repentigny and Sorel, and questionable in the Québec region (State of the St. Lawrence Monitoring Committee 2008). Bacterial contamination in the Repentigny–Sorel section is mainly attributable to certain municipal wastewater treatment facilities (Montréal, Longueuil and Repentigny) that discharge water into the river without disinfecting it (State of the St. Lawrence Monitoring Committee 2008). Turbidity has also increased in general in this sector and is probably due to a modification in the river's flow regime, increased runoff and erosion, and agricultural practices. According to data from monitoring stations used in calculating the national freshwater quality indicator, the water quality at the mouths of the Bayonne River and Rivière du Loup is particularly poor (Environnement Canada 2010a).

In terms of toxic contamination, although contamination by metals (except mercury; Rondeau 2005) and organic contaminants (insecticides, herbicides, PAHs, etc.) is low in general, an increase has been observed in polybrominated diphenyl ethers (used as fire retardants), substances contained in pharmaceutical (e.g., steroids and medications) and personal-care (e.g., hormones) products, PCBs, furans and dioxins (Rondeau 2005; State of the St. Lawrence Monitoring Committee 2008). It should be noted that, of all the St. Lawrence tributaries, the rivers that are the most contaminated by PCBs, furans and dioxins are the Richelieu and Yamaska, which have concentrations exceeding the quality criteria thresholds for the protection of piscivorous terrestrial wildlife (State of the St. Lawrence Monitoring Committee 2008). Several of the above-mentioned substances are cause for concern because they are bioaccumulative and can have toxic and endocrine-disruptive effects in molluscs and fish, which in turn are eaten by certain species of ducks.

4.2.11 Sediment quality in the St. Lawrence

Toxic contamination of sediments in the riverine lakes (lakes Saint-François, Saint-Louis and Saint-Pierre) is one of the indicators used in the State of the St. Lawrence program (State of the St. Lawrence Monitoring Committee 2008). The water in Lake Saint-François comes from the Cornwall-Massena region and the Great Lakes, where petrochemical plants, textile manufacturers, the automobile industry and aluminum smelters discharge their effluents. Although mercury and PCB concentrations have diminished considerably in Lake Saint-François since the 1970s, they are still at levels that may produce effects on benthic organisms. Mercury concentrations measured in sediments have decreased by 50% but remain above the threshold for minor effects on organisms (Pelletier 2002). PCB concentrations in sediments have decreased by 95% since the 1980s and are close to the threshold of no effects on organisms (Pelletier 2002). However, these data involve the thin layer on the surface of sediments (0–3 cm), which covers a layer of contaminated sediments beneath that could very well be resuspended in the water in the event of certain meteorological events or human activities like dredging (Pelletier 2002).

Lake Saint-Louis is contaminated by point sources of mercury, PAH, metals and PCBs from the Ottawa River, Saint-Louis River and locations further upstream in the St. Lawrence.

Concentrations of organic substances (PCBs, PAHs, etc.) in the lake's sediments have decreased over the years, thanks to various cleanup programs but still remain slightly above the probable effects level for benthic organisms (Pelletier 2008b). Metal and mercury concentrations have either not decreased or have decreased very little since the 1980s (State of the St. Lawrence Monitoring Committee 2008). These results are worrisome given the fact that many ducks (including scaup, which feed extensively on benthic organisms such as crustaceans, molluscs and insect larvae) frequent Lake Saint-Louis during spring and fall migration, and many pairs nest on the Îles de la Paix, which is among the lake's most contaminated areas.

Lake Saint-Pierre is threatened by non-point sources of contaminants associated with municipal effluents and the water from the Great Lakes and Ottawa River. Some point sources of metals (iron, zinc, chromium, copper, nickel, lead and mercury) are still active. Mercury concentrations in the lake have decreased by 90% since the 1970s and are now below the threshold effects level for benthic organisms (Pelletier 2008a). PCB levels have also decreased greatly since 1986, by around 90–95% (Pelletier 2008a). Lastly, significant concentrations of metals (except mercury), organochlorine pesticides and total phosphorous are no longer found in sediments in the northern part of Lake Saint-Pierre (Pelletier 2008a).

Maintenance dredging is carried out on a periodic or regular basis in the stretch of the St. Lawrence between Cornwall and Rimouski, including the St. Lawrence Seaway (Cornwall–Montréal); St. Lawrence waterway (Montréal–Île d'Orléans); the ports of Montréal, Bécancour, Trois-Rivières and Québec; harbours; public docks and marinas. This is the equivalent of several hundred thousand cubic metres annually. Developers still dispose of dredged material in the aquatic environment, mainly for financial reasons (L. Breton, EC, pers. comm.). In addition, since dredging is very often repeated, the same disposal sites are used year after year.

4.2.12 Bank erosion and shoreline modification along the St. Lawrence

In the stretch of the St. Lawrence between Cornwall and Québec alone, 400 km of shoreline (or roughly 25%) has been destroyed by erosion (Argus inc. 1996). The most notable effects are between Montréal and Sorel, where 50% of the shoreline (270 km) is affected (Environnement Canada 2006a). Although commercial vessels are responsible for roughly 15% of the erosion in the system, pleasure boating also plays a role, particularly in the Lake Saint-Pierre archipelago, where pleasure craft travelling at high speed can cause significant damage to the shoreline and to shallow aquatic grass beds (Dauphin 2000). Bank erosion has been especially severe on the many islands between Montréal and Sorel, where aerial photos taken in 1964 and 1983 show annual losses of shoreline ranging from 3 m (affecting 70 km of shoreline), to 1.25 m (affecting 80 km) and 1 m (affecting 100 km) (Argus Groupe-conseil inc. 1991). Close to 1,500 ha of island habitat has probably been lost in this stretch of the fluvial section alone since the opening of the St. Lawrence Seaway in 1959 (Argus Groupe-conseil inc. 1991). Sectors where urgent action is needed to counter erosion include Îles de la Paix, Varennes Islands, Contrecœur Islands and the Lake Saint-Pierre archipelago (Dauphin and Lehoux 2004; Environnement Canada 2006a); the threat is particularly great on the barrier islands in the Îles de Contrecœur NWA, where priority wetlands are found.

In addition, the region along the coast between Kamouraska and L'Isle-Verte still contains several dozen hectares of diked marsh (not converted for agricultural use) with impaired ecological functions (Argus inc. 1998).

4.2.13 Recreation and tourism

Since BCR 13 is by far the most populous BCR in Quebec and has many major tourist destinations, waterfowl species are likely to suffer the consequences of disturbance resulting from tourism and recreation. For example, the failure to respect a ban on coming ashore on some protected islands (e.g., Îles de la Paix and Contrecœur Islands) is very harmful, since it results in the disturbance of breeding waterfowl that are in the midst of laying eggs or raising broods.

4.2.14 Invasive species

Greater and Lesser scaup, which staged in large numbers (up to 50,000 individuals) on the riverine lakes of the St. Lawrence in the 1970s and 1980s (see species accounts in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]), seem to have modified their migration habits and now stop over on the Great Lakes instead, taking advantage of the abundance of introduced zebra and quagga mussels (Petrie et al. 2006; Ross et al. 2005). Contaminants, particularly selenium, bioaccumulate in these mussels, which are then eaten by the scaup, where they bioaccumulate further (Ross et al. 2005; Petrie et al. 2007) at thresholds that may be harmful to birds' reproductive success (Long Point Waterfowl and Wetlands Research Fund 2007; Petrie et al. 2007).

In terms of invasive plant species, the fluvial section between lakes Saint-Louis and Saint-Pierre is one of the sectors most affected by exotic invasive plants, which account for over 50% of the vegetation cover on the Îles de la Paix and Boucherville, Varennes and Contrecœur islands (Jean et al. 2005).

Some native species are also invasive. For example, in the Gros-Cacouna marsh in the Lower St. Lawrence region, cattails have made major inroads in the bulrush marsh (Environnement Canada 2006a), making it unusable for duck broods, which have difficulty moving and foraging in the dense vegetation.

4.3 Use of BCR 13 by waterfowl

4.3.1 Migration

Geese (6): Greater White-fronted Goose, Snow Goose (Lesser and Greater), Ross's Goose, Brant, Cackling Goose and Canada Goose (Atlantic and Resident populations)
Swan (1): Mute Swan
Dabbling ducks (10): Wood Duck, Gadwall, Eurasian Wigeon, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Shoveler, Northern Pintail and Green-winged Teal
Diving ducks (5): Canvasback, Redhead, Ring-necked Duck, Greater Scaup and Lesser Scaup
Sea ducks (11): Common Eider (*dresseri*), Surf Scoter, White-winged Scoter, Black Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser
Stiff-tailed duck (1): Ruddy Duck

TOTAL = 34 species

Highlights of migration period:

- Over 800,000 Snow Geese stage all along the fluvial section of the St. Lawrence and the upper estuary (from Lake Saint-François to Cap Tourmente on the north shore and Trois-Pistoles on the south shore) and in numerous farm fields (Baie-du-Febvre, Victoriaville, Cap Tourmente NWA and Côte-du-Sud region, among others) (GSGOS).
- Almost the entire Atlantic Population of Canada Geese migrate through BCR 13.
- Roughly 15,000 Brant (Atlantic Population) migrate through BCR 13 in spring, staging mainly in the eelgrass beds in L'Isle-Verte Bay.
- The entire stretch of the St. Lawrence included in BCR 13 (including the Ottawa River) is of critical importance to thousands of dabbling ducks, particularly Lake Saint-Pierre, which is a major staging ground for these birds in spring, when you can see flocks of several thousand Gadwall, American Wigeon, American Black Duck, Mallard, Northern Pintail and Green-winged Teal in the flooded fields along this riverine lake (e.g., Berthierville, Saint-Barthélemy, Maskinongé, Baie-du-Febvre; WSHO). In fall, flocks of several thousand dabbling ducks congregate in Cap Tourmente NWA, around Île aux Grues and off Montmagny, among other locations (ÉPOQ).
- Several thousand Ring-necked Duck, Greater Scaup and Lesser Scaup stage along the Ottawa River and in lakes Saint-François, Saint-Louis and Saint-Pierre (WSHO).

As many as 2,300,000 geese, swans and ducks are estimated to pass through BCR 13 during migration (Table 2).

4.3.2 Breeding

Geese (2): Snow Goose (Greater) and Canada Goose (Resident Population)
Dabbling ducks (9): Wood Duck, Gadwall, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Shoveler, Northern Pintail and Green-winged Teal
Diving ducks (3): Redhead, Ring-necked Duck and Lesser Scaup
Sea ducks (4): Common Eider (*dresseri*), Common Goldeneye, Hooded Merganser and Common Merganser
Stiff-tailed duck (1): Ruddy Duck

TOTAL = 19 species

Breeding season highlights:

- A very small Snow Goose colony has become established on the Battures aux Loups Marins (flats), which is roughly 4,000 km south of the species' traditional breeding range (CWS, unpubl. data).
- The Resident Population of Canada Geese, which managers in the province are trying to limit (see species account in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]), nest in large numbers on the islands between Boucherville and Lake Saint-Pierre; the population in the fluvial section as a whole has increased from roughly 500 pairs in 2004 to nearly 1,000 pairs in 2007 (WSHO).
- The Boucherville, Varennes and Verchères islands, Îles de Contrecœur NWA and Berthier-Sorel Islands are preferred nesting areas for Mallard, Gadwall, Northern Pintail, American Wigeon and Northern Shoveler; many of these islands have the dense tallgrass meadows favoured by dabbling ducks.
- The numerous wetlands along the Ottawa River (e.g., Plaisance), Richelieu River (e.g., Île aux Noix), St. Lawrence River (e.g., Lac Saint-François NWA, Beauharnois Canal, Lake Saint-Pierre), fluvial estuary (e.g., Grondines) and upper estuary (e.g., Cap Tourmente and Baie de

L'Isle-Verte NWAs) are used extensively by all species of dabbling ducks during the breeding season.
- Peatlands in the Centre-du-Québec, Chaudière-Appalaches (e.g., Lotbinière area) and Bas-Saint-Laurent (Lower St. Lawrence) (particularly the L'Isle-Verte area) regions are enormously important for nesting American Black Duck (Bélanger et al. 1994), while cordgrass marshes are essential for brood rearing in this species (Gauthier et al. 1980).
- In agricultural landscapes, Mallards nest in field crops (i.e., grain, soybeans, corn), while American Black Ducks are found more often on land used for dairy farming (forage crops and pastures) and in forested landscapes (Maisonneuve et al. 2006).
- Redhead and Lesser Scaup are secretive but regular nesters in certain marshes along the St. Lawrence, from Lake Saint-François (e.g., Lac Saint-François NWA) to Lake Saint-Pierre (e.g., Yamachiche Bay and Baie-du-Febvre; ÉPOQ).
- The Ruddy Duck nests mainly on the edges of artificial ponds in the Lake Saint-Pierre region, including the Baie-du-Febvre area (Jauvin 1996; ÉPOQ).

BCR 13 probably supports close to 43,500 breeding pairs (Table 2).

4.3.3 Moulting

Our information on the use of BCR 13 by moulting waterfowl is fragmentary. However, many wetlands scattered here and there along the St. Lawrence undoubtedly support sizeable numbers of individuals at this stage of their annual life cycle.
Geese (1): Canada Goose (Resident Population)
Dabbling ducks (8): Wood Duck, Gadwall, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Pintail and Green-winged Teal
Diving ducks (2): Redhead and Ring-necked Duck
Stiff-tailed duck (1): Ruddy Duck

TOTAL = at least 12 species

Highlights of moulting period:
- Aquatic grass beds in Saint-François Bay and along the shoreline of Lake Saint-Pierre, as well as artificial marshes developed for waterfowl in Nicolet, are extremely important for moulting waterfowl, with thousands of Mallards (as many as 10,000) and hundreds of Northern Pintails, American Black Ducks and Ring-necked Ducks using these habitats. Other species occurring in smaller numbers, which were captured during banding activities, include Redhead, Ruddy Duck, Gadwall, Wood Duck, American Wigeon and Green-winged Teal (CWS, unpubl. data).
- The extensive marshes near Thurso are another important habitat for moulting Mallards and American Black Ducks (CWS, unpubl. data).
- Cap Tourmente NWA hosts several hundred moulting Green-winged Teal, as well as significant numbers of Blue-winged Teal, Mallard, American Black Duck and Wood Duck (CWS, unpubl. data).
- Baie de L'Isle-Verte NWA is used by numerous moulting dabbling ducks, including American Black Duck, Green-winged Teal, Mallard, Northern Pintail and Wood Duck (CWS, unpubl. data).

4.3.4 Wintering

Geese (1): Canada Goose (probably Resident Population)
Dabbling ducks (3): American Black Duck, Mallard and Northern Pintail
Sea ducks (3): Common Goldeneye, Hooded Merganser and Common Merganser
TOTAL = 7 species

Winter highlights:

- Roughly 500 American Black Duck, 2,000 Mallard, 1,200 Common Goldeneye and 1,300 Common Merganser on average overwinter in the greater Montréal region—particularly in the Beauharnois Canal sector and in the Lachine Rapids (Bannon 2008).
- The Ottawa, Richelieu and Saint-François rivers have substantial numbers of overwintering waterfowl, as do the Lake Boivin (near Granby) and Beauport areas (ÉPOQ).

BCR 13 probably supports close to 9,000 overwintering individuals (Table 2).

Table 2. Conservation objectives; numbers (IBP/32,200 km² ± standard deviation), density (IBP/100 km² ± standard deviation) and trends during the breeding season; numbers (when available; otherwise, occurrence) during the migration, moulting and wintering periods in BCR 13 (species in red are the priority species of this BCR; see section 4.4).

BCR 13	Objective[a]	Breeding Number[b] ± s.d.	%	% cum.	Density[c] ± s.d.	Trend[d]	Spring Migration[e]	Moulting[f]	Wintering[f]
Mallard	21,000	17,100 ± 1,300	40	40	53.18 ± 4.14	-1.4	80,000	Yes	> 5,200[g]
American Black Duck	11,000	10,400 ± 1,500	24	64	32.38 ± 4.81	6.7	316,000	Yes	> 700[g]
Green-winged Teal	8,900	5,200 ± 1,000	12	76	16.01 ± 2.98	-16.3	84,000	Yes	No
Wood Duck	2,800	2,200 ± 430	5	81	6.76 ± 1.35	1.3	11,000	Yes	No
Canada Goose[h]	< 3,000[i]	2,100 ± 250	5	86	6.46 ± 0.77	-4.5	367,000	Yes	> 90[g]
Common Merganser	1,000	1,800 ± 240	4	90	5.44 ± 0.74	3.2	114,000	?	> 1,600[g]
Ring-necked Duck	1,300	1,100 ± 140	3	93	3.37 ± 0.44	1.7	163,000	Yes	No
Northern Pintail	900	830 ± 140	2	95	2.59 ± 0.43	2.1	33,000	Yes	Yes
Gadwall	700	580 ± 130	1	96	1.80 ± 0.39	0.1	1,900	Yes	No
Common Eider *dresseri*	n. d.	500[j]	1	97	n. d.	n. d.	1,300	Yes	No
American Wigeon	400	440 ± 110	1	98	1.37 ± 0.33	-5.8	5,300	Yes	No
Common Goldeneye	700	360 ± 50	1	99	1.11 ± 0.16	-33.1	140,000	?	> 1,600[g]
Northern Shoveler	n. d.	160 ± 30	< 1	100	0.50 ± 0.09	22.6	500	Yes	No
Hooded Merganser	n. d.	140 ± 50	< 1	100	0.44 ± 0.15	n. d.	67,000	Yes	Yes
Blue-winged Teal	n. d.	110 ± 40	< 1	100	0.34 ± 0.13	n. d.	1,700	Yes	No
Snow Goose	500,000-750,000[k]	Yes	< 1	100	n. d.	n. d.	820,000[l]	No	No
Redhead	n. d.	Yes	< 1	100	n. d.	n. d.	Yes	Yes	No
Lesser Scaup	n. d.	Yes	< 1	100	n. d.	n. d.	29,000	?	No
Ruddy Duck	n. d.	Yes	< 1	100	n. d.	n. d.	Yes	Yes	No
Red-breasted Merg.		Occas.[m]					Yes	No	No
Greater Scaup		Occas.[m]					22,000	No	No
G. White-fronted Goose		No					Yes	No	No
Ross's Goose		No					Yes	No	No
Brant		No					15,000[n]	No	No
Cackling Goose		No					Yes	No	No
Mute Swan		No					Yes	No	No
Eurasian Wigeon		No					Yes	No	No
Canvasback		No					Yes	No	No
Surf Scoter		No					Yes	No	No
White-winged Scoter		No					Yes	No	No
Black Scoter		No					Yes	No	No
Long-tailed Duck		No					Yes	No	No
Bufflehead		No					12,000	?	No
Barrow's Goldeneye		No					Yes	No	No
Total	**49,000[o]**	**43,500[p]**	**100**	**100**	**132.08[q] ± 9.77**	**-2.5[r]**	**> 2,300,000**	**?**	**> 9,200**

[a] Population objective for the BCR; unless otherwise indicated, the objective is expressed as **indicated breeding pairs (IBP)** and corresponds to the total breeding population according to the 2004 WLOW and 2004 WSHO. n. d. = not determined.

[b] Number of **IBP** according to the total of the 2004–2007 averages for WLOW and WSHO ± standard deviation for the entire BCR.
Yes = Species breeds in the BCR, but CWS surveys do not allow population to be calculated. Occas. = Species breeds occasionally in the BCR (every 2 to 5 years). Excep. = Species breeds exceptionally in the BCR (fewer than once every five years). No = Species does not breed in the BCR.

[c] Density of **IBP** 100 km² based on mean of 2004–2007 averages for WLOW and WSHO ± standard deviation.

[d] **Breeding population** trend based on WLOW and WSHO data for 2004–2007 and expressed as the mean annual percentage of increase or decrease (-);
* = significant trend, $p < 0.05$; ▲ = nearly significant trend ($0.05 \leq p \leq 0.10$).

[e] Number of migrating **individuals** in spring. Unless otherwise indicated, this estimate is based on the total number of indicated breeding pairs in the BCR (see[b]) and the IBP in the BCRs located north of this BCR; all IBP were multiplied by a factor (2.67 for geese; 2.10 for dabbling ducks; 2.63 for diving ducks and 2.56 for sea ducks) to take account of nonbreeding individuals. For less abundant species, Yes = Species occurs in the BCR, but in unknown numbers. No = Species does not occur in the BCR.

[f] Number of **individuals**, according to various sources. For species listed without a number, Yes = Species occurs in the BCR, but in unknown numbers; No = Species does not occur in the BCR; ? = It is not known whether the species occurs in the BCR.

[g] Average number of **individuals** (2003–2008) in the Montréal region (Bannon 2008); this number therefore represents a minimum number for the entire BCR, hence the use of the symbol “>“.

[h] Resident Population of Canada Geese for objective, breeding, moulting and wintering. For spring migration, Canada geese are a mixture of Resident and Atlantic populations.

[i] Objective in **IBP**, determined after consulting with CWS specialists. Although the ideal objective would be zero due to issues arising from conflicts with human beings, this will obviously never be achieved (see species account in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]).

[j] Number of **breeding pairs** from the Triennial Ring-billed Gull Survey in the St. Lawrence River and estuary (CWS, unpubl. data, 2009). (In addition, see species account in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]).

[k] Objective for entire population (and not only for this BCR) of the Greater Snow Goose in **migration**, expressed as the number of **individuals**, from Bélanger and Lefebvre 2006.

[l] Number of **individuals** according to 2008 data from Greater Snow Goose Spring Survey in Quebec (CWS, unpubl. data).

[m] According to observations of nests and broods reported in ÉPOQ.

[n] Rough estimate of the number of **individuals** based on a telemetry study (New Jersey Division of Fish and Wildlife 2003), surveys in the St. Lawrence estuary in 2002 and 2003 (CWS, unpubl. data) and 2004–2007 WSHO data (CWS, unpubl. data).

[o] This number corresponds to the total of the objectives for **breeding populations** only.

[p] Standard deviation not available for total breeding population due to lack of standard deviation for breeding population of the Common Eider.

[q] Density of all species of breeding waterfowl, except for Common Eider and species that occur in small numbers.

[r] Trend for all species of breeding waterfowl for which this statistic could be calculated.

4.4 Priority species in BCR 13

Priority species in BCR 13 were selected using *objective* prioritization methods (see section 2.5 and Appendix 16.2), combined with the *subjective* experience of CWS specialists. A conservation objective has been set for each priority species (see section 4.5).

High priority	Medium priority
American Black Duck: Objective 2 Blue-winged Teal: Objective 3	Brant: Objective 4 Canada Goose (Atlantic Pop.): Objective 5 Wood Duck: Objective 6 Greater Scaup: Objective 7 Lesser Scaup: Objective 7 Snow Goose: Objective 8

Special management measures
Canada Goose (Resident Pop.): Objective 9 Snow Goose: Objective 8

4.5 Conservation objectives and actions recommended for priority species in BCR 13

Objective 1 comprises actions that apply to a number of the priority species. Objectives 2 to 9 comprise actions targeting a specific priority species or group of species.

Objective 1
Ensure the conservation of high-priority and medium-priority species.

Monitoring and surveys

Action 1 Continue WLOW, which serves as a baseline for determining breeding population objectives.
► American Black Duck, Blue-winged Teal, Wood Duck, Canada Goose

Action 2 Institute a spring survey of migrants of priority species that do not breed in the BCR.
► Brant, Greater Scaup, Lesser Scaup

Action 3 Continue the pre-season banding program to monitor harvest rates, document birds' movements, quantify survival and obtain indices of reproductive success of priority species.
► American Black Duck, Blue-winged Teal, Wood Duck

Action 4 Institute a survey to monitor the productivity of priority species.
► American Black Duck, Blue-winged Teal

Action 5 Continue the St. Lawrence freshwater wetland monitoring program (Jean et al. 2005; State of the St. Lawrence Monitoring Committee 2008) to better understand wetland vegetation dynamics and determine the extent of losses of different types of wetlands.
► American Black Duck, Blue-winged Teal, Wood Duck, Brant

Action 6 Institute a survey of a series of key wetlands used by certain priority species (along the St. Lawrence and farther inland); determine the extent and nature of losses and modifications to wetlands.
► American Black Duck, Blue-winged Teal, Wood Duck, Brant

Knowledge acquisition

Action 7 Determine the most important parameters (e.g., adult survival by season, productivity) in the annual cycle of priority species in order to guide monitoring and conservation efforts.
► American Black Duck, Blue-winged Teal, Wood Duck, Brant, Greater Scaup, Lesser Scaup

Action 8 Determine local factors (e.g., habitat characteristics, food resources) that have an impact on the breeding of priority species.
► American Black Duck, Blue-winged Teal, Wood Duck

Action 9 Determine the abundance and distribution of priority species according to wetland type and wetland location in the BCR; locate priority habitats that face threats and develop strategies to curb these threats.
► American Black Duck, Blue-winged Teal, Wood Duck

Action 10 Determine links between breeding grounds, moulting areas and wintering grounds (delineation of populations).
► Brant, Greater Scaup, Lesser Scaup

Action 11 Locate the best habitats to be protected for certain priority species.
► Blue-winged Teal (marshes), Brant (eelgrass beds)

Active surveillance

Action 12 Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to priority species.
► American Black Duck, Blue-winged Teal, Wood Duck, Brant, Canada Goose, Greater Scaup, Lesser Scaup, Snow Goose

Action 13 Continue the Harvest Questionnaire Survey and the Species Composition Survey (Wingbee) to monitor harvest rates of priority species.
► American Black Duck, Blue-winged Teal, Wood Duck, Canada Goose, Brant, Greater Scaup, Lesser Scaup, Snow Goose

Action 14 Ensure the efficacy of the CWS Oil Spill Emergency Response Plan in order to prevent and limit mortality in priority species in the event of an oil spill.
► American Black Duck, Blue-winged Teal, Wood Duck, Brant, Canada Goose, Greater Scaup, Lesser Scaup, Snow Goose

Action 15 Ensure the efficacy of the CWS Avian Mortality Events Emergency Response Plan, and make improvements if necessary, to prevent and limit mortality in priority species in the event of an outbreak of avian disease (e.g., avian cholera, botulism).

► American Black Duck, Blue-winged Teal, Wood Duck, Brant, Canada Goose, Greater Scaup, Lesser Scaup, Snow Goose

Action 16 Ensure the adequate surveillance of NWAs in the fluvial section, particularly during the nesting period.

► American Black Duck, Blue-winged Teal, Wood Duck

Action 17 Provide advice to the IJC when needed and inform it on the requirements of priority species (Lehoux et al. 2003).

► American Black Duck, Blue-winged Teal

Environmentally sustainable practices

Action 18 Raise awareness among farmers of the environmental issues associated with large-scale monocultures (grains, soybeans, corn) in the St. Lawrence lowlands to counter the loss of breeding habitats in this region (forest patches, forested and shrubby riparian strips, agricultural wildland or abandoned fields, etc.).

► American Black Duck, Blue-winged Teal, Wood Duck

Action 19 Promote sustainable, ecological agriculture which ensures the presence of suitable waterfowl habitat (riparian strips, healthy aquatic habitats, etc.) during both the nesting and brood-rearing periods; for instance, encourage private programs such as the program by Fondation de la faune du Québec and the Union des producteurs agricoles to enhance watercourse biodiversity in agricultural environments (*Programme de mise en valeur de la biodiversité des cours d'eau en milieu agricole*) and Nature Québec's zero-carbon farm initiative (*Agriculture et climat: Vers des fermes 0 carbone*).

► American Black Duck, Blue-winged Teal, Wood Duck

Action 20 Raise awareness among island landowners and farmers in the fluvial section of the need to preserve crucial breeding habitats (particularly tallgrass meadows) on islands and to keep livestock away from the shoreline to prevent trampling, which exacerbates the erosion problem.

► American Black Duck, Blue-winged Teal

Action 21 Raise awareness among the authorities responsible for land-use planning and development (residential and industrial development) of the importance of conserving wetlands.

► American Black Duck, Blue-winged Teal, Wood Duck

Action 22 Raise awareness among pleasure boaters and kayakers of the importance of avoiding all disturbance to waterfowl on islands in the fluvial section in summer (not coming ashore on islands during the nesting and brood-rearing periods, and not approaching birds during the moulting period).

► American Black Duck, Blue-winged Teal, Wood Duck

Action 23 Raise awareness among pleasure boaters of the importance of reducing their speed in channels and when navigating close to the shoreline in order to lessen the impact of waves on shore erosion (Environnement Canada 2006a).

► American Black Duck, Blue-winged Teal, Wood Duck

Action 24 Raise awareness among the public of the issue of invasive species and practices to prevent their spread (e.g., washing boat hulls).

► American Black Duck, Blue-winged Teal, Wood Duck, Brant, Canada Goose, Greater Scaup, Lesser Scaup

Habitat measures

Action 25 Acquire, restore or protect emergent marshes in the Lake Saint-Louis–Lake Saint-Pierre section whenever possible (particularly the Lake Saint-Pierre archipelago; Lehoux et al. 2003); specifically, restore marshes that are choked with vegetation by creating openings so that they can be used again by duck broods (see *Atlas de restauration des rives du Saint-Laurent* [Environnement Canada 2006a] to identify sites where this type of restoration can be undertaken).
► American Black Duck, Blue-winged Teal

Action 26 Stabilize banks to combat erosion and the loss of island habitat, particularly in the Îles de la Paix, Varennes and Contrecœur islands and the Lake Saint-Pierre archipelago (Dauphin and Lehoux 2004; Environnement Canada 2006a); portions of the shoreline where bank stabilization is a priority have already been identified (see *Bilan de la sévérité de l'érosion dans le Saint-Laurent dulcicole* [Dauphin and Lehoux 2004]), particularly the barrier islands in the Îles de Contrecœur NWA where priority wetlands are seriously threatened.
► American Black Duck, Blue-winged Teal

Action 27 Encourage the establishment of an invasive plant monitoring network made up of local communities, conservation organizations and governments; when possible (see *Atlas de restauration des rives du Saint-Laurent* [Environnement Canada 2006a]), use direct control (e.g., manual weeding) or measures to prevent propagation (e.g., control of runners).
► American Black Duck, Blue-winged Teal

Objective 2
Ensure the conservation of the American Black Duck; increase the breeding population to 11,000 indicated breeding pairs and maintain this population (Table 2).

► **Key habitats (breeding):** marshes, peatlands, agricultural watercourses, swamps, beaver ponds, lakes
► **Primary conservation issues:** habitat loss (shift to intensive farming practices, drainage of farmland, peatland exploitation, deforestation, cottage and resort development [shoreline encroachment]), harvest rates, climate change (possible effect on wintering)

In addition, consult the Population Monitoring Implementation Plan (Black Duck Joint Venture 2008b) and the Research Program Implementation Plan (Black Duck Joint Venture 2008c) for a list of BDJV recommendations for the American Black Duck.

Other actions specifically targeting the American Black Duck in BCR 13:

Monitoring and surveys

Action 28 Institute a monitoring program of wintering American Black Duck to document changes and assess if they are related to climate change (this survey and the effects of global warming are identified in the BDJV 2010 Research Program Implementation Plan).

Knowledge acquisition

Action 29 Compare the use of natural and exploited peatlands in the St. Lawrence Valley by the American Black Duck; determine if peatland exploitation (peat mining and cranberry production) has an impact on breeding in the species.

Action 30 To preserve local breeding populations as well as migrant and wintering populations identified as vulnerable, determine the natal region of birds bagged in the sport and Aboriginal harvests.

Action 31 Locate moulting areas used by the American Black Duck; determine if they are threatened and, if so, develop strategies to combat these threats.

Environmentally sustainable practices

Action 32 Educate farmers about the issues arising from drainage practices that are degrading cordgrass marshes along the upper estuary between Kamouraska and L'Isle-Verte (Argus inc. 1998; Environnement Canada 2006a).

Action 33 Raise awareness among commercial peatland users of the importance of leaving strips of residual vegetation at least five metres wide for nesting American Black Ducks (Bélanger et al. 1994).

Action 34 Raise hunters' awareness of the importance of respecting regulations on daily bag and possession limits for American Black Ducks.

Habitat measures

Action 35 Acquire, restore or protect cordgrass marshes in the Lower St. Lawrence region whenever possible (see Argus inc. 1998), since these marshes are the preferred brood-rearing habitat of the American Black Duck.

Action 36 Restore, whenever possible, salt marshes where the creation of drainage canals has resulted in the drying up of the marsh and pools; using sills to seal off canals can significantly improve the quality of marshes by restoring vegetation and increasing the number of pools (see the *Atlas de restauration des rives du Saint-Laurent* [Environnement Canada 2006a] to find sites where this type of restoration work can be carried out).

Action 37 Whenever possible, restore aboiteaus that can be restored (see the *Atlas de restauration des rives du Saint-Laurent* [Environnement Canada 2006a] to find sites where this type of restoration work can be done); removing dikes can restore exchanges between diked marshes and the St. Lawrence.

Action 38 Acquire, restore or protect natural peatlands (e.g., create a corridor of protected natural peatlands in the Arthabasca, Bécancour, de l'Érable, Bellechasse, Lévis and Lotbinière MRCs); investigate the possibility of increasing the links between peatlands in the vicinity of the Baie de L'Isle-Verte NWA (e.g., integrate the Bois-des-Bel bog with the NWA); create a protected buffer zone around the Baie de L'Isle-Verte NWA.

Action 39 In agricultural and mixed agricultural and forest landscapes, conserve and protect woodlots containing streams, ponds and lakes, since these habitats are particularly sought out by American Black Ducks during the nesting period (Maisonneuve et al. 2006).

Objective 3
Ensure the conservation of the Blue-winged Teal; at a minimum, maintain the breeding population at 110 indicated breeding pairs (Table 2).

- ► **Key habitats (breeding):** freshwater and brackish-water marshes, agricultural watercourses and ponds, agricultural wildland (abandoned fields), herbaceous riparian strips, swamps, beaver ponds
- ► **Primary conservation issues:** habitat loss (shift to intensive farming practices, drainage of fields, filling-in of small wetlands), harvest rates

Other actions specifically targeting the Blue-winged Teal in BCR 13:

Active surveillance

Action 40 Ensure adequate surveillance along the Ottawa River during the sport hunt.

Environmentally sustainable practices

Action 41 Raise hunters' awareness of the importance of respecting regulations on daily bag and possession limits for Blue-winged Teal.

Objective 4
Ensure the conservation of the Atlantic Population of the Brant; maintain the ecological integrity of staging areas.

- ► **Key habitats (migration):** eelgrass beds, cordgrass marshes and other salt marshes
- ► **Primary conservation issues:** habitat quality (condition of eelgrass beds), oil spills, harvest rates

Other actions specifically targeting the Brant in BCR 13:

Knowledge acquisition

Action 42 Determine the causes promoting the appearance of the pathogen *Labyrinthula zosterae,* which is responsible for eelgrass wasting disease.

Environmentally sustainable practices

Action 43 Raise awareness among the responsible authorities of the importance of treating wastewater before it is discharged, which is not being done by certain municipalities in the Bas-Saint-Laurent region (State of the St. Lawrence Monitoring Committee 2008). High nutrient and sediment loads in the water promote the growth of phytoplankton and filamentous algae to the detriment of eelgrass.

Habitat measures

Action 44 Acquire, restore or protect eelgrass beds (e.g., Cacouna Bay and the mouth of the Trois-Pistoles River) whenever possible (see *Atlas de restauration des rives du Saint-Laurent* [Environnement Canada 2006a]).

Objective 5
Ensure the conservation of the Atlantic Population of the Canada Goose; maintain the ecological integrity of staging areas.

► **Key habitats (migration):** agricultural fields (annual crops), flooded fields, floodplains and shoreline along the fluvial section, ponds, peatlands
► **Primary conservation issues:** harvest rates, oil spills

Note: In addition, see the report *A management plan for the Atlantic Population of Canada Geese* (Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008) for a complete list of measures proposed for this population.

There are no actions specifically targeting the Atlantic Population of the Canada Goose in BCR 13 other than those listed under Objective 1.

Objective 6
Ensure the conservation of the Wood Duck; increase the breeding population to 2,800 indicated breeding pairs and maintain this population (Table 2).

► **Key habitats (breeding):** presence of tree cavities (snags and live mature trees) or artificial nesting boxes in mature deciduous or mixed forests near lakes, ponds, streams, rivers, flooded forests, swamps or beaver ponds
► **Primary conservation issues:** habitat loss (logging, harvesting of farm woodlots, scarcity of mature trees and snags with cavity potential in lowland areas), inter- and intraspecific competition for nesting cavities, harvest rates

Other actions specifically targeting the Wood Duck in BCR 13:

Knowledge acquisition

Action 45 Compare the productivity of Wood Ducks nesting in natural cavities with conspecifics using artificial nest boxes to determine the importance of nest boxes in the species' productivity.

Action 46 Determine the importance of cavities excavated by Pileated Woodpeckers for breeding Wood Duck.

Environmentally sustainable practices

Action 47 Increase awareness among the authorities responsible for forest management and harvesting on the importance of maintaining sufficient numbers of large trees (diameter breast height [DBH] of 30 cm or more) and protecting trees with potential nesting cavities (snags and live mature trees) for nesting Wood Ducks (e.g., maintain one snag per hectare; Bergeron et al. 1997).

Action 48 Increase awareness among the authorities responsible for forest management and harvesting on preserving riparian strips (e.g., when certain species are present, protect a strip at least 20 m wide and keep a certain percentage of the strips intact).

Action 49 Raise awareness among farmers and private landowners of the importance of preserving agricultural woodlots and trees with nesting cavities.

Action 50 For old-growth forests (exceptional forest ecosystems) located on private land, make landowners aware of the importance of protecting them and invite them to sign voluntary conservation agreements.

Action 51 Educate the public about the importance of snags for cavity-nesting ducks.

Habitat measures

Action 52 Support the nest box program run by the Société d'aménagement de la baie Lavallière, to ensure its long-term existence.

Objective 7
Ensure the conservation of Greater and Lesser scaup; maintain the ecological integrity of the foraging areas used during migration by the two species.

► **Key habitats (migration):** Ottawa River and the fluvial section (particularly the riverine lakes)
► **Primary conservation issues:** availability and quality of food resources, susceptibility to contamination (selenium), harvest rates, oil spills, loss of amphipod-rich wetlands

Other actions specifically targeting Greater and Lesser scaup in BCR 13:

Monitoring and surveys

Action 53 Continue the monitoring of water quality in the fluvial section of the St. Lawrence and the monitoring of toxic sediment contamination in the St. Lawrence (Rondeau 2005; State of the St. Lawrence Monitoring Committee 2008; Pelletier 2008b).

Knowledge acquisition

Action 54 Determine the food sources used by Greater and Lesser scaup in their major staging areas to determine if these resources are limited or threatened and to guide monitoring and conservation efforts for the two species.

Action 55 Determine regional factors (e.g., food resources) with an impact on migration and individual condition in Greater and Lesser scaup.

Action 56 Compare the current distribution and abundance of Greater and Lesser scaup in their major staging areas with abundance and distribution in the 1970s and 1980s, to identify the reasons for the changes that have occurred.

Action 57 Accurately determine the specific proportion of Greater and Lesser scaup in mixed flocks of migrants to guide monitoring and conservation efforts (the National Harvest Survey provides an indication of this proportion in fall).

Active surveillance

Action 58 Continue to pursue cooperative efforts and actions put forward under the Great Lakes Water Quality Agreement and the Great Lakes Air Quality Agreement, since the issues involved (e.g., potential contamination) are major ones affecting scaup frequenting the St. Lawrence.

Environmentally sustainable practices

Action 59 Since sediments in lakes Saint-François, Saint-Louis and Saint-Pierre are still contaminated, encourage efforts to reduce toxic effluent discharges by upstream industries in the fluvial section (Pelletier 2002; 2005; 2008b).

Action 60 Raise awareness among hunters of the issue of disturbing scaup in their staging areas in fall (e.g., Waterfowl Gathering Area in western part of Lake Saint-Pierre).

Habitat measures

Action 61 Protect important staging areas used by scaup that currently do not have protected status by having them designated as a Waterfowl Gathering Area or Marine Wildlife Area, for example.

Objective 8
Ensure the conservation of the Snow Goose, while ensuring the sustainable integrated management of the species; maintain the number of migrants at between 500,000 and 750,000 individuals (Table 2).

- **Key habitats (migration):** bulrush marshes, particularly in the Cap Tourmente NWA, L'Isle-aux-Grues archipelago, and Saint-Vallier, Montmagny, Cap-Saint-Ignace and Trois-Saumons Migratory Bird Sanctuaries.
- **Primary conservation issues:** availability and quality of food resources, harvest rates, degradation of bulrush marshes, oil spills

Note: Consult the most recent Greater Snow Goose Action Plan for a complete list of strategic actions proposed for this subspecies.

Although the species is considered to be overabundant, it must be kept in mind that this was not always the case—the population only numbered 3,000 individuals in the early 1900s—and a significant cause of mortality, such as an epidemic on the breeding grounds, could result in a dramatic decline in the population. Quebec has always been an important migration route and staging area for Snow Geese.

Other actions specifically targeting the Snow Goose in BCR 13:

Monitoring and surveys

Action 62 Continue the GSGOS.

Action 63 Continue fall surveys of the ratio of young to adults to be able to measure annual productivity in the population over the long term.

Action 64 Continue to locate neck-collared individuals in spring and fall.

Action 65 Begin the monitoring of bulrush marsh ecological integrity again (Cap Tourmente and Côte-du-Sud).

Knowledge acquisition

Action 66 Monitor changes in the dispersal of geese in response to changes in agricultural practices and to management measures undertaken.

Action 67 Improve models for predicting population trends in response to various management scenarios.

Active surveillance

Action 68 Continue the spring conservation hunt as an exceptional management measure until the objective for the population as a whole has been achieved.

Action 69 Ensure adequate surveillance during the spring and fall hunts.

Habitat measures

Action 70 Plant lure crops on public land next to bulrush marshes used by Snow Geese to minimize browsing in marshes in fall.

Objective 9
Limit the growth of the Resident Population of the Canada Goose and restrict its expansion.

- **Key habitats (breeding):** well-maintained, open expanses of grass near bodies of water (e.g., golf courses, urban parks); islands in the fluvial section and fluvial estuary of the St. Lawrence
- **Primary conservation issues:** invasive species, short-distance migrant, constantly high reproductive success, less exposed to mortality from sport hunting

Note: Consult the handbook *Canada and Cackling Geese: Management and Population Control in Southern Canada* (Environnement Canada 2010c) for a complete list of proposed strategic actions for managing the Resident Population.

Other actions specifically targeting the Resident Population of the Canada Goose in BCR 13:

Monitoring and surveys

Action 71 Continue banding Resident Canada Geese to document their movements, quantify survival rates, obtain indices of reproductive success and determine the growth rate of the population.

Knowledge acquisition

Action 72 Study the impacts of the increase in the population of Resident Canada Geese on duck habitats and productivity.

Active surveillance

Action 73 Follow up on management actions, either long-standing or new, aiming to increase the sport harvest or control the population of Resident Canada Geese.

Action 74 Educate the public about potential issues arising from the cohabitation of Resident Canada Geese and humans.

Habitat measures

Action 75 Raise awareness among municipalities and golf course and urban park managers of landscape modification techniques that can be used to make these green spaces less attractive to Resident Canada Geese.

5. Atlantic Northern Forest (BCR 14)

5.1 General description

In Canada, BCR 14 is limited to the Eastern provinces, encompassing a portion of eastern Quebec and all of New Brunswick, Prince Edward Island and Nova Scotia (Figure 1) (Wiken et al. 1996). In Quebec, BCR 14 covers 129,082 km^2, of which 65,928 km^2 (51%) is on land and 63,154 km^2 (49%) is aquatic (Figure 2); this is the only BCR in which nearly half of its territory in Quebec is aquatic. The terrestrial portion of BCR 14 represents only 4% of Quebec's land mass, making it the second smallest of the six BCRs in the province.

In Quebec, the terrestrial portion of BCR 14 is a strip (from 50 km to 150 km wide) running south of the St. Lawrence River from the U.S. border to the Gaspésie region (Figure 8), corresponding roughly to the Appalachian mountain range. The Magdalen Islands are also included in BCR 14. The Appalachians are the dominant physiographic feature in BCR 14, and the terrain consists primarily of hills and mountains. In the western part, which includes the Estrie (Eastern Townships) and Chaudière-Appalaches regions, the landscape is dominated by hills (400 m high on average) and valleys, although there are also a few higher peaks (Sutton Mountains, 700–900 m; Mount Mégantic, 1,105 m; Mount Gosford, 1,183 m). The central part of the BCR in the Bas-Saint-Laurent (Lower St. Lawrence) region includes a portion of the Notre-Dame Mountains (600–700 m), as well as several deep valleys (Témiscouata and Matapédia river valleys). In the eastern part of the BCR (Gaspésie region), the Notre-Dame Mountains gain elevation and divide into the Chic-Choc and McGerrigle ranges, which together contain over 25 peaks higher than 1,000 m, including Mount Jacques-Cartier at 1,268 m. However, the Chaleur Bay uplands are no higher than 450–600 m (Environnement Canada 2005b) and the Magdalen Islands are low-lying and flat, with elevations ranging from sea level to 170 m (Dubois 1992; GéoBase 2008).

BCR 14 ranks second in population in the province (after BCR 13), despite the fact that urban areas make up less than 1% of the territory. Over 700,000 people live in BCR 14: 65% in the western part (Estrie and Chaudière-Appalaches regions), 21% in the central part (Bas-Saint-Laurent region) and 14% in the eastern part (Gaspésie–Îles-de-la-Madeleine region) (adapted from Ministère des Affaires municipales des Régions et de l'Occupation du territoire 2007). There are three First Nations communities in the eastern part of the BCR (Listuguj, Gesgapegiag and Gespeg; 2,200 people) (Affaires indiennes et du Nord Canada 2009; Statistique Canada 2009).

In the eastern portion of BCR 14, the low fertility of the soils has limited the development of agriculture, which is carried out in the flatter, less rugged portions (Environnement Canada 2006b). The BCR is predominantly forested owing to the acid soils and maritime climate (cool and wet: average daily temperatures of -4°C in January and 18°C in July [Environnement Canada 2005a; Parcs Canada 2009] and mean annual precipitation ranging from 900 mm to 1,300 mm [Environnement Canada 2005b]), with the proportion of forests increasing progressively from west to east (Figure 8) (Environnement Canada 2006b).

In the western portion of the BCR, mixed and hardwood forests predominate, most of which are fairly young due to extensive selective cutting in the past. The vast majority of these forests are privately owned (Ministère des Ressources naturelles et de la Faune du Québec 2003b). Old-growth forests (exceptional forest ecosystems) cover 768 ha (MRNF, unpubl. data) and contain mature trees likely to attract cavity-nesting ducks. Agriculture accounts for roughly one third of land use (Figure 8) (Ministère du Développement durable de l'Environnement et des Parcs du

Québec 2002e; Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002i).

The central part of the BCR is mainly forested, except for the upper part of the Matapédia and Mitis river valleys, where the landscape is a mixture of forests and farm fields, and the area along the St. Lawrence, which is primarily agricultural (Figure 8). In the eastern part of this sector, stands consist chiefly of softwoods such as balsam fir, spruce and Eastern white cedar, while stands in the western part are mainly deciduous, containing such species as sugar maple (Ministère des Ressources naturelles et de la Faune du Québec 2003f). Land here is 60% publicly owned (Crown land) and 40% privately owned (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002c). Old-growth forests cover 1,049 ha (MRNF, unpubl. data).

Lastly, in the eastern part of this BCR, forests are particularly noteworthy for their abundance (95% of the territory; Figure 8) and the vigour of the softwood regeneration, with 83% of forests publicly owned. Old-growth forests cover nearly 1,463 ha (MRNF, unpubl. data). Only 2% of this part of the BCR is agricultural (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002f).

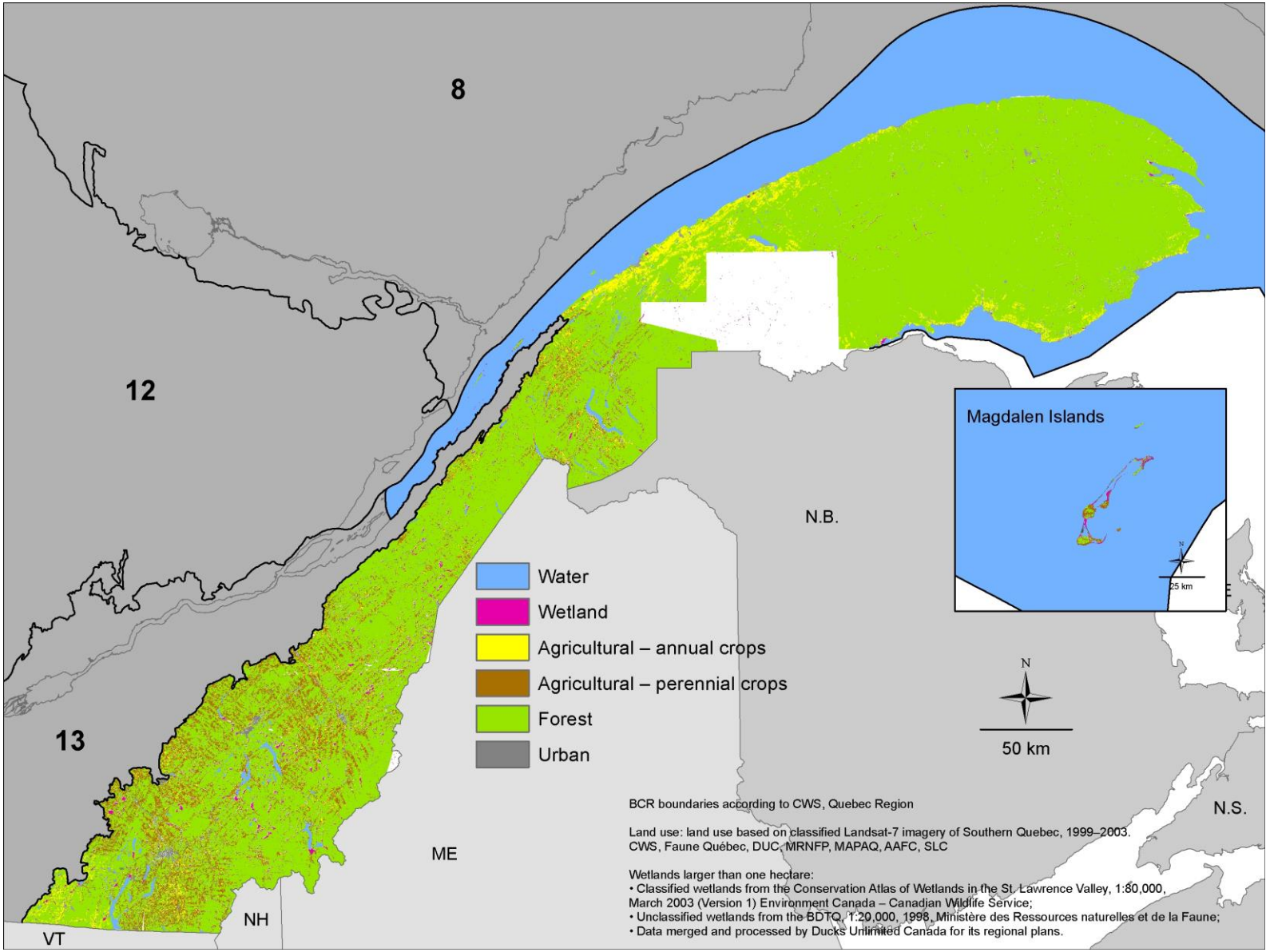
The marine portion of BCR 14 in Quebec is sizeable and includes the southern half of the upper estuary, lower estuary and Gulf of St. Lawrence (Figure 8), beginning roughly at L'Islet-sur-Mer and taking in the coastline of the estuary and Gulf, the Gaspé Peninsula to Listuguj in Chaleur Bay, and the Magdalen Islands. The terrestrial and marine portions do not meet up until Saint-Simon (Figure 3); to the west, the terrestrial portion along the coast is included in BCR 13.

BCR 14 is drained by an extensive river system, with many large rivers, including the Saint-François, Chaudière, Etchemin, Kamouraska, Rimouski, Matapédia and Bonaventure (Canards Illimités Canada 2006a; Canards Illimités Canada 2007a; Canards Illimités Canada 2008d; Canards Illimités Canada 2008a). It also includes several large lakes over 1,000 ha in area (Memphrémagog, Saint-François, Aylmer, Témiscouata and Matapédia) (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002e; Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002d; Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002c; Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002f).

The Quebec portion of BCR 14 contains an estimated 97,000 ha of wetlands, making up 1.5% of the territory (both coastal and inland portions) (J. Beaulieu, Ducks Unlimited Canada, pers. comm.). In the western portion of the BCR, there are a multitude of small wetlands scattered here and there over the landscape (Figure 9), together only covering about 2% of the territory (Canards Illimités Canada 2007a; Ducks Unlimited Canada, unpubl. data). Natural peatlands and shrub and treed swamps are the dominant wetland types (Canards Illimités Canada 2007a), while marshes are rare (Canards Illimités Canada 2007e).

In the central portion of the BCR, wetlands cover slightly over 1% of the territory (Canards Illimités Canada 2008f; Ducks Unlimited Canada, unpubl. data). Swamps and natural peatlands are the most common types (Figure 9). Coastal wetlands are not very abundant but include bulrush marshes (270 ha), cordgrass marshes (889 ha) and eelgrass beds (240 ha). The cordgrass marshes are located between Trois-Pistoles and Le Bic, and at Rimouski and Pointe-au-Père (Lemieux and Lalumière 1995; Argus inc. 1998). A few sizeable eelgrass beds are

Figure 8. Location of BCR 14 in Quebec and land use (white = no data)



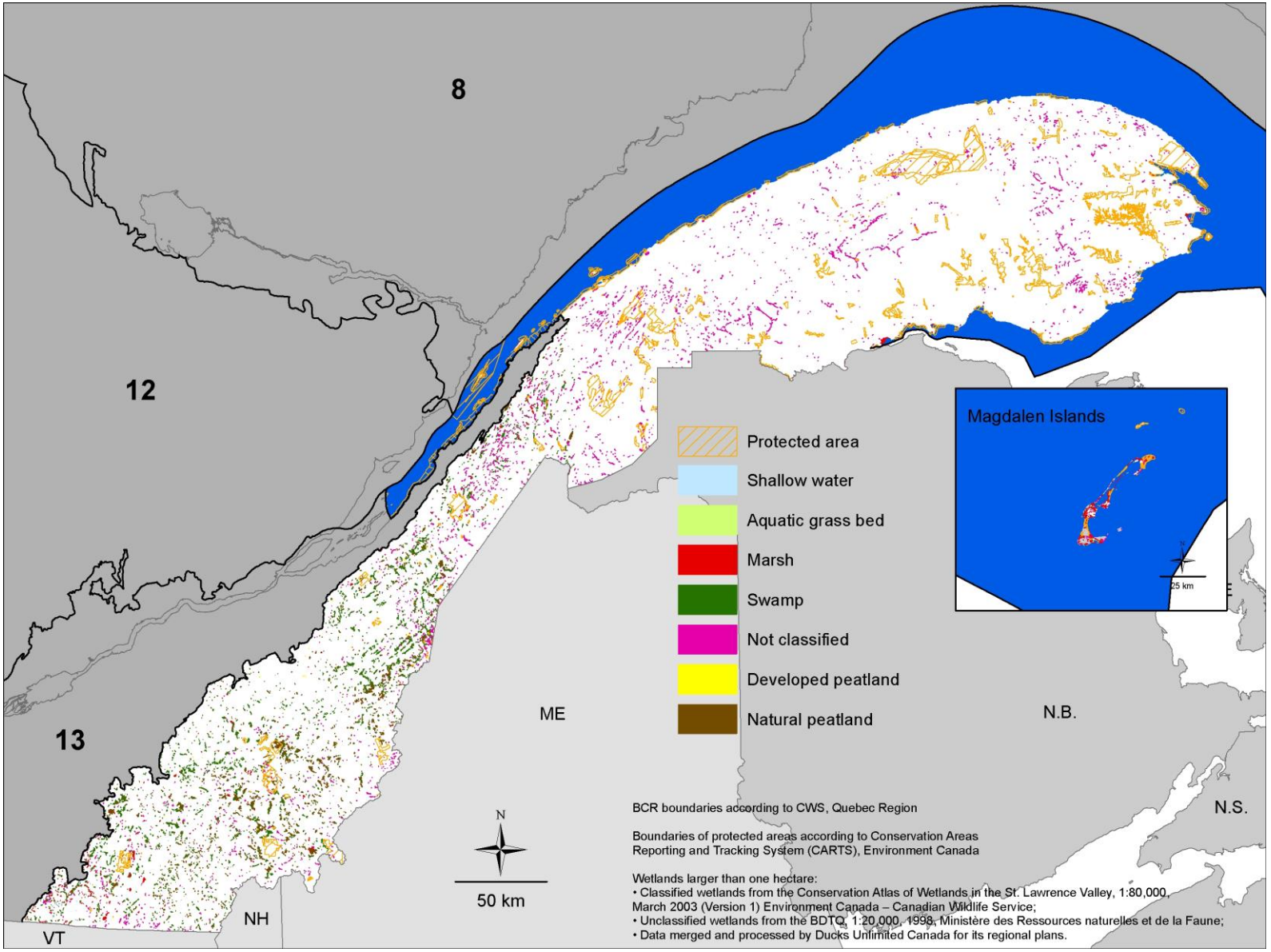
found in such places as Rimouski, Pointe-au-Père and Mitis Bay (Canards Illimités Canada 2008f). Rockweed beds also become more frequent in the central part of BCR 14 (Gratton and Dubreuil 1990). In the lower part of the intertidal zone, blue mussel beds occur, particularly downstream of Rimouski (Canards Illimités Canada 2008f), providing food for Common Eiders and scoters. The Rasade Islands are a known moulting area for scoters, which forage mainly in the subtidal zone (water depths of between 0 and 10 m), where the molluscs they seek are abundant (J.-P.L. Savard, EC–S&T, unpubl. data). Many of the dozens of islands in the estuary in this part of the BCR have shorelines rich in wetlands (Canards Illimités Canada 2008f). In addition, a good number of these islands provide excellent nesting habitat for Common Eider (Bicquette and Blanche islands and Île aux Pommes contain 55% of the species' nests in the estuary; Joint Working Group on the Management of the Common Eider 2004). When it comes time for brood-rearing, however, the eiders leave the nesting islands (with the exception of Île aux Lièvres and Bic and Saint-Barnabé islands, which have a well-developed shoreline) and head to the shoreline of the mainland, which has abundant food and is located a safe distance from the island larid colonies, since larids are the main predators of eider ducklings (Joint Working Group on the Management of the Common Eider 2004).

In the eastern part of the BCR, wetlands make up no more than 0.6% of the territory, with close to one third located on the Magdalen Islands (Canards Illimités Canada 2008a; Canards Illimités Canada 2008e). The rugged terrain in the interior of the Gaspé Peninsula limits the development of wetlands (slightly over 3,000 ha), with most watersheds containing few lakes or wetlands. Although the inland portion of the peninsula is poor in wetlands, the Gulf of St. Lawrence and Chaleur Bay are rich in these habitats (6,324 ha; Figure 9), particularly eelgrass beds (probably over 5,000 ha) (Canards Illimités Canada 2008a) and cordgrass marshes (roughly 1,200 ha) (Argus inc. 1998; Lehoux 2003). The landscape is also dotted with a number of barachois (baymouth bars) and large marshes (e.g., Baie au Chêne and mouth of the Dartmouth, York and Saint-Jean rivers). The Magdalen Islands contain 4,000 ha of diverse wetlands that are unique and fragile: marshes (freshwater, brackish water and saltwater), aquatic grass beds, lagoons, ponds, bays, peatlands and swamps (Canards Illimités Canada 2008a; Canards Illimités Canada 2008e). Cordgrass marshes on the islands total roughly 2,200 ha (Lehoux 2003).

Outside the breeding season, the south shore of the estuary is a favourite staging area for a number of species of sea ducks, particularly in fall (Lehoux et al. 1996). However, when winter arrives, the birds move to the Gulf of St. Lawrence.

Protected areas with good waterfowl habitat are few and far between in the western part of BCR 14 (only 4,300 ha designated as Waterfowl Gathering Areas [WGAs]), but are better represented in the central and eastern portions. In the central part, over 54,000 ha have been designated as WGAs, 850 ha as Migratory Bird Sanctuaries (MBSs), and 200 ha as NWA (Îles de l'Estuaire NWA), with over 33,000 ha included in the Saguenay-St. Lawrence Marine Park; in the east, nearly 27,000 ha have been designated as WGAs and roughly 2,200 ha as MBSs, with another 1,000 ha included in the Pointe de l'Est NWA (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002j).

Figure 9. General classification of wetlands in BCR 14 (white = does not correspond to wetlands)



5.2 Characteristics of conservation issues in BCR 14

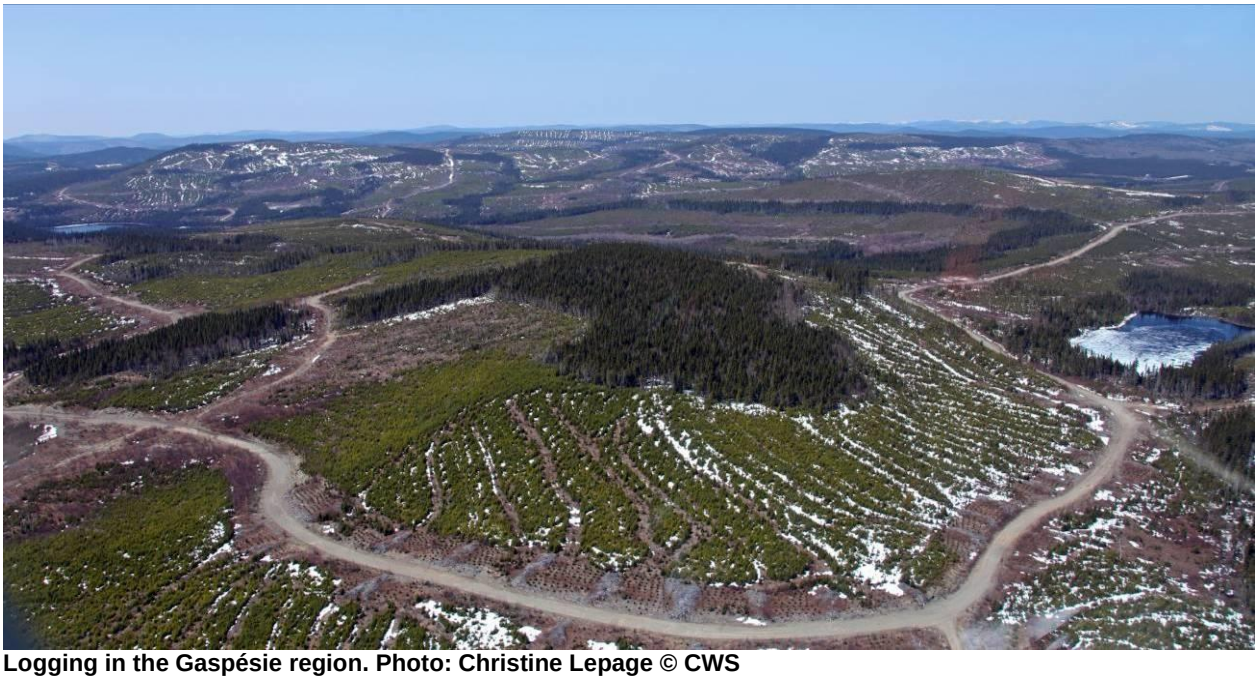
The issues discussed below are those for which we were able to provide additional information in BCR 14. The environmental impacts of these issues on waterfowl and recommended mitigation measures are discussed in Chapter 3.

5.2.1 Urban development

The soils in the Quebec portion of BCR 14, which are poor in organic matter, have limited the development of agriculture and, in turn, that of cities and towns. Consequently, built-up areas represent a very small proportion of the territory (less than 1%). Despite the lack of urban development, BCR 14 is the second-most populated BCR in Quebec after BCR 13, with over 700,000 inhabitants (Li and Ducruc 1999). The main cities are Sherbrooke in the west (147,000 inhabitants) and Rimouski in the east (42,000 inhabitants; Institut de la statistique du Québec 2009a). Between 2001 and 2006, the populations of these two cities grew by 6.2% and 1.7% respectively (Institut de la statistique du Québec 2009a).

5.2.2 Logging

Forest is the main land cover type in BCR 14, increasing progressively from west to east. During the 19th century, selective cutting (or high grading) was carried out in most of the region's forests to harvest the large-diameter high-value species (Fortin and Lechasseur 1993). Later, due to the increased market for pulp and paper, logging intensified and large mills were built (Gaudreau 1988; Fortin and Lechasseur 1993); logging is still an important industry here, particularly in the Bas-Saint-Laurent and Gaspésie regions. As a result, although forests still make up a large part of the land mass, their composition and structure have been profoundly altered by past human activities (Boucher et al. 2009).



Logging in the Gaspésie region. Photo: Christine Lepage © CWS

5.2.3 Exploitation of peatlands

Roughly 60% of all commercial peatland exploitation in Quebec occurs in the Bas-Saint-Laurent and Gaspésie regions (BCR 14). The Bas-Saint-Laurent region ranks first in peat production in the province, accounting for roughly 45% of output (Ministère du développement économique de l'innovation et de l'exportation 2009b), and peat mining is the second-largest industry in the region after logging (Cazes 1994).

5.2.4 Oil and gas development

Both the terrestrial and marine environments in BCR 14 have significant oil and gas potential. There are over 25 holders of exploration licences for petroleum, natural gas and underground reservoirs, and exploration activities are under way in several sedimentary basins (Ministère des Ressources naturelles et de la Faune du Québec 2011b). Among others, the eastern Gaspé basin, St. Lawrence Estuary Quaternary Basin and Magdalen Carboniferous Basin/Bradelle Platform (BCR 14) have promising oil and gas potential (Bureau d'audiences publiques sur l'environnement 2004; Ministère des Ressources naturelles et de la Faune du Québec 2011b).

5.2.5 Wind power generation

The Quebec portion of BCR 14 has very great potential for wind power considering that among the 22 wind farms in service in the province in 2013, 20 are installed there, mostly in the Bas-Saint-Laurent and Gaspésie regions (Ministère des Ressources naturelles et de la Faune du Québec 2014). In addition, many wind farms under construction or in the project stage are also located in BCR 14.

Wind farm in the Gaspésie region. Photo: Christine Lepage © CWS

5.2.6 Shipping and shipping infrastructures

The main ports in BCR 14—Gaspé, Rimouski, Matane and Chandler—are smaller than those in BCR 13 and BCR 8 in terms of tonnage handled (Fisheries and Oceans Canada 2010). However, the area off the coastline of BCR 14 is used extensively by ships entering or leaving the St. Lawrence Seaway (Bolduc 2007). Indeed, in March 1970, the barge *Irving Whal*e spilled 30 tonnes of bunker oil between Prince Edward Island and the Magdalen Islands after a hatch came loose in a storm. The slick drifted across an eider feeding area, contaminating about 5,000 birds (Service canadien de la faune and Fédération canadienne de la faune 2003). Oil residues can still be found in sand dunes on the Magdalen Islands.

5.2.7 Road transportation and infrastructures

The main highway construction and extension projects in BCR 14 include the extension of Highway 73 between Beauceville and Saint-Georges (roughly 18 km) and the conversion of Highway 185 into a four-lane divided highway between Highway 20 and the New Brunswick border (94 km) (Ministère des Transports du Québec 2007a).

5.2.8 Aquaculture

In the Quebec portion of BCR 14, the Gaspé region and Magdalen Islands are the main areas where shellfish farming is practiced. Issues involving predation by scoters have been reported in Gaspé and Cascapédia bays (Moisan and Cauvier 2010). Common Eiders have also caused damage to aquaculture operations in the Grande Entrée Lagoon in the Magdalen Islands. The situation became worse in the spring of 2011, prompting MAPAQ to offer technical and financial assistance to mussel farming operations to put in place and perfect hazing methods for sea ducks (Gouvernement du Québec 2011g).

Mussel farming (buoys in foreground) in Cascapédia Bay, Chaleur Bay.
Photo: Élisabeth Varennes, Université du Québec à Rimouski

5.2.9 Water quality in the St. Lawrence

In the estuary and Gulf of St. Lawrence, water quality depends on whether municipalities disinfect wastewater before discharging it into the system, which some neglect to do (State of the St. Lawrence Monitoring Committee 2008). The bacterial quality of the coastal waters around the Magdalen Islands is better than that in the coastal waters in the Lower St. Lawrence and Gaspé regions.

5.2.10 Sediment quality in the St. Lawrence

Maintenance dredging is periodically carried out in fishing harbours and at public docks and marinas around the Gaspé Peninsula, Chaleur Bay and the Magdalen Islands. This dredging is equivalent to several hundred thousand cubic metres annually (L. Breton, EC, pers. comm.). To fight bank and beach erosion in the Magdalen Islands, the municipality has asked authorities to require developers to reuse dredged material in beach replenishment or infrastructure projects

(granular materials) (L. Breton, EC, pers. comm.). See also section 3.2.15 to learn about the effects that these activities might have on wildlife.

5.2.11 Bank erosion and shoreline modification along the St. Lawrence

Coastal erosion is a serious problem in BCR 14, particularly in the Gaspé region and the Magdalen Islands. Erosion affects an estimated 60% of the coastline of the estuary and Gulf of St. Lawrence (Ministère des Transports du Québec 2012). This problem, which is expected to worsen in coming decades due to rising sea levels and the gradual dwindling of ice cover caused by climate change (Savard et al. 2008a), will very likely have repercussions on coastal marshes, on which large numbers of geese and ducks depend.

Besides the heavy erosion problems, here are various general measures that could be taken to renaturalize anthropogenically modified shorelines in BCR 14. In Chaleur Bay in the Gaspé region, wharves and embankments could be dismantled (Environnement Canada 2006a). Bank stabilization and the planting of vegetation in riprapped areas could also be envisaged to make sites more attractive to wildlife. The restoration of disturbed dune habitats on the Magdalen Islands would also provide unquestionable environmental benefits (Environnement Canada 2006a).

5.2.12 Recreation and tourism

Since this BCR (particularly the western portion) is the second most populous BCR in Quebec and a major tourist destination, waterfowl are likely to suffer from the consequences of human disturbance. For example, for colonial species like the Common Eider, just a single visit to a colony during the breeding season by a passerby may lead to the destruction of a number of nests in the following minutes if a predator is lurking nearby (Bolduc and Guillemette 2003). Broods are also at risk when recreational activities on the water (e.g., pleasure boating, kayaking, scuba diving) alarm the adults; adults will flee the scene, leaving the ducklings at the mercy of avian predators, who will take advantage of the situation to prey on them (Mikola et al. 1994; Guillemette 1997).

5.3 Use of BCR 14 by waterfowl

5.3.1 Migration

Geese (4): Snow Goose (Lesser and Greater), Brant, Cackling Goose and Canada Goose (Atlantic, North Atlantic and Resident populations)
Dabbling ducks (9): Wood Duck, Gadwall, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Shoveler, Northern Pintail and Green-winged Teal
Diving ducks (3): Ring-necked Duck, Greater Scaup and Lesser Scaup
Sea ducks (13): King Eider, Common Eider (*borealis* and *dresseri*), Harlequin Duck, Surf Scoter, White-winged Scoter, Black Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser

TOTAL = 29 species

Highlights of migration period:

- Over 70,000 Snow Geese stage in farm fields and on tidal flats in the Bas-Saint-Laurent region and, to a lesser extent, in the western part of Chaleur Bay (GSGOS and WSHO).
- Roughly 15,000 Brant (Atlantic Population) migrate through BCR 14 in spring, staging particularly in eelgrass beds (WSHO).
- Over 300,000 Canada Geese (Atlantic and North Atlantic populations) migrate through BCR 14.
- Several tens of thousands of Common Eider (*dresseri* subspecies) stage all along the south shore of the lower estuary (WSHO).
- Harlequin Ducks congregate along the south coast of the Gaspé Peninsula (Savard et al. 2008c).
- Over 50,000 Black Scoters and Surf Scoters stage in the western part of Chaleur Bay (Falardeau and Savard 2003; Perry and McAloney 2003; Rail and Savard 2003; McAloney et al. 2005) and all along the south shore of the lower estuary (WSHO).
- Several hundred Barrow's Goldeneye frequent the south shore of the lower estuary (including Anse à Mercier, Baie du Ha! Ha!, Mitis Bay and Blanc Rock; Robert et al. 2003).
- The mouths of rivers and barachois (baymouth bars) on the south shore of the Gaspé Peninsula (e.g., Nouvelle, Petite rivière Cascapédia, Bonaventure, Port-Daniel, Saint-Jean, York and Dartmouth rivers) form vast aquatic habitats, punctuated by meandering channels, that attract large numbers of geese (Canada Geese and Brant) and ducks (including several thousand Common Merganser; WSHO).

As many as 1,800 000 geese and ducks are estimated to pass through BCR 14 during migration (Table 3).

5.3.2 Breeding

Geese (1): Canada Goose (Resident Population)
Dabbling ducks (9): Wood Duck, Gadwall, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Shoveler, Northern Pintail and Green-winged Teal
Diving ducks (2): Ring-necked Duck and Greater Scaup
Sea ducks (6): Common Eider (*dresseri*), Harlequin Duck, Common Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser

TOTAL = 18 species

Breeding season highlights:

- Cordgrass marshes provide crucial brood-rearing habitat for the American Black Duck (Gauthier et al. 1980).
- A small population of Greater Scaup, composed of roughly 30–40 pairs, nest on the edge of ponds in the Magdalen Islands (Fradette 1992), representing a small breeding enclave roughly 800 km south of the species' traditional breeding range in the province.
- Around 14% of the North American population of the dr*esseri* subspecies of the Common Eider (roughly 16,400 pairs in 2009 according to BIOMQ; CWS, unpubl. data) nests on islands in the estuary.
- Many clear, fast-flowing rivers on the Gaspé Peninsula provide excellent foraging habitat for Harlequin Ducks during the breeding season (Savard et al. 2008c; SOS-POP 2008).
- The Estrie, Chaudière-Appalaches and Bas-Saint-Laurent regions have mature sugar maple–yellow birch stands, noteworthy due to their extensive use by two species of cavity-nesting ducks breeding in southern Quebec: Wood Duck and Common Goldeneye.

BCR 14 probably supports close to 70,000 breeding pairs (Table 3).

5.3.3 Moulting

Although the information presented here is limited owing to our lack of knowledge on most species during the moulting period, we would like to emphasize the importance of BCR 14 to certain species during this important, even crucial, period in their annual life cycle. According to current information, these species moult here in large numbers:
Dabbling ducks (2): American Black Duck and Mallard
Diving ducks (1): Greater Scaup
Sea ducks (3): Common Eider (*dresseri*), Harlequin Duck and Surf Scoter
TOTAL = at least 6 species

Highlights of moulting period:
- Moulting Greater Scaup are present on Île de l'Est (East Island) and Havre aux Basques Bay in the Magdalen Islands (Fradette 1992).
- Several hundred Mallards moult in the Saint-François River, in downtown Sherbrooke (CWS, unpubl. data).
- Roughly 5,000 Common Eider moult between Cape Marteau and Mitis Point (including the Razade Islands; Rail and Savard 2003).
- As many as 200 Harlequin Duck moult at the tip of the Forillon Peninsula, around Bonaventure Island and between Port-Daniel and Newport (Gilliland et al. 2002; Langlois 2005).
- Close to 12,000 scoters (probably Surf Scoters) moult upstream of Rimouski (between Cape Marteau and Cap à l'Orignal; Rail and Savard 2003).

5.3.4 Wintering

Of the six BCRs in Quebec, BCR 14 has the largest number of species that overwinter there regularly, mainly because of the presence of the Gulf of St. Lawrence.
Dabbling ducks (2): American Black Duck and Mallard
Sea ducks (10): King Eider, Common Eider (probably *borealis*), Harlequin Duck, White-winged Scoter, Long-tailed Duck, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser
TOTAL = 12 species

Winter highlights:
- Roughly 12,000 Common Eider overwinter in the waters offshore of the Magdalen Islands (Brion Island and Bird Rocks), and 2,200 spend the winter in the eastern Gaspé region (CETWS).
- As many as 40 Harlequin Ducks have been counted between Port-Daniel and Newport in winter (BGTWS).
- Several thousand Long-tailed Ducks overwinter in the offshore waters around the Gaspé Peninsula (including the area off Cap d'Espoir and around Plate Island [i.e., an estimated 3,000 individuals in 2002; BGTWS]) and the Magdalen Islands (CETWS).
- Over 600 Barrow's Goldeneye, 700 Common Goldeneye and 1,000 Red-breasted Merganser overwinter near the south shore of the Gaspé (from Chaleur Bay to Cap des Rosiers; Robert and Savard 2006; BGTWS).

- The outlet of Lake Témiscouata and a portion of the Madawaska River are among the small number of inland areas used by overwintering waterfowl (mainly American Black Duck and Common Goldeneye) in the eastern portion of BCR 14 (ÉPOQ).

BCR 14 probably supports close to 77,000 overwintering individuals (Table 3).

Table 3. Conservation objectives; numbers (IBP/66,500 km² ± standard deviation), density (IBP/100 km² ± standard deviation) and trends during the breeding season; numbers (when available; otherwise, occurrence) during the migration, moulting and wintering periods in BCR 14 (species in red are the priority species of this BCR; see section 5.4).

BCR 14	Objective[a]	Breeding					Spring Migration[e]	Moulting[f]	Wintering[f]
		Number[b] ± s.d.	%	% cum.	Density[c] ± s.d.	Trend[d]			
Common Eider *dresseri*	40,000[g]	16,400[h]	25	25	n. d.	n. d.	95,000	5,000[i]	No
Mallard	6,600	14,600 ± 5,400	21	46	21.98 ± 8.12	14.4*	60,000	Yes	30[j]
American Black Duck	21,000	14,000 ± 4,100	20	65	21.10 ± 6.16	2.3	232,000	Yes	> 650[j]
Ring-necked Duck	n. d.	10,700 ± 4,800	15	80	16.05 ± 7.19	5.5*	132,000	?	No
Common Merganser	n. d.	3,500 ± 700	5	85	5.32 ± 1.05	n. d.	143,000	?	> 300[j]
Green-winged Teal	n. d.	3,300 ± 1,000	5	90	4.97 ± 1.46	1.6	67,000	?	No
Common Goldeneye	n. d.	2,500 ± 2,300	3	93	3.70 ± 3.44	3.5	99,000	?	700[j]
Hooded Merganser	n. d.	2,000 ± 1,000	3	96	2.95 ± 1.57	12.6*	43,000	?	Yes
Canada Goose[k]	0	1,400 ± 730	2	98	2.04 ± 1.09	0.0	355,000	?	No
Wood Duck	n. d.	410 ± 200	1	99	0.62 ± 0.30	-7.9	5,100	?	No
American Wigeon	n. d.	290 ± 130	< 1	99	0.43 ± 0.20	3.0*	4,400	?	No
Red-breasted Merganser	250	200 ± 30	< 1	99	0.30 ± 0.04	-1.0	195,000	?	> 1,000[j]
Northern Shoveler	n. d.	180 ± 160	< 1	100	0.27 ± 0.25	0.8	400	?	No
Northern Pintail	n. d.	120 ± 80	< 1	100	0.18 ± 0.13	0.8	31,000	?	No
Harlequin Duck	n. d.	50[l]	< 1	100	n. d.	n. d.	Yes	200[m]	40[j]
Blue-winged Teal	n. d.	Yes	< 1	100	n. d.	n. d.	1,400	?	No
Greater Scaup	n. d.	Yes	< 1	100	n. d.	n. d.	22,000	Yes	No
Gadwall	n. d.	Yes	< 1	100	n. d.	n. d.	700	?	No
Lesser Scaup		Occas.[n]					28,000	?	No
Bufflehead		Occas.[o]					4,600	?	No
Snow Goose	500,000-	No					70,000[q]	No	No
Brant		No					15,000[r]	No	No
King Eider		No					Yes	No	Yes
Common Eider *borealis*	10,000[s]	No					Yes	No	13,700[t]
Surf Scoter		No					51,000	12,000[i]	No
White-winged Scoter		No					800	?	Yes
Black Scoter		No					57,000	?	No
Long-tailed Duck		No					60,000	No	> 60,000[u]
Barrow's Goldeneye	700[v]	No					Yes	?	700[j]
Total	**68,000[w]**	**70,000[x]**	**100**	**100**	**82.65[y] ± 23.18**	**4.2*[z]**	**> 1,800,000**	**?**	**> 77,000**

[a] Population objective for the BCR; unless otherwise indicated, this objective is expressed in **indicated breeding pairs (IBP)** and corresponds to the total breeding population according to the 2000 WUPL and 2004 WSHO. n. d. = not determined.

[b] Number of **IBP** according to the total of the 2004–2007 averages for WUPL and WSHO ± standard deviation for the entire BCR.
Yes = Species breeds in the BCR, but CWS surveys do not allow population to be calculated. Occas. = Species breeds occasionally in the BCR (every 2 to 5 years).
Excep. = Species breeds exceptionally in the BCR (fewer than once every five years). No = Species does not breed in the BCR.

[c] Density of **IBP** per 100 km² based on mean of 2004–2007 averages for WUPL and WSHO ± standard deviation.

[d] **Breeding population** trend based on WUPL data for 1990–2007 and expressed as the mean annual percentage of increase or decrease (-); * = significant trend, $p < 0.05$; ▲ = nearly significant trend ($0.05 \leq p \leq 0.10$).

[e] Number of migrating **individuals** in spring. Unless otherwise indicated, this estimate is based on the total number of indicated breeding pairs in the BCR (see[b]) and IBP in the BCRs located north of this BCR; all IBP were multiplied by a factor (2.67 for geese; 2.10 for dabbling ducks; 2.63 for diving ducks and 2.56 for sea ducks) to take account of nonbreeding individuals. For less abundant species, Yes = Species occurs in the BCR, but in unknown numbers. No = Species does not occur in the BCR.

[f] Number of **individuals**, according to various sources. For species listed without a number, Yes = Species occurs in the BCR, but in unknown numbers; No = Species does not occur in the BCR; ? = It is not known whether the species occurs in the BCR.

[g] Objective in **breeding pairs** (for estuary as a whole; however, most colonies are in BCR 14) from the *Quebec Management Plan for the Common Eider* Somateria mollissima dresseri (Joint Working Group on the Management of the Common Eider 2004).

[h] Number of **breeding pairs** according to BIOMQ in 2009 (CWS, unpubl. data).

[i] Number of **individuals** according to Rail and Savard 2003.

[j] Number of **individuals** according to BGTWS in 2009 (CWS, unpubl. data).

[k] Resident Canada Geese for objective, breeding and moulting. For spring migration, Canada geese are a mixture of Resident, Atlantic and North Atlantic populations.

[l] Rough estimate of the number of **breeding pairs** based on Robert et al. 2001 and Brodeur et al. 2008b.

[m] Number of **individuals** according to Gilliland et al. 2002.

[n] According to Cyr 1995.

[o] According to observations of nests and broods reported in ÉPOQ.

[p] Objective for entire population (and not only for this BCR) of the Greater Snow Goose in **migration**, expressed as the number of **individuals**, from Bélanger and Lefebvre 2006.

[q] Number of **individuals** according to 2008 data from GSGOS in Quebec (CWS, unpubl. data).

[r] Rough estimate of the number of **individuals** based on a telemetry study (New Jersey Division of Fish and Wildlife 2003), surveys in the St. Lawrence estuary in 2002 and 2003 (CWS, unpubl. data) and 2004–2007 WSHO data (CWS, unpubl. data).

[s] Objective expressed as the number of **individuals**, from Eastern Habitat Joint Venture 2007.

[t] Number of **individuals** from CETWS in 2006 (CWS, unpubl. data).

[u] Number of **individuals** based on an ÉPOQ record in January 1992.

[v] Objective expressed as the number of **individuals** (to be obtained on the wintering grounds in BCR 14), adapted from Environment Canada 2011 .

[w] This number corresponds to the total of the objectives for **breeding populations** only.

[x] Standard deviation not available for total breeding population due to lack of standard deviation for breeding population of the Common Eider.

[y] Density of all species of breeding waterfowl, except for Common Eider and species that occur in small numbers.

[z] Trend for all species of breeding waterfowl for which this statistic could be calculated.

5.4 Priority species in BCR 14

Priority species in BCR 14 were selected using *objective* prioritization methods (see section 2.5 and Appendix 16.2), combined with the *subjective* experience of CWS specialists. A conservation objective has been set for each priority species (see section 5.5).

High priority	Medium priority
Common Eider (*dresseri*): Objective 2	Barrow's Goldeneye: Objective 5
American Black Duck: Objective 3	Brant: Objective 6
Harlequin Duck: Objective 4	Canada Goose (North Atlantic Pop.): Objective 7
	Canada Goose (Atlantic Pop.): Objective 7
	Red-breasted Merganser: Objective 8
	Black Scoter: Objective 9
	Surf Scoter: Objective 9
	Long-tailed Duck: Objective 8

5.5 Conservation objectives and actions recommended for priority species in BCR 14

Objective 1 comprises actions that apply to a number of the priority species. Objectives 2 to 9 comprise actions targeting a specific priority species or group of species.

Objective 1
Ensure the conservation of high-priority and medium-priority species.

Monitoring and surveys

Action 1 Continue WUPL and WLOW, which provide a baseline for determining breeding population objectives.
► American Black Duck, Harlequin Duck, Canada Goose, Red-breasted Merganser

Action 2 Institute a spring survey of migrants of priority species that do not breed in the BCR.
► Brant, Black Scoter, Surf Scoter

Action 3 Institute a survey of a series of key wetlands used by certain priority species (along the St. Lawrence and farther inland); determine the extent and nature of previous losses and modifications to wetlands and those expected in the future.
► American Black Duck, Brant

Knowledge acquisition

Action 4 Determine the most important parameters (e.g., adult survival by season, productivity) in the annual cycle of priority species in order to guide monitoring and conservation efforts.

► Common Eider, American Black Duck, Harlequin Duck, Brant, Barrow's Goldeneye, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter, Long-tailed Duck

Action 5 Determine local factors (e.g., habitat characteristics, food resources) that have an impact on the breeding of priority species.

► Common Eider, American Black Duck, Harlequin Duck, Red-breasted Merganser

Action 6 Determine regional factors (e.g., climate, food resources) that have an impact on the overwintering of priority species.

► Common Eider, Harlequin Duck, Barrow's Goldeneye, Red-breasted Merganser, Long-tailed Duck

Action 7 Determine regional factors (e.g., food resources) that have an impact on the moulting of priority species.

► Common Eider, Harlequin Duck, Surf Scoter

Action 8 Determine regional factors (e.g., food resources and potential impacts of wind farms) that have an impact on the migration of priority species.

► Common Eider, Brant, Black Scoter, Surf Scoter, Red-breasted Merganser, Long-tailed Duck

Action 9 Determine links between breeding grounds, moulting areas and wintering grounds (delineation of populations).

► Common Eider, Harlequin Duck, Brant, Barrow's Goldeneye, Red-breasted Merganser, Black Scoter, Surf Scoter, Long-tailed Duck

Action 10 Quantify the potential for overlap between the activities of the commercial fishery and aquaculture industry on one hand and the use of the marine environment by priority species of sea ducks on the other; determine potential areas of conflict between these activities and priority species and develop recommendations to prevent or lessen conflicts.

► Common Eider, Black Scoter, Surf Scoter

Action 11 Complete the work to locate moulting areas used by priority species.

► Common Eider, Harlequin Duck, Barrow's Goldeneye

Active surveillance

Action 12 Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to priority species.

► Common Eider, American Black Duck, Harlequin Duck, Brant, Barrow's Goldeneye, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter, Long-tailed Duck

Action 13 Continue the Harvest Questionnaire Survey and the Species Composition Survey (Wingbee) to monitor harvest rates of priority species.

► American Black Duck, Canada Goose, Brant

Action 14 Ensure the efficacy of the CWS Oil Spill Emergency Response Plan in order to prevent and limit mortality in priority species in the event of an oil spill.

► Common Eider, American Black Duck, Harlequin Duck, Brant, Barrow's Goldeneye, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter, Long-tailed Duck

Action 15 Ensure the efficacy of the CWS Avian Mortality Events Emergency Response Plan and make improvements if necessary, to prevent and limit mortality in priority species in the event of an outbreak of avian disease (e.g., avian cholera).

► Common Eider, American Black Duck, Harlequin Duck, Brant, Barrow's Goldeneye, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter, Long-tailed Duck

Action 16 Implement a special sea duck harvest survey to estimate as accurately as possible the harvest of priority species.

► Common Eider, Barrow's Goldeneye, Red-breasted Merganser, Black Scoter, Surf Scoter, Long-tailed Duck

Habitat measures

Action 17 Acquire, restore or protect cordgrass marshes in the Bas-Saint-Laurent region and Chaleur Bay when possible (see Argus inc. 1998).

► American Black Duck, Brant

Action 18 In the case of key moulting areas used by priority species that are designated as a WGA, extend protection to this critical period of the birds' annual cycle; in the case of such moulting areas that have no protection at all, ensure they are protected by having them designated as a WGA or Marine Wildlife Area, for example.

► Common Eider, Harlequin Duck, Surf Scoter

Action 19 In the case of key wintering areas used by priority species that are designated as a WGA, extend protection to this critical period of the birds' annual cycle; in the case of such wintering areas that have no protection at all, ensure they are protected by having them designated as a WGA or Marine Wildlife Area, for example.

► Common Eider, Harlequin Duck, Barrow's Goldeneye, Red-breasted Merganser

Action 20 Protect key staging areas used by priority species that do not have protected status by having them designated as a WGA or Marine Wildlife Area, for example.

► Brant, Barrow's Goldeneye, Black Scoter, Surf Scoter

Objective 2
Ensure the conservation of the *dresseri* subspecies of the Common Eider; increase the breeding population to 40,000 breeding pairs and maintain this population (Table 3).

► **Key habitats (breeding):** islands and islets in the upper and lower estuary containing open areas with sparse vegetation, tallgrass meadows, low shrublands or coniferous forest edges

► **Key habitats (brood rearing):** coastline of the upper and lower estuary (zones with abundant periwinkles and amphipods)

► **Key habitats (moulting):** coastline of the upper and lower estuary (sector between Cape Marteau and Mitis Point)

► **Primary conservation issues:** epidemics, oil spills, predation (foxes and gulls), harvest rates, human disturbance (e.g., pleasure boating) in breeding colonies and brood-rearing areas, seaweed harvesting along the coast, accidental trapping of birds in fishing nets, habitat loss due to aquaculture activities

Note: In addition, see the *Plan for the Common Eider* Somateria mollissima dresseri (Joint Working Group on the Management of the Common Eider 2004) for a list of strategic measures proposed for the subspecies.

Other actions specifically targeting Common Eider in BCR 14:

Monitoring and surveys

Action 21 Encourage the continuation of the annual survey of estuary colonies carried out as part of eiderdown harvesting activities.

Action 22 Maintain the Common Eider banding program and expand it in order to monitor harvest rates, document movements, quantify survival rates and obtain indices of reproductive success in the species.

Knowledge acquisition

Action 23 Develop an effective survey technique for monitoring eider colonies (e.g., counting males) that can be used throughout the *dresseri* eiders' breeding range, so that the survey methods used by the various authorities responsible for managing this subspecies can be standardized.

Action 24 Study the dynamics of avian cholera and the proximate causes of epidemics.

Action 25 Determine the impact of gull predation on duckling survival.

Action 26 Determine if the subspecies *dresseri* should be managed under different populations, and if so, develop models for these populations.

Action 27 Quantify the potential for overlap between commercial seaweed harvesting and the use of the marine environment by eider crèches; determine if harvesting activities have potential impacts on duckling survival and provide this information to the authorities concerned.

Active surveillance

Action 28 Ensure adequate surveillance of the Îles de l'Estuaire NWA during the breeding season, since the level of surveillance determines the condition of colonies (Joint Working Group on the Management of the Common Eider 2004).

Environmentally sustainable practices

Action 29 Ensure that eiderdown harvesting is carried out according to best practices (see Bédard et al. 2008 on this subject) to prevent excessive disturbance to the hens and to ensure that the resource is managed sustainably.

Action 30 Raise awareness among pleasure boaters and kayakers of the importance of respecting bans on landing or coming ashore on islands in the estuary and of not disturbing eiders during the critical incubation and brood-rearing periods; establish or continue partnerships with local organizations to increase the chances of success of this action.

Habitat measures

Action 31 Acquire or protect key nesting sites that do not yet have protected status.

Action 32 Propose the creation of Marine Wildlife Areas (or other means of legal protection) for the species' main brood-rearing areas.

Objective 3
Ensure the conservation of the American Black Duck; increase the breeding population to 21,000 indicated breeding pairs and maintain this population level (Table 3).

- ► **Key habitats (breeding):** marshes; peatlands; swamps; beaver ponds; the shoreline of lakes, rivers and streams; agricultural watercourses
- ► **Key habitats (brood rearing):** cordgrass marshes
- ► **Primary conservation issues:** habitat loss (shift to intensive farming practices, drainage of farmland, exploitation of peatlands, cottage and resort development [shoreline encroachment]), harvest rates

Note: In addition, consult the Population Monitoring Implementation Plan (Black Duck Joint Venture 2008b) and the Research Program Implementation Plan (Black Duck Joint Venture 2008c) for a list of BDJV recommendations for the American Black Duck.

Other actions specifically targeting the American Black Duck in BCR 14:

Monitoring and surveys

Action 33 Institute a survey of productivity in the American Black Duck.

Action 34 Continue the pre-season banding program to monitor harvest rates, document movements, quantify survival rates and obtain indices of reproductive success of the American Black Duck.

Knowledge acquisition

Action 35 Determine American Black Duck abundance and distribution during the breeding season by wetland type and wetland location in the BCR; locate priority habitats that face threats and develop strategies to curb these threats.

Action 36 Compare the use of natural and developed peatlands by the American Black Duck (Estrie, Chaudière-Appalaches and Bas-Saint-Laurent regions); determine if peatland exploitation (peat mining and cranberry production) has an impact on breeding in the species.

Action 37 Determine the origin of the thousands of American Black Ducks that frequent the tidal flats around islands in the estuary in fall.

Action 38 Locate key staging areas used by the American Black Duck during spring and fall migration so that they can be protected if required (supplement the MRNF's information on WGAs).

Active surveillance

Action 39 Ensure adequate surveillance (in the Magdalen Islands and other locations) to prevent the use of cartridges with lead shot (prohibited since 1999), which contaminate many aquatic birds.

Environmentally sustainable practices

Action 40 Raise awareness among commercial peatland users of the importance of leaving strips of residual vegetation at least five metres wide for nesting American Black Ducks (Bélanger et al. 1994).

Action 41 Raise awareness among authorities responsible for land-use planning and development of the loss of wetlands and the modification of natural shorelines associated with cottage and resort development (development pressure is strong, particularly in the Estrie region).

Action 42 Promote sustainable, ecological agriculture that ensures the presence of suitable waterfowl habitat (riparian strips, healthy aquatic habitats, etc.) during both the nesting and brood-rearing periods; for instance, encourage private programs such as the program by Fondation de la faune du Québec and the Union des producteurs agricoles to enhance watercourse biodiversity in agricultural environments (*Programme de mise en valeur de la biodiversité des cours d'eau en milieu agricole*) and Nature Québec's zero-carbon farm initiative (*Agriculture et climat: Vers des fermes 0 carbone*).

Habitat measures

Action 43 Acquire, restore or protect natural peatlands; protect some of the few large unaltered peatlands remaining in the BCR (e.g., hills around Lake Memphrémagog and Coaticook-Scotstown Plateau; Canards Illimités Canada 2007e), among others.

Objective 4

Ensure the conservation of the Eastern Population of the Harlequin Duck; establish a survey to monitor the breeding population and maintain the ecological integrity of foraging areas used during the moulting period. Ultimately, allow the species to be removed from the list of species designated under SARA and the list of species at risk (threatened and vulnerable species) established by the Quebec government.

► **Key habitats (breeding):** fast-flowing rivers in the Gaspé region
► **Key habitats (moulting):** coastal waters between Newport and Port-Daniel, the tip of Forillon Peninsula and around Bonaventure Island
► **Primary conservation issues:** recreational activities on rivers near where the species nests, development (aquaculture and fisheries) and use (boating activities) of coastal areas, oil spills, poaching

Note: Consult the *Management Plan for the Harlequin Duck (*Histrionicus histrionicus*) Eastern Population, in Atlantic Canada and Québec* (Environment Canada 2007) for the complete list of recommendations on this population.

Other actions specifically targeting the Harlequin Duck in BCR 14:

Monitoring and surveys

Action 44 Institute a breeding pair survey specially tailored to the Harlequin Duck.

Action 45 Institute a survey of populations in major moulting areas.

Environmentally sustainable practices

Action 46 Make hunters aware of the importance of respecting current regulations prohibiting the hunting of the Harlequin Duck.

Action 47 Promote awareness among outfitters, fishing guides and whitewater guides of the importance of not disturbing Harlequin Ducks during the nesting and brood-rearing periods.

Action 48 Raise awareness among canoeists and anglers of the importance of not approaching Harlequin Ducks during the nesting and brood-rearing periods.

Action 49 Make pleasure boaters and kayakers aware of the importance of not disturbing moulting Harlequin Ducks when circulating near known moulting areas (e.g., Bonaventure Island, shoreline between Port-Daniel and Newport).

Habitat measures

Action 50 Explore the possibility of protecting rivers used by breeding Harlequin Ducks (not including rivers in Parc national de la Gaspésie and salmon rivers, which are already protected).

Objective 5

Ensure the conservation of the Eastern Population of Barrow's Goldeneye; maintain a winter population of at least 700 individuals (Table 3). Ultimately, allow the species to be removed from the list of species designated under SARA and the list of species at risk (threatened and vulnerable species) established by the Quebec government.

► **Key habitats (wintering):** intertidal zone in Chaleur Bay
►**Primary conservation issues:** oil spills, harvest rates, climate change

Note: Consult the *Management Plan for the Barrow's Goldeneye (*Bucephala islandica*), Eastern Population, in Canada* (Environment Canada 2011) for the complete list of recommendations on this population.

Other actions specifically targeting Barrow's Goldeneye in BCR 14:

Monitoring and surveys

Action 51 Continue the BGTWS.

Action 52 Carry out a survey of potential breeding lakes (fishless lakes at an elevation of over 500 m) in the Gaspé region to determine if Barrow's Goldeneye breed there.

Active surveillance

Action 53 Ensure adequate surveillance in areas where the goldeneye congregate during the sport hunt.

Environmentally sustainable practices

Action 54 Make hunters aware of current regulations on the season and daily bag and possession limits for Barrow's Goldeneye.

Action 55 Make hunters aware of the importance of knowing how to reliably distinguish Barrow's Goldeneye from Common Goldeneye in the field (http://publications.gc.ca/site/eng/344768/publication.html).

Objective 6
Ensure the conservation of the Atlantic Population of Brant; maintain the ecological integrity of the species' staging areas.

► **Key habitats (migration):** eelgrass beds, cordgrass marshes and other salt marshes
► **Primary conservation issues:** habitat quality (condition of eelgrass beds), oil spills, harvest rates

Other actions specifically targeting Brant in BCR 14:

Knowledge acquisition

Action 56 Locate the best eelgrass beds and marshes to be protected for the species, where necessary.

Action 57 Determine the causes promoting the appearance of the pathogen *Labyrinthula zosterae,* responsible for eelgrass wasting disease.

Habitat measures

Action 58 Restore or protect eelgrass beds (e.g., off Rimouski and in Mitis Bay and Chaleur Bay) whenever possible (see *Atlas de restauration des rives du Saint-Laurent* [Environnement Canada 2006a]).

Objective 7
Ensure the conservation of the North Atlantic and Atlantic populations of the Canada Goose; maintain the ecological integrity of staging areas used by these populations.

► **Key habitats (migration):** farm fields (annual crops), flooded fields, floodplains along the fluvial section, shoreline of the St. Lawrence, ponds, peatlands
► **Primary conservation issues:** harvest rates, oil spills

Note: In addition, see the report *A management plan for the Atlantic Population of Canada Geese* (Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008) for a complete list of measures proposed for this population.

There are no other actions specifically targeting the Atlantic and North Atlantic populations of the Canada Goose in BCR 14 other than those listed under Objective 1.

Objective 8
Ensure the conservation of sea ducks overwintering in offshore waters in the St. Lawrence (including the Long-tailed Duck and Red-breasted Merganser); maintain overwintering in Quebec.

► **Key habitats (wintering):** ice-free pelagic zones around the Gaspé Peninsula and the Magdalen Islands
► **Primary conservation issues:** oil spills, potential wind farms in the marine environment, potential oil and gas exploration in the St. Lawrence, harvest rates, climate change

Other actions specifically targeting Long-tailed Duck and Red-breasted Merganser in BCR 14:

Monitoring and surveys

Action 59 Institute a monitoring program of sea ducks overwintering in ice-free pelagic zones in the St. Lawrence (aside from *borealis* Common Eider).

Knowledge acquisition

Action 60 Identify the food sources used by Long-tailed Duck and Red-breasted Merganser on their wintering grounds to determine if they are limited or threatened and to guide monitoring and conservation efforts.

Objective 9
Ensure the conservation of the Black Scoter and Surf Scoter; maintain the ecological integrity of foraging areas used in migration and during the moulting period.

► **Key habitats (migration):** coastal waters along the south shore of the lower estuary and the western half of Chaleur Bay
► **Key habitats (moulting):** coastal waters along the south shore of the lower estuary
► **Primary conservation issues:** oil spills, harvest rates, potential aquaculture activities

There are no other actions specifically targeting the Black Scoter and Surf Scoter in BCR 14 other than those listed under Objective 1.

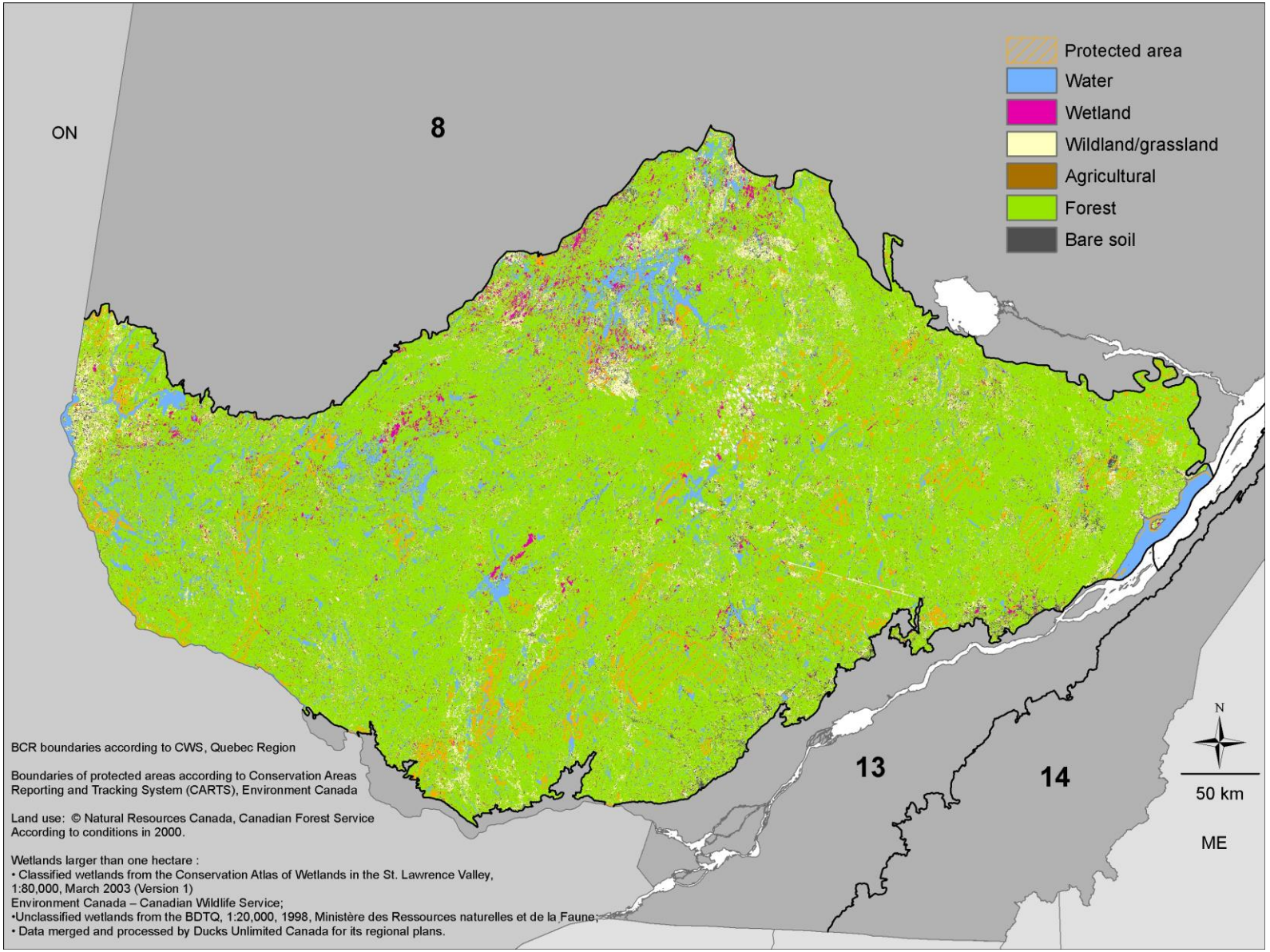
6. Boreal Hardwood Transition (BCR 12)

6.1 General description

BCR 12 straddles the Canada–U.S. border, taking in parts of southern Quebec, Ontario and Manitoba (Figure 1) (Wiken et al. 1996). It shares Quebec's boreal forest with BCR 7 and BCR 8 (Bélanger et al. 2003). BCR 12 in Quebec encompasses 170,952 km^2 of territory, 169,807 km^2 (99.3%) on land and 1,145 km^2 (0.7%) on the water (Figure 2). Although this BCR has the smallest aquatic portion of all the province's BCRs, it ranks third in terms of its land mass (11% of Quebec's territory).

In Quebec, the terrestrial portion of BCR 12 corresponds to the southern Laurentians (Environnement Canada 2005b). Its southern boundary extends from the Ottawa Valley to Saint-Fidèle on the north shore of the upper estuary, along a line running north of Québec (Figure 10). Its northern boundary runs from Notre-Dame-du-Nord on the Ontario border, along a line north of Gouin Reservoir, to the south shore of Lac Saint-Jean. The terrain in BCR 12 is rugged; in general, the elevation ranges from 300 m to 600 m, although there are some peaks with elevations of 900 m to 1,200 m (Environnement Canada 2005b). The higher peaks include Mount Sainte-Anne (800 m), Mount Tremblant (968 m), Mount Belle Fontaine (1,151 m) and Mount Raoul-Blanchard (1,181 m) (Ressources naturelles Canada 2009b).

Figure 10. Location of BCR 12 in Quebec and land use



BCR 12 ranks fourth among Quebec's BCRs in terms of population, with slightly over 450,000 inhabitants. The Laurentides administrative region has the highest population in the BCR (over 200,000 people), with close to half of the BCR's inhabitants (adapted from Ministère des Affaires municipales des Régions et de l'Occupation du territoire 2007). The main population centres include Gatineau, Maniwaki, Saint-Jérôme and Shawinigan (Environnement Canada 2005b). There are nine First Nations communities, together containing around 11,400 people, located in almost all the BCR's administrative regions (Affaires indiennes et du Nord Canada 2009; Statistique Canada 2009). The largest Aboriginal community is the Atikamekw community of Manawan, which has 2,100 inhabitants (Affaires indiennes et du Nord Canada 2009).

BCR 12 has warm summers and cold, snowy winters. The mean annual temperature is around 1.5°C, with summer and winter means of 14°C and -11°C respectively, although the climate is milder along the southern edge of the BCR. Mean annual precipitation ranges from 800 mm in the northwest to 1,000 mm near Québec. Between Québec and Saguenay–Lac-Saint-Jean, annual precipitation can be as high as 1,200 mm to 1,600 mm (Environnement Canada 2005b).

The soils in BCR 12 are poor in nutrients (ICOAN international 2009). This, combined with the rugged terrain, explains why agricultural and urban development has been limited in this BCR. Inhabited areas, which are few, are mainly concentrated in the southern part along the edge of the St. Lawrence lowlands. Agriculture is practiced in the Ottawa Valley (Outaouais), where it plays an important role, as well as in the Témiscamingue and Charlevoix regions. Agricultural land represents less than 2% of the land in the BCR (Environnement Canada 2005b). Forestry is the main land use, although cottage and resort development is also an important sector. Over half of the territory is occupied by public forests. BCR 12 is one of the regions in Quebec with the richest timber reserves (Environnement Canada 2005b). Most of the forests in BCR 12 have already been logged (Gaudreau 1988).

Forest ecosystems in BCR 12 are very diverse, with both a south-north gradient (northern hardwood–boreal forest transition) and east-west gradient (based on elevation and climate). This BCR therefore has four bioclimatic domains. In the far south is the sugar maple–yellow birch bioclimatic domain, which runs north to the Mont-Laurier depression. It is dominated by hardwood stands, although mixed or softwood stands also occur on xeric sites (Saucier et al. 2009). Further north is the balsam fir–yellow birch bioclimatic domain, which is the dominant one in BCR 12. It contains a mixture of species typical of the boreal forest (balsam fir, spruces, jack pine, white birch) and deciduous forest (maples, white pine, yellow birch) and is characterized by a mosaic of stands of different ages and species. In the north-central (south of Gouin Reservoir) and eastern portions of the BCR are two small enclaves of the balsam fir–white birch bioclimatic domain, representing the beginning of the typical boreal forest; tree species diversity is relatively low here and the forest consists mainly of softwoods such as balsam fir, white spruce, black spruce and jack pine and early-successional hardwoods such as white birch and trembling aspen. Lastly, a small portion of the BCR in the extreme north hosts the black spruce–feather moss bioclimatic domain. Old-growth forests (exceptional forest ecosystems) cover 13,465 ha and are fairly well distributed throughout the BCR; 98% are publicly owned (MRNF, unpubl. data).

BCR 12 is drained by an extensive river system, with many major rivers, including the Montmorency, Jacques-Cartier, Batiscan, Gatineau, Saint-Maurice, Ottawa, Maskinongé and L'Assomption (Canards Illimités Canada 2008c; Canards Illimités Canada 2007c; Canards Illimités Canada 2007d; Canards Illimités Canada 2007b; Canards Illimités Canada 2008b). It also contains a number of large lakes over 1,000 ha in size (e.g., Jacques-Cartier, Saint-Joseph, Édouard, Mékinac, Kempt, Devenyns, Baskatong, Cabonga, des Trente et Un Milles and Parent)

and several hydroelectric reservoirs (Gouin, Blanc, Manouane, Grand-Mère, Dozois, Témiscamingue, Kipawa, Decelles and des Quinze) (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002b; 2002g; ICOAN international 2009).

The Quebec portion of BCR 12 contains an estimated 700,000 ha of wetlands, although this is a very approximate figure given the paucity of data on this BCR (Canards Illimités Canada 2009d; Eastern Habitat Joint Venture 2007; J. Beaulieu and P. Dulude, Ducks Unlimited Canada, pers. comm.). Data are particularly scarce on the types of wetlands present, since the vast majority of these habitats have not been classified (Canards Illimités Canada 2008c; Canards Illimités Canada 2007c; Canards Illimités Canada 2007d; Canards Illimités Canada 2007b; S. Labrecque, CWS, pers. comm.). The information available indicates, however, that peatlands make up less than 5% of the territory (Marineau 2004) and that submerged and floating aquatic beds occur along the shorelines of a number of lakes and rivers (Chapdelaine and Rail 2004). In addition, there are roughly 320 ha of cordgrass marshes along the north shore of the upper estuary (at four sites between Petite-Rivière-Saint-François and Saint-Joseph-de-la-Rive) (Argus inc. 1998), as well as one eelgrass bed (near Les Prairies) (Lemieux and Lalumière 1995). One thing is sure: beaver ponds are abundant in BCR 12, since the Outaouais, Abitibi-Témiscamingue, Laurentides and Lanaudière regions have the highest densities of beaver colonies in Quebec (Lafond and Pilon 2004).

BCR 12 has few protected areas containing suitable waterfowl habitat. Only 10,387 ha have been designated as WGAs (which is eight times less than in BCR 14, putting BCR 12 last in terms of WGA area, since BCRs 7 and 3 have none); other protected areas in BCR 12 include a small portion of the Saguenay–St. Lawrence Marine Park (3,729 ha) and 162,684 ha of planned aquatic reserves (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002j).

6.2 Characteristics of conservation issues in BCR 12

The issues discussed below are those for which we were able to provide additional information in BCR 12. The environmental impacts of these issues on waterfowl and recommended mitigation measures are discussed in Chapter 3.

6.2.1 Urban development

Although BCR 12 borders the most populous BCR in Quebec, it does not contain any major urban centres. The terrain in BCR 12 is made up of series of hills, plateaus, depressions and a few higher ridges, with the population concentrated mainly in the valleys, particularly those located near the St. Lawrence lowlands. Statistics from the Laurentides administrative region are a good example; this region is experiencing spectacular population growth, and the portion in BCR 12 is no exception (population trends since 2001: Saint-Colomban, +35%; Prévost, +22%; Sainte-Adèle, +15%; Saint-Jérôme, +7%; Institut de la statistique du Québec 2009b). Along the St. Lawrence, the Charlevoix region is another centre of population, although numbers in the largest municipalities are stable or decreasing compared with 2001 (La Malbaie, -2%, Baie-Saint-Paul, stable; Institut de la statistique du Québec 2009b).

6.2.2 Logging

Most of the forests in the Quebec portion of BCR 12 have been logged since European settlement, and today timber production is still the main resource industry in this BCR.

6.2.3 Wind power generation

It is only since 2013 that wind energy is produced in BCR 12. All wind farms in service (Seigneuries de Beaupré-2 and -3), under construction (Rivière-du-Moulin and Seigneurie de Beaupré-4) or in the project stage (Côte-de-Beaupré) are located inland (Ministère des Ressources naturelles et de la Faune du Québec 2014).

6.2.4 Road transportation and infrastructures

Transportation projects of note in BCR 12 include the conversion of Highway 175 into a four-lane divided highway between Québec and Saguenay (roughly 194 km) (Ministère des Transports du Québec 2007a). One of the main conservation issues raised by this project, due to the special meteorological conditions present, is that highway maintenance crews will use more de-icing agents than usual compared with highways of the same type elsewhere. Since the completion of the project will involve an increase in the road surface of about 50%, very large quantities of melting agents will end up in watercourses. The Ministère des Transports expects to increase the quantity of de-icing agents used by 50% (Conseil régional de l'environnement – région de la Capitale nationale 2005).

6.2.5 Recreation and tourism

The Laurentides administrative region ranks third in tourism activity in the province, behind only Montréal and Québec, and first among non-urban regions. Tourism not only dominates the region but is growing in leaps and bounds: between 2000 and 2004, the number of tourists in the region increased by 46%, compared with 18% in the province overall (Ministère du développement économique de l'innovation et de l'exportation 2009a). Although tourism demand is high in the Laurentians, the region has identified landscape protection as one of its development niches (Créneau d'excellence Tourisme de villégiature quatre saisons 2010).

6.3 Use of BCR 12 by waterfowl

6.3.1 Migration

Since most of BCR 12 lies inland and the BCR only includes a small portion of coastline (the upper estuary from Cap Tourmente to Saint-Fidèle, in the Charlevoix region), it has a smaller number of migrants (both in number of species and individuals) than the other BCRs in southern Quebec. The following species occur here annually in migration:

Geese (4): Snow Goose (Lesser and Greater), Brant, Cackling Goose and Canada Goose (Atlantic and Resident populations)

Dabbling ducks (9): Wood Duck, Gadwall, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Shoveler, Northern Pintail and Green-winged Teal

Diving ducks (3): Ring-necked Duck, Greater Scaup and Lesser Scaup

Sea ducks (10): Common Eider (*dresseri*), Surf Scoter, Black Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser

TOTAL = 26 species

Highlights of migration period:

- More than 150,000 Canada Geese (mainly Atlantic Population birds) stage in BCR 12.
- Hundreds of Brant, American Black Duck, Mallard, Green-winged Teal, Ring-necked Duck, Common Eider, Common Goldeneye and Common Merganser migrate along the stretch of the upper estuary included in BCR 12 (WSHO and ÉPOQ).
- Between 200 and 300 Barrow's Goldeneye frequent the area between Saint-Irénée and La Malbaie (Robert et al. 2003; ÉPOQ).

More than 900,000 individuals are estimated to pass through BCR 12 during migration (Table 4).

6.3.2 Breeding

Geese (1): Canada Goose (Atlantic and Resident populations)
Dabbling ducks (8): Wood Duck, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Shoveler, Northern Pintail and Green-winged Teal
Diving ducks (1): Ring-necked Duck
Sea ducks (8): Common Eider (*dresseri*), Surf Scoter, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser
TOTAL = 18 species

Breeding season highlights:

- BCR 12 is the heart of the Quebec breeding range of two cavity-nesting species: Wood Duck and Hooded Merganser (WUPL). In the case of both species, this is due in large part to the abundance of beaver ponds in BCR 12; the Outaouais, Abitibi-Témiscamingue, Laurentides and Lanaudière regions are among those in Quebec with the highest density of beaver colonies (Lafond and Pilon 2004).
- The forests in BCR 12—deciduous in the south and mixed in the north—provide key breeding habitat for certain species of ducks that are among the most abundant in the province (American Black Duck, Ring-necked Duck, Common Goldeneye and Common Merganser; WUPL).
- The Témiscamingue lowlands also support a substantial number of breeding waterfowl, particularly Wood Duck, Mallard, Blue-winged Teal, Green-winged Teal and Hooded Merganser (WUPL).
- Laurentide Wildlife Reserve supports a number of breeding pairs of Surf Scoters (Morrier et al. 2008), although it is located quite far south of the species' traditional breeding grounds in Quebec.
- Pairs of Barrow's Goldeneye nest along the edges of small, high-elevation lakes in the Charlevoix region (Robert et al. 2008a; CWS, unpubl. data).

BCR 12 supports close to 180,000 breeding pairs (Table 4).

6.3.3 Moulting

There is very little information about moulting waterfowl in BCR 12. However, since this BCR contains several large lakes and reservoirs, as well as part of the upper estuary, there is reason to believe that geese and some species of ducks moult in the BCR. The following species are known to moult there regularly:
Diving ducks (1): Ring-necked Duck
Sea ducks (1): Common Goldeneye

TOTAL = at least 2 species

Highlights of moulting period:
- CWS banding programs provide a little information, local in nature, on moulting: Lake Malbaie, in the Laurentide Wildlife Reserve, probably supports around one hundred or so moulting Common Goldeneye females, as well as 35–40 moulting Ring-necked Ducks (CWS, unpubl. data).

6.3.4 Wintering

Dabbling ducks (4): American Wigeon, American Black Duck, Mallard and Northern Pintail
Sea ducks (4): Common Goldeneye, Barrow's Goldeneye, Common Merganser and Red-breasted Merganser

TOTAL = 8 species

Winter highlights:
- As many as 1,300 American Black Ducks overwinter in the sector between Pointe-au-Pic and Port-au-Saumon (BGTWS).
- Between 500 and 600 Barrow's Goldeneye congregate on the tidal flats in the sector between Saint-Irénée and La Malbaie (BGTWS); these birds are present fairly constantly from December to April (Robert and Savard 2006).

BCR 12 probably supports close to 2,000 overwintering individuals (Table 4).

Table 4. Conservation objectives; numbers (IBP/170,100 km² ± standard deviation), density (IBP/100 km² ± standard deviation) and trends during the breeding season; numbers (when available; otherwise, occurrence) during the migration, moulting and overwintering periods in BCR 12 (species in red are the priority species of this BCR; see section 6.4).

BCR 12	Objective[a]	Breeding Number[b] ± s.d.	%	% cum.	Density[c] ± s.d.	Trend[d]	Spring Migration[e]	Moulting[f]	Wintering[f]
American Black Duck	67,000	57,800 ± 5,100	32	32	33.97 ± 2.99	3.1*	208,000	?	1,300[g]
Ring-necked Duck	29,000	29,900 ± 4,400	17	49	17.56 ± 2.60	3.9*	119,000	Yes	No
Common Goldeneye	18,000	24,600 ± 3,300	14	62	14.44 ± 1.93	4.6*	102,000	Yes	Yes
Common Merganser	30,000	24,300 ± 3,200	14	76	14.27 ± 1.86	2.3*	121,000	?	Yes
Hooded Merganser	16,000	16,000 ± 1,800	9	85	9.42 ± 1.08	7.2*	54,000	?	No
Mallard	5,800	9,000 ± 2,300	5	90	5.28 ± 1.34	11.2*	31,000	?	Yes
Green-winged Teal	10,000	8,500 ± 1,400	5	95	5.00 ± 0.80	12.0*	45,000	?	No
Bufflehead	n. d.	3,500 ± 1,000	2	97	2.03 ± 0.59	3.1	10,000	?	No
Canada Goose[h]	0	3,400 ± 800	2	98	1.99 ± 0.45	11.5*	185,000	?	No
Wood Duck	n. d.	2,600 ± 500	1	99	1.50 ± 0.32	10.1*	5,900	?	No
Blue-winged Teal	n. d.	Yes	< 1	100	n. d.	n. d.	700	?	No
Red-breasted Merganser	n. d.	Yes	< 1	100	n. d.	n. d.	Yes	?	Yes
American Wigeon	n. d.	Yes	< 1	100	n. d.	n. d.	2,200	?	Yes
Northern Shoveler	n. d.	Yes	< 1	100	n. d.	n. d.	100	?	No
Northern Pintail	n. d.	Yes	< 1	100	n. d.	n. d.	16,000	?	Yes
Common Eider *dresseri*	n. d.	Yes	< 1	100	n. d.	n. d.	Yes	?	No
Surf Scoter	n. d.	Yes	< 1	100	n. d.	n. d.	Yes	?	No
Barrow's Goldeneye	600[i]	Yes[j]	< 1	100	n. d.	n. d.	Yes	?	600[g]
Gadwall		Occas.[k]					300	?	No
Lesser Scaup		Occas.[k]					14,000	No	No
Snow Goose		No					Yes	No	No
Brant		No					1,000[l]	No	No
Cackling Goose		No					Yes	No	No
Greater Scaup		No					11,000	No	No
Black Scoter		No					Yes	No	No
Long-tailed Duck		No					Yes	No	No
Total	**176,000[m]**	**179,600 ± 21,200**	**100**	**100**	**104.91[n] ± 11.00**	**4.3*[o]**	**> 900,000**	**?**	**> 1,900**

[a] Population objective for the BCR; unless otherwise indicated, this objective is expressed as **indicated breeding pairs (IBP)** and corresponds to the total breeding population according to the 2000 WUPL, 2004 WLOW and 2004 WSHO. n. d. = not determined.

[b] Number of **IBP** according to the total of the 2004-2007 averages for WUPL, WLOW and WSHO ± standard deviation for the entire BCR.
Yes = Species breeds in the BCR, but CWS surveys do not allow population to be calculated. Occas. = Species breeds occasionally in the BCR (every 2 to 5 years).
Excep. = Species breeds exceptionally in the BCR (fewer than once every five years). No = Species does not breed in the BCR.

[c] Density of **IBP** per 100 km² based on mean of 2004-2007 averages for WUPL, WLOW and WSHO ± standard deviation.

[d] **Breeding population** trend based on WUPL data for 1990-2007 and expressed as the mean annual percentage of increase or decrease (-);
* = significant trend, $p < 0.05$; ▲ = nearly significant trend ($0.05 \leq p \leq 0.10$).

[e] Number of migrating **individuals** in spring. Unless otherwise indicated, this estimate is based on the total number of indicated breeding pairs in the BCR (see[b]) and IBP in

the BCRs located north of this BCR; all IBP were multiplied by a factor (2.67 for geese; 2.10 for dabbling ducks; 2.63 for diving ducks and 2.56 for sea ducks) to take account of nonbreeding individuals. For less abundant species, Yes = Species occurs in the BCR, but in unknown numbers. No = Species does not occur in the BCR.

[f] Number of **individuals**, according to various sources. For species listed without a number, Yes = Species occurs in the BCR, but in unknown numbers; No = Species does not occur in the BCR; ? = It is not known whether the species occurs in the BCR.

[g] Number of **individuals** according to 2009 BGTWS (CWS, unpubl. data).

[h] Resident Canada Geese for objective. For breeding, number includes Resident (estimated at 2,700 IBP approx.) and Atlantic (estimated at 700 IBP approx.) populations. For spring migration, Canada geese are a mixture of Resident and Atlantic populations.

[i] Objective expressed as the number of **individuals** (to be obtained on the wintering grounds in BCR 12), adapted from Environment Canada 2011.

[j] May consist of around 100 breeding pairs according to rough estimates based on observations made during WUPL in 1990-2007 (CWS, unpubl. data).

[k] According to observations of nests and broods reported in ÉPOQ.

[l] Rough estimate based on a telemetry study (New Jersey Division of Fish and Wildlife 2003), surveys in the St. Lawrence estuary in 2002 and 2003 (CWS, unpubl. data) and 2004–2007 WSHO data (CWS, unpubl. data).

[m] This number corresponds to the total of the objectives for **breeding populations** only.

[n] Density of all species of breeding waterfowl, except for species that occur in small numbers.

[o] Trend for all species of breeding waterfowl for which this statistic could be calculated.

6.4 Priority species in BCR 12

Priority species in BCR 12 were selected using *objective* prioritization methods (see section 2.5 and Appendix 16.2), combined with the *subjective* experience of CWS specialists. A conservation objective has been set for each priority species (see section 6.5).

High priority	Medium priority
American Black Duck: Objective 2 Barrow's Goldeneye: Objective 3 Hooded Merganser: Objective 4	Common Goldeneye: Objective 4 Wood Duck: Objective 4

6.5 Conservation objectives and actions recommended for priority species in BCR 12

Objective 1 comprises actions that apply to a number of the priority species. Objectives 2 to 4 comprise actions targeting a specific priority species or group of species.

Objective 1
Ensure the conservation of high-priority and medium-priority species.

Monitoring and surveys

Action 1 Continue WUPL and WLOW, which provide baselines for determining breeding population objectives.
► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Action 2 Continue the pre-season banding program to monitor harvest rates, document movements and obtain indices of reproductive success of priority species.
► American Black Duck, Wood Duck

Knowledge acquisition

Action 3 Determine the most important parameters (e.g., adult survival by season, productivity) in the annual cycle of priority species in order to guide monitoring and conservation efforts.
► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Action 4 Determine local factors (e.g., habitat characteristics, food resources) that have an impact on the breeding of priority species.
► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Active surveillance

Action 5 Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to priority species.
► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Action 6 Continue the Harvest Questionnaire Survey and the Species Composition Survey (Wingbee) to monitor harvest rates of priority species.

► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Action 7 Ensure the efficacy of the CWS Oil Spill Emergency Response Plan in order to prevent and limit mortality in priority species in the event of an oil spill.

► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Action 8 Ensure the efficacy of the CWS Avian Mortality Events Emergency Response Plan and make improvements where necessary, to prevent and limit mortality in priority species in the event of an outbreak of avian disease (cholera, etc.).

► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Environmentally sustainable practices

Action 9 Increase awareness among the authorities responsible for forest management and harvesting on preserving riparian strips (e.g., when certain species are present, protect a strip over 20 m wide and keep a certain percentage of the strips intact).

► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Action 10 Increase awareness among the authorities responsible for forest management and harvesting on the importance of maintaining sufficient numbers of large trees (DBH of 30 cm or more) and of protecting trees with nesting cavities (snags and live mature trees) for cavity-nesting ducks.

► Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Action 11 Increase awareness among the authorities responsible for hydroelectric development on the importance of conserving wetlands, lakes and rivers suitable for priority species.

► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Action 12 Raise awareness among the authorities responsible for land-use planning and development of the loss of wetlands and the modification of natural shorelines associated with residential, industrial and cottage and resort development, which are exerting strong pressure in the BCR (particularly in the Ottawa Valley and the Laurentians).

► American Black Duck, Hooded Merganser, Barrow's Goldeneye, Common Goldeneye, Wood Duck

Objective 2
Ensure the conservation of the American Black Duck; increase the breeding population to 67,000 indicated breeding pairs and maintain this population (Table 4).

- ► **Key habitats (breeding):** marshes; beaver ponds; peatlands; swamps; the shoreline of lakes, rivers and streams; agricultural watercourses
- ► **Primary conservation issues:** habitat loss and modification (logging [loss of protective cover in riparian strips and increased predation, among other things], cottage and resort development [shoreline encroachment], drainage of farmland, filling of wetlands, hydroelectric development [flooding of wetlands], urban and industrial development), harvest rates

Note: In addition, consult the Population Monitoring Implementation Plan (Black Duck Joint Venture 2008b) and the Research Program Implementation Plan (Black Duck Joint Venture 2008c) for a list of BDJV recommendations for the American Black Duck.

Other actions specifically targeting the American Black Duck in BCR 12:

Monitoring and surveys

Action 13 Institute a survey of productivity in the American Black Duck.

Action 14 Institute a monitoring program of wintering American Black Duck to document changes and assess if they are related to climate change (this survey and the effects of global warming are identified in the BDJV 2010 Research Program Implementation Plan).

Action 15 Institute a survey of a series of key wetlands used by the American Black Duck at different periods of its annual life cycle; determine the extent of wetland losses and modifications.

Knowledge acquisition

Action 16 Determine the abundance and distribution of the American Black Duck during the breeding season according to wetland type and wetland location in the BCR; locate priority habitats that face threats and develop strategies to curb these threats.

Environmentally sustainable practices

Action 17 Promote sustainable, ecological agriculture that ensures the presence of suitable waterfowl habitat (riparian strips, healthy aquatic habitats, etc.) during both the nesting and brood-rearing periods; for instance, encourage private programs such as the program by Fondation de la faune du Québec and the Union des producteurs agricoles to enhance watercourse biodiversity in agricultural environments (*Programme de mise en valeur de la biodiversité des cours d'eau en milieu agricole*) and Nature Québec's zero-carbon farm initiative (*Agriculture et climat: Vers des fermes 0 carbone*).

Objective 3
Ensure the conservation of the Eastern Population of the Barrow's Goldeneye; maintain a breeding population of at least 100 indicated breeding pairs and a winter population of at least 600 individuals (Table 4). Ultimately, allow the population to be removed from the list of species designated under the *Species at Risk Act* and the list of species at risk (threatened and vulnerable species) established by the Quebec government.

- **Key habitats (breeding):** presence of tree cavities (snags and living mature trees) in the balsam fir–white birch or black spruce–feather moss forest near small (< 15 ha), high-elevation (> 500 m) lakes without fish
- **Key habitats (wintering):** broad tidal flats in the upper estuary (Saint-Irénée, La Malbaie and Cap-à-l'Aigle sectors)
- **Primary conservation issues:** habitat loss (logging, scarcity of mature trees and snags with potential cavities), stocking of fishless lakes, oil spills, harvest rates, inter- and intraspecific competition for nesting cavities, climate change (possible impact on wintering)

Note: Consult the *Management Plan for the Barrow's Goldeneye (*Bucephala islandica*), Eastern Population, in Canada* (Environment Canada 2011) for the complete list of recommendations on this population.

Other actions specifically targeting Barrow's Goldeneye in BCR 12:

Monitoring and surveys

Action 18 Continue the BGTWS.

Knowledge acquisition

Action 19 Finish the work to locate the moulting areas used by the species.

Action 20 Determine the regional factors (e.g., climate, food resources) with an impact on the overwintering of Barrow's Goldeneye.

Active surveillance

Action 21 Ensure adequate surveillance in areas where the goldeneye congregate during the sport hunt.

Environmentally sustainable practices

Action 22 Raise awareness among outfitters and land managers (e.g., ZECs, Quebec national parks, ecological reserves) who stock fishless lakes of the potential impacts of this practice on Barrow's Goldeneye; the species prefers fishless lakes due to the abundant invertebrates found in these lakes precisely because of the lack of fish, which also feed on invertebrates.

Action 23 Increase awareness among the authorities concerned (natural resource exploitation) to avoid constructing roads near fishless lakes (200 m) in order to reduce access to these lakes.

Action 24 Make hunters aware of current regulations on the season and daily bag and possession limits for Barrow's Goldeneye.

Action 25 Make hunters aware of the importance of knowing how to reliably distinguish Barrow's Goldeneye from Common Goldeneye in the field (http://publications.gc.ca/site/eng/344768/publication.html).

Habitat measures

Action 26 In the case of key wintering areas used by Barrow's Goldeneye that are designated as a WGA (including Saint-Irénée and La Malbaie), extend protection to this critical period of the birds' annual cycle; in the case of key wintering areas for the species that have no protection at all, ensure they are protected by having them designated as a WGA or Marine Wildlife Area, for example.

Objective 4
Ensure the conservation of cavity-nesting ducks; maintain a Wood Duck population of at least 2,600 indicated breeding pairs (IBP), a Hooded Merganser population of at least 16,000 IBP and a Common Goldeneye population of at least 18,000 IBP (Table 4).

- **Key habitats (breeding):** presence of tree cavities (snags and living mature trees) in mature forests near lakes, ponds, streams, flooded forest, swamps and beaver ponds
- **Primary conservation issues:** habitat loss and modification (natural resource exploitation: logging leading to a scarcity of mature trees and snags with potential cavities, hydroelectric development [flooding of wetlands], cottage and resort development [shoreline encroachment]), inter- and intraspecific competition for nesting cavities, harvest rates

There are no specific actions targeting Wood Duck, Hooded Merganser or Common Goldeneye in BCR 12 other than those listed under objective 1.

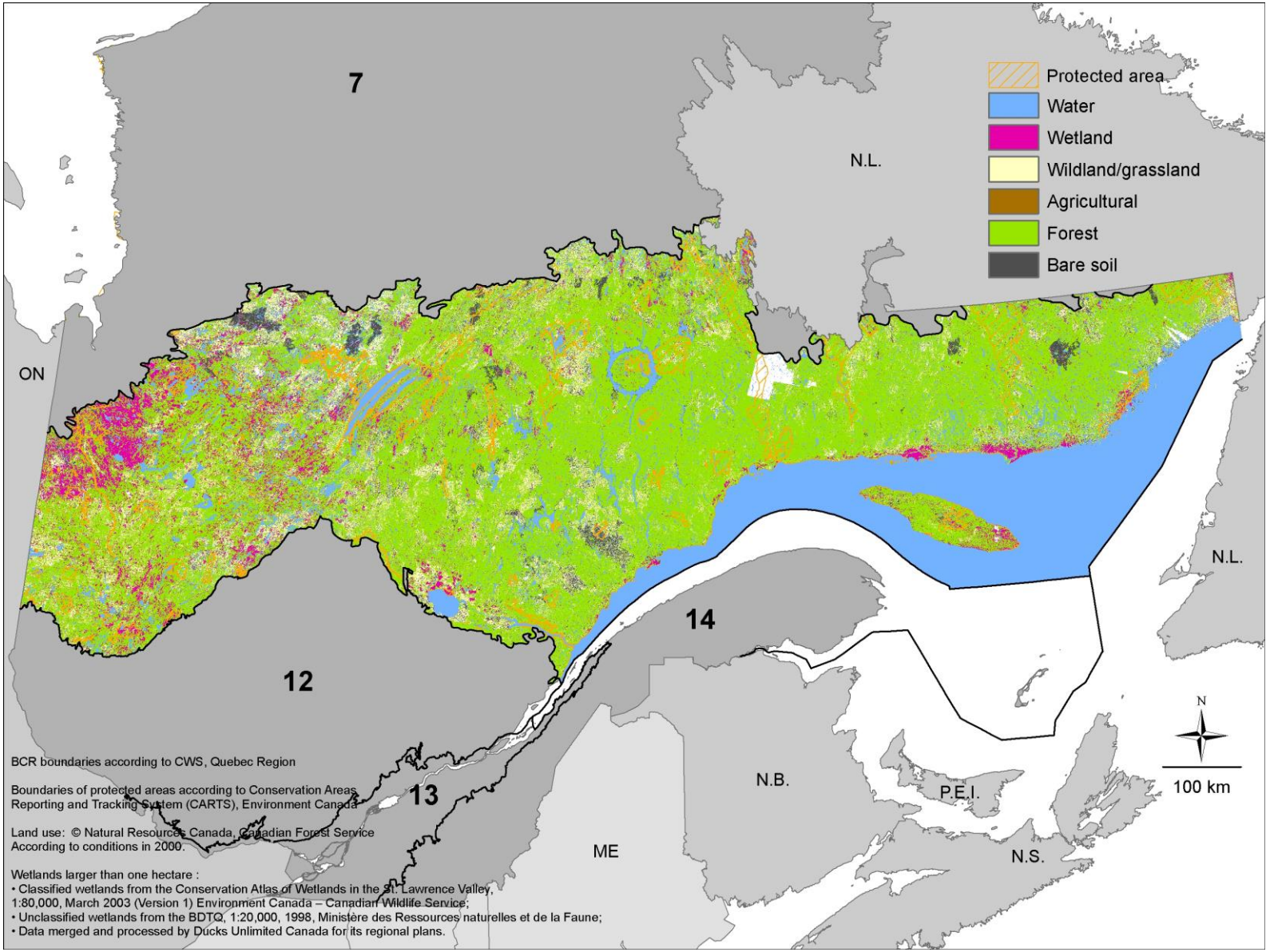
7. Boreal Softwood Shield (BCR 8)

7.1 General description

BCR 8 is situated entirely in Canada. This crescent-shaped BCR extends from the Saskatchewan–Alberta border to Newfoundland (Figure 1) (Wiken et al. 1996; ICOAN international 2009). In Quebec, it covers an area of 543,009 km^2, of which 462,399 km^2 (85%) is on land and 80,610 km^2 (15%) is aquatic (Figure 2). BCR 8 is the second-largest BCR in Quebec in terms of area (its land mass makes up 31% of the Quebec territory). Conifer stands cover over 80% of this vast territory, which also has coastal habitats in its eastern half (Eastern Habitat Joint Venture 2007).

The terrestrial portion of BCR 8 crosses the entire province in a broad swath from west to east, mainly between the 48th and 52nd parallels (Figure 11). It includes the Nottaway River and Lac au Goéland sector in the Abitibi Plains region, the Mistassini Hills in the Rupert River Plateau region (on the western boundary of the boreal forest) as well as the Lac Saint-Jean valley and lowlands (between Lake Mistassini and Manicouagan reservoir) in the Laurentian Highlands. BCR 8 also takes in the north shore of the lower estuary and the Gulf of St. Lawrence (from Saint-Fidèle to Blanc-Sablon), Anticosti Island and all the coastal islands in this sector (Environnement Canada 2005b). In general, the terrain is rolling, with elevations ranging from 300 m to 600 m (Environnement Canada 2005b). There are a few high summits: the Otish Mountains (including Mount Yapeitso, 1,130 m), Groulx Mountains (one of the highest mountain ranges in Quebec, with several peaks over 900 m, and Mount Veyrier, 1,104 m), Valin

Figure 11. Location of BCR 8 in Quebec and land use (white = no data)



Mountains (up to 980 m), Mount Babel (952 m) and the Severson Mountains (up to 914 m) (Direction générale de l'information géographique 2001; Sépaq 2009). Anticosti Island has relatively flat terrain, with the elevation rarely reaching 150 m (Environnement Canada 2005b).

BCR 8 ranks third among Quebec BCRs in population (after BCR 13 and 14), even though urban areas are few and far between. In fact, 75% of the 522,800 inhabitants in the BCR are concentrated in the Saguenay–Lac-Saint-Jean (54%) and Abitibi-Témiscamingue (25%) regions (adapted from Ministère des Affaires municipales des Régions et de l'Occupation du territoire 2007). The largest cities are Saguenay, Rouyn-Noranda, Val-d'Or, Alma, Sept-Îles and Baie-Comeau (Environnement Canada 2005b). There are also 15 Aboriginal communities in BCR 8 with almost 19,000 inhabitants. Ten of these communities are in the Côte-Nord (North Shore) region (Uashat and Maliotenam, two communities near Sept-Îles, together form the largest in terms of territory), and this region is home to 52% of the BCR's Aboriginal inhabitants (Affaires indiennes et du Nord Canada 2009; Statistique Canada 2009).

Summers in BCR 8 are cool and rainy in the Gulf of St. Lawrence and on Anticosti Island, but hot and humid in the Saguenay–Lac-Saint-Jean region. The mean summer temperature in BCR 8 ranges from 11.5°C to 12.5°C. Winters are cold throughout the BCR, with mean winter temperatures of -12.5°C to -13.5°C in the western portion and -9°C further east. The mean annual temperature is around 0°C in the western part and around 1.0–1.5°C, further east. Mean annual precipitation ranges from 650 mm to 900 mm in the Rupert River Plateau in the west to from 800 mm to 1,100 mm further east; the mean is over 1,000 mm on the coast of the Gulf of St. Lawrence, where it is constantly windy (Environnement Canada 2005b).

In general, soils are fairly poor and the growing season is short in BCR 8; therefore, it is not very conducive to the development of agriculture, except in a few places in the Abitibi region and in the Lac Saint-Jean and Saguenay River lowlands (Environnement Canada 2005b). The main land-use in BCR 8 is logging, although hydroelectric power generation and mining are also well-established activities. Most of the forests in BCR 8 are publicly owned, except for the mixed forests around Lac Saint-Jean and a few areas in the southern Abitibi region. In addition, the Côte-Nord region—almost all of which is included in BCR 8—has one of the largest areas of forest in the province (Ministère des Ressources naturelles et de la Faune du Québec 2003c).

BCR 8 is the only BCR in Quebec where the forest landscape is overwhelmingly boreal in character. Aside from the Saguenay and Lac Saint-Jean lowlands, which are part of the balsam fir–yellow birch bioclimatic domain, BCR 8 includes most of the balsam fir–white birch and black spruce–feather moss domains in Quebec. In the balsam fir–white birch domain, which is found in the southern part of the BCR, the dominant tree species are balsam fir, white spruce and white birch, although black spruce, jack pine, tamarack and trembling aspen can be found on some sites in pure or mixed stands. The black spruce–feather moss domain covers most of the BCR. Black spruce is the most dominant species by far and often forms pure stands but is also associated with balsam fir and shade-intolerant hardwoods such as white birch and trembling aspen; the abundance of these companion species depends primarily on the natural disturbance regime. A low ground cover of feather mosses is also common. The black spruce–lichen bioclimatic domain occurs along a thin strip in the northeastern part of the BCR (Saucier et al. 2009).

While the latitudinal climatic gradient governs the distribution of bioclimatic domains, the longitudinal gradient—linked mainly to the precipitation regime—influences the pattern of natural disturbances. The moderate precipitation in the western part of the BCR favours a short fire cycle (generally less than 200 years), while the maritime climate in the east, with its more

abundant precipitation, leads to longer fire cycles. Spruce budworm is also another important agent of disturbance in the boreal forest. Since balsam fir is the primary host of spruce budworm, the regions belonging to the balsam fir–white birch bioclimatic domain are most likely to be affected by budworm outbreaks. These two types of natural disturbances have an impact on the composition and age structure of forest landscapes in BCR 8 (Bergeron et al. 2007; Bouchard et al. 2008; Morin et al. 2008; Saucier et al. 2009).

The proportion of old-growth forests is fairly high in the boreal forest, even in areas where fires are relatively frequent (Gauthier et al. 2008). BCR 8 is the BCR in Quebec containing the largest area of old-growth forest (exceptional forest ecosystems). The BCR's 67 old-growth forests, all publicly owned, cover a total of 25,085 ha (MRNF, unpubl. data).

In addition, the Quebec part of BCR 8 has a sizeable marine portion, the largest of all the BCRs. This marine portion, which covers over 80,000 km^2, encompasses the entire northern half of the lower estuary and Gulf of St. Lawrence (including Anticosti Island) to Quebec's eastern border (Figure 11). In addition, BCR 8 includes many large rivers: the Saguenay, Sainte-Marguerite, Nottaway, Toulnustouc, Péribonka, aux Outardes, Otish and Témiscamie. It also contains a number of large lakes, with a few larger than 20,000 ha (e.g., Saint-Jean, Manouane, Péribonka, Mistassini, Chibougamau, Waswanipi and Matagami) (Direction générale de l'information géographique 2001). The hydroelectric reservoirs in the BCR (Manicouagan, aux Outardes 4, Pipmuacan) (Direction générale de l'information géographique 2001) serve as staging areas for some species of waterfowl.

The north shore of the estuary is a favourite staging area for sea ducks in spring, fall and winter, and is also used as a moulting area by some species. The distribution of these species in the habitat reflects their dietary preferences (the substrate types and depths frequented vary depending on the species). The distribution of waterfowl during these seasons can be explained in large part by the distribution of bivalves (e.g., blue mussels and clams) and aquatic invertebrates (e.g., amphipods). For example, during migration, many scoters can be found between Tadoussac and Pointe-des-Monts (including the Forestville area and Jérémie Islets, two known moulting sites; J.-P.L. Savard, EC–S&T, unpubl. data), while Common Eiders and Long-tailed Ducks are concentrated mainly between Pointe-des-Monts and Sept-Îles, and in the Mingan Islands (Lehoux et al. 1996). When winter arrives, the north shore of the estuary provides shelter for significant numbers of ducks; the currents and tides prevent the formation of an ice cover, particularly between the Saguenay and Betsiamites rivers. In the Gulf of St. Lawrence, the majority of ducks overwinter in the Mingan Islands and around both ends of Anticosti Island, depending on how much ice is present in a given year (Lehoux et al. 1996; Goudie et al. 2000; CWS, unpubl. data).

In general, the Quebec portion of BCR 8 can be seen as a mosaic of uplands and innumerable wetlands, lakes and rivers. Over 4 million hectares of wetlands can be found in this BCR. In the Abitibi region, wetlands cover over 25% of the territory and the density of beaver colonies has been estimated at over 6 colonies/10 km^2, a sizeable population (Environnement Canada 2006b; Eastern Habitat Joint Venture 2007; ICOAN international 2009). There is very little data on the distribution of the various wetland types in the BCR (wetlands in the region had not yet been classified when this plan was drawn up; S. Labrecque, CWS, pers. comm.). The information available indicates, however, that fens and treed, semi-treed and open (unforested) bogs are found (Marineau 2004).

Cordgrass marshes stretch over roughly 1,100 ha in the lower estuary between Les Bergeronnes and Pointe-aux-Outardes, as well as roughly 1,300 ha on the north shore of the

Gulf, between Baie-Trinité and Blanc-Sablon. Since a tidal influence is felt in the Saguenay Fjord and River as far west as the city of Saguenay, there are also some cordgrass marshes in this sector, roughly five between Baie-Sainte-Marguerite and Saint-Fulgence, with the largest, only 7 ha in size, located at Anse-Saint-Jean (Argus inc. 1998). Given the strength of the waves in the Gulf of St. Lawrence, cordgrass marshes usually only occur as small, isolated wetlands in sheltered bays. As one moves progressively northeast, the zones of saltwater cordgrass and saltmeadow cordgrass in these marshes are gradually replaced by salt meadows (or high marshes) (Argus inc. 1998). East of Havre-Saint-Pierre, salt marshes become more frequent, particularly at Baie-Johan-Beetz, Aguanish, Kegaska, Port-Saint-Servan and Saint-Augustin, and in Washicoutai and Coacoachou bays (Couillard and Grondin 1986). The Mingan Islands are of limestone, and many are scattered with pools that attract ducks (including several species of dabbling ducks) during the breeding season.

On the Lower North Shore, the rocky shoreline, which is composed of granite, is deeply indented. The sea penetrates the land, creating a landscape that is a vast mosaic of granite slabs and a multitude of pools. This habitat, and the numerous islands found there, provides particularly suitable habitat for the Common Eider, the most common breeding species of waterfowl in the region. Unlike the estuary, where the eiders' breeding and brood-rearing habitats are widely separated, they closely overlap on the Lower North Shore (Joint Working Group on the Management of the Common Eider 2004).

An inventory of eelgrass beds between Tadoussac and Baie-Comeau found over 10 of these habitats, covering a total of 960 ha (Lemieux and Lalumière 1995). Nearly 80% of these beds are located between Forestville and Baie-Comeau, and none were found in the portion of the Saguenay that was surveyed.

There are numerous protected areas providing suitable waterfowl habitat in BCR 8, occupying an extensive area. They include 326,416 ha designated as WGAs, or nearly three times as much as in BCR 13, which ranks just behind BCR 8 in area designated as WGAs. There are also nine migratory bird sanctuaries (60,967 ha), the Saguenay–St. Lawrence Marine Park (of which over 354,000 ha are located in BCR 8) and close to 480,000 ha of planned aquatic reserves (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002j).

7.2 Characteristics of conservation issues in BCR 8

The issues discussed below are those for which we were able to provide additional information in BCR 8. The environmental impacts of these issues on waterfowl and recommended mitigation measures are discussed in Chapter 3.

7.2.1 Urban development

The Quebec portion of BCR 8 has very few urban areas. The human population is concentrated in three sectors. In the western sector, in the portion of the Abitibi-Témiscamingue administrative region that lies in the BCR, population centres include Rouyn-Noranda and Val-d'Or (population trend since 2001: +0.8 % and -1.0 % respectively; Institut de la statistique du Québec 2009b). In the central portion of the BCR, the cities of Saguenay (-2.3%) and Alma (-0.4%) are the two main urban centres. In the east, most of the population is concentrated in a thin strip along the estuary and Gulf of St. Lawrence, where Sept-Îles (+0.5%) and Baie-Comeau (-2.3%; Institut de la statistique du Québec 2009b) are the main cities. The major population centres in this BCR

have not experienced any sizeable population growth since 2001. However, resource exploitation (e.g., logging, mining) sometimes results in small, localized population booms or even the creation of new towns, where the very rapid development is likely to have a negative impact on wildlife habitat of high ecological value (e.g., wetlands).

7.2.2 Agriculture

Although the Abitibi and Saguenay–Lac-Saint-Jean lowlands in BCR 8 are particularly well suited to farming, the agriculture occurring in these regions is not at all comparable to that in the St. Lawrence lowlands. However, intensive agriculture similar to that found in BCR 13 is practiced in some areas, sometimes resulting in the systematic drainage of farmland and the draining and filling of small wetlands.

The agricultural and climatic potential of northern Quebec has been highlighted in order to promote the introduction of crops adapted to local conditions. The niches of berry, apple and livestock production could be developed in the coming years (Ministère du développement économique de l'innovation et de l'exportation 2011; Ministère du développement économique de l'innovation et de l'exportation 2010). In addition, blueberry production is a major industry in BCR 8 and is expanding rapidly. While Quebec's blueberry fields totalled 19,471 ha in 2002, with 92% located in the Saguenay–Lac-Saint-Jean region and 6% in the Côte-Nord region (Ministère des Ressources naturelles et de la Faune du Québec et Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec 2002), according to 2010 data, the crop totals 31,880 ha, with 85% in the Saguenay–Lac-Saint-Jean region and 10% in the Côte-Nord region (Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec 2011b). During the 2004–2009 period, Quebec recorded the greatest increase of all provinces in wild blueberry acreage; in addition, blueberry production in the province rose by 79% during this period (Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec 2011b).

Newly cleared land slated for berry production near Chibougamau. Photo: Christine Lepage © CWS

Cranberry production is developing in the Lac Saint-Jean lowlands (Canards Illimités Canada 2009c), which is increasing the pressure on peatlands in, or on the edge of, the areas where this crop is grown.

In terms of cattle production, the Abitbi-Témiscamingue region alone was responsible for over 73% of the increase in Quebec's cattle population from 1997 to 2007 (Ministère du développement économique de l'innovation et de l'exportation 2011).

7.2.3 Logging

Since most of this BCR is not suited to agriculture because of the short growing season and poor soils, forests still cover the majority of the territory, providing the basis of the main economic activity, logging. The exploitation of the boreal forest is fairly recent compared with forests further south, and logging has only been carried out for a few decades in the region. However, given the vastness of the territory, the first rotation has still not been completed, in

other words, most areas have only been logged once and current logging is still mostly being carried out on “virgin” forest (Drolet et al., in prep.). Aside from the mixed forests around Lac Saint-Jean and in some areas of the southern Abitibi region, which are privately owned, forests in BCR 8 are located primarily on public land (lands in the domain of the state) and are managed in accordance with the *Forest Act*.

Logging operations near Chibougamau. Photo: Christine Lepage © CWS

7.2.4 Mining

According to October 2011 data, there were 27 active mines in Quebec (Ministère des Ressources naturelles et de la Faune du Québec 2011c). Most are gold mines and are located in the western part of BCR 8, particularly along the Rouyn-Noranda–Val-d'Or axis of the Abitibi region. In the eastern part of the BCR, mainly iron ore is mined (around Havre-Saint-Pierre and Fermont).

Several mining exploration projects are planned in BCR 8 in the near future, facilitated by the mineral strategy of the Quebec government. New mining development will be concentrated in the following three sectors: (1) Rouyn-Noranda–Val-d'Or (mainly gold mines); (2) Matagami–Chibougamau (zinc, copper, gold and silver); and (3) the Otish Mountains (a uranium mine, among others) (Ministère des Ressources naturelles et de la Faune du Québec 2010). Mining exploration and development are activities in BCR 8 that could have effects on habitats, among others. It should be noted that, although the government’s mineral strategy could accelerate mineral development in northern Quebec, it also aims to enforce stricter environmental standards (Ministère des Ressources naturelles et de la Faune du Québec 2009c).

Mine tailings on the edge of Lake Chibougamau. Photo: Christine Lepage © CWS

7.2.5 Oil and gas development

The marine environment in the Quebec portion of BCR 8 contains oil and gas resources. The St. Lawrence Estuary Quaternary Basin and Ordovician Anticosti Basin, located in the estuary and Gulf of St. Lawrence, have oil and gas potential (Bureau d'audiences publiques sur l'environnement 2004).

7.2.6 Aquaculture

The Côte-Nord region has a few commercial mussel and scallop farming operations. No conflicts with sea ducks have been reported to date in BCR 8 (although there have been problems in BCR 14, see Moisan and Cauvier 2010 on this subject).

7.2.7 Hydroelectric power generation

The second most important activity after logging in BCR 8 is hydroelectric generation. A significant portion of the large rivers found in the BCR have been developed for hydropower (Manicouagan, aux Outardes, Sainte-Marguerite, Bersimis, Ha! Ha! and Péribonka water systems) or are currently under construction (Romaine River). Some of the province's largest dams are in BCR 8, including Daniel-Johnson dam in the Manic-5 complex. Once completed in 2020, the Romaine River hydropower complex will consist of four generating stations with reservoirs.

Shoreline of Outardes-4 reservoir under low water conditions. Photo: Christine Lepage © CWS

In accordance with the Québec Energy Strategy 2006–2015 (Ministère des Ressources naturelles et de la Faune du Québec 2006), Hydro-Québec is in the process of planning new hydroelectric projects. They include generating stations on the Rivière du Petit Mécatina, a generating station near Kipawa dam in the Témiscamingue region and a project on the Magpie River, all located in BCR 8 (Hydro-Québec 2009).

7.2.8 Wind power generation

A single wind farm project is planned in BCR 8, the Val-Éo wind farm on Hébertville plain near Saint-Gédéon (Ministère des Ressources naturelles et de la Faune du Québec 2014). According to the MRNF, the administrative regions of Côte-Nord, Saguenay–Lac-Saint-Jean and Nord-du-Québec (the southern portion of which is part of BCR 8) are among those with strong wind power potential (Ministère des Ressources naturelles et de la Faune du Québec 2011a).

7.2.9 Shipping and shipping infrastructures

The St. Lawrence is an extremely busy waterway, and the coastline of BCR 8 is no exception (see Figure 18 in Bolduc 2007), with a number of major ports (Sept-Îles, Port-Cartier, Port-Alfred, Baie-Comeau and Havre-Saint-Pierre; Fisheries and Oceans Canada 2010). The oil spill from the ore carrier *Gordon C. Leitch* in the port of Havre-Saint-Pierre in 1999 is an example of the potential impacts of shipping on waterfowl: nearly 950 Common Eiders were found dead, despite the small quantity of bunker oil spilled (49 tonnes) (Roberge and Chapdelaine 2000). Since generally only a small percentage of dead oiled birds are found after a spill (an estimated 10–30% in the case of birds that die at sea; Wiese and Robertson 2004), a much greater number of eiders no doubt perished in the Havre-Saint-Pierre spill.

Looking for oiled birds after the oil spill at Havre-Saint-Pierre in March 1999. Photo: Denis Lehoux © CWS

7.2.10 Road transportation and infrastructures

The announcement of the Plan Nord in May 2011, the provisions of which included facilitating access to the North (Gouvernement du Québec 2011c), has highlighted a number of planned construction and improvement projects involving highway and rail infrastructures in BCR 8. Among these projects, there are the extension of Highway 167 from Lake Albanel to the Otish Mountains and the Renard Mine (roughly 250 km), the extension of Highway 138 between Natashquan and Blanc-Sablon, and improvements to Highway 389 between Baie-Comeau and Fermont (Gouvernement du Québec 2011c). The Highway 167 extension, which will open up new territory and facilitate the development of projects in the mining, forestry, energy, and tourism and recreation sectors, will go through the Lacs Albanel-Mistissini-et-Waconichi Wildlife Reserve and the planned Albanel-Témiscamie-Otish National Park (Quebec provincial park) for a distance of at least 50 km (Agence canadienne d'évaluation environnementale 2010).

7.2.11 Water quality in the St. Lawrence

Water quality depends largely on the prior treatment of wastewater before it is discharged, which has still not been implemented by some municipalities along the estuary and Gulf of St. Lawrence (State of the St. Lawrence Monitoring Committee 2008). For comparison purposes, the bacterial quality of the coastal waters in the Côte-Nord region (BCR 8) is better than that in the Bas-Saint-Laurent (BCR 13 and 14) and Gaspésie (BCR 14) regions.

7.2.12 Sediment quality in the St. Lawrence

Dredging activities on the north shore of the St. Lawrence are concentrated in the Port of Sept-Îles and the port facilities at Baie-Comeau, as well as in fishing harbours and around public docks. Due to the sediment dynamics in this part of the St. Lawrence system, maintenance dredging is less frequent in this BCR than in BCR 13 and 14 (L. Breton, EC, pers. comm.). However, dredging to construct new shipping infrastructures is more common. As elsewhere in the St. Lawrence, developers most often dispose of dredge material in the marine environment but must obtain a disposal at sea permit beforehand.

Disposal at sea of fishing offals is a regular practice on the North Shore. These offals come from transformation plants, and a permit delivered by Environment Canada is mandatory before proceeding to their disposal.

Finally, Baie des Anglais, just east of Baie-Comeau, is one of the most highly contaminated sites in the St. Lawrence system (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002a).

7.2.13 Recreation and tourism

Given the different population centres in BCR 8 and the region's tourism potential (particularly the Saguenay–Lac-Saint-Jean region and the coast of the Côte-Nord region), waterfowl, which are highly sensitive to human disturbance, are likely to suffer negative impacts from this activity. For example, when pleasure boats, motorized or not, come too close to a Common Eider crèche (group of broods and hens), the hens will flee, leaving the ducklings completely vulnerable to an attack by avian predators (Mikola et al. 1994; Guillemette 1997).

7.3 Use of BCR 8 by waterfowl

7.3.1 Migration

Geese (4): Snow Goose (Lesser and Greater), Brant, Cackling Goose and Canada Goose (North Atlantic, Atlantic and Resident populations)
Dabbling ducks (9): Wood Duck, Gadwall, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Shoveler, Northern Pintail and Green-winged Teal
Diving ducks (4): Redhead, Ring-necked Duck, Greater Scaup and Lesser Scaup
Sea ducks (13): King Eider, Common Eider (*borealis* and *dresseri*), Harlequin Duck, Surf Scoter, White-winged Scoter, Black Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser
Stiff-tailed duck (1): Ruddy Duck

TOTAL = 31 species

Highlights of migration period:

- Over 100,000 Snow Geese stage in farm fields in the Saguenay–Lac-Saint-Jean region (GSGOS).
- Roughly 15,000 Brant (Atlantic Population) migrate through BCR 8 in spring, particularly in the Bergeronnes, Pointe-aux-Outardes and Sept-Îles areas, and in the Mingan Islands (WSHO and ÉPOQ).
- Tens of thousands of Canada Geese (Atlantic, North Atlantic and Resident populations) migrate through the upper and lower estuary and the Gulf of St. Lawrence (WSHO).
- Tens of thousands of Common Eider (first *borealis*, then *dresseri*, which migrate a bit later; see accounts on these subspecies in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]) stage along the lower estuary and particularly in the Gulf of St. Lawrence (e.g., Mingan Islands, Watshishou MBS) (WSHO).
- Roughly 200,000 Surf Scoters and Black Scoters stop along the north shore of the lower estuary and Gulf of St. Lawrence (Rail and Savard 2003; WSHO).
- Tens of thousands of Long-tailed Ducks, Red-breasted Mergansers and Common Mergansers frequent the upper and lower estuary and Gulf of St. Lawrence, including Anticosti Island (WSHO).

As many as 3,000,000 geese and ducks are estimated to pass through BCR 8 during migration (Table 5).

7.3.2 Breeding

Of the six Quebec BCRs, BCR 8 has the greatest diversity of species during the breeding season. Regular breeders in this BCR include:
Geese (1): Canada Goose (North Atlantic, Atlantic and Resident populations)
Dabbling ducks (9): Wood Duck, Gadwall, American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Northern Shoveler, Northern Pintail and Green-winged Teal
Diving ducks (4): Redhead, Ring-necked Duck, Greater Scaup and Lesser Scaup
Sea ducks (10): Common Eider (*dresseri*), Harlequin Duck, Surf Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser
Stiff-tailed duck (1): Ruddy Duck

TOTAL = 25 species

Breeding season highlights:

- Roughly 15% of the North Atlantic Population of Canada Geese breed in the inland portion of the Middle and Lower North Shore and on Anticosti Island (CWS, unpubl. data), with locally high breeding densities on Anticosti Island (WUPL and WSHO).
- The forests of BCR 8—which are mainly coniferous—represent the core breeding range in Quebec of some of the province's most abundant duck species (American Black Duck [over 20% of the North American population], Green-winged Teal, Ring-necked Duck, Common Goldeneye and Common Merganser; WUPL).
- The Abitibi lowlands support many breeding individuals of American Wigeon, Blue-winged Teal, Green-winged Teal and Hooded Merganser (WLOW); Bufflehead and Lesser Scaup also breed in the Abitibi region. The abundant beaver ponds here (Lafond and Pilon 2004) provide highly suitable nesting habitat (i.e., presence of snags for cavity-nesting ducks) as well as brood-rearing habitat.
- Roughly 18% of the *dresseri* subspecies of Common Eider (roughly 20,000 pairs in 2009) nest on the Mingan Islands and in the migratory bird sanctuaries on the Middle and Lower North Shore (CWS, unpubl. data).
- The Harlequin Duck frequents some rivers in the Côte-Nord region (see species account in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]) (Robert et al. 2001; Savard et al. 2008c; SOS-POP 2008).
- Over 90% of the Eastern Population of Barrow's Goldeneye, a cavity-nesting species, breed near small, high-elevation (> 500 m), fishless lakes in areas with rugged, mountainous terrain, in the balsam fir–white birch and black spruce–feather moss bioclimatic domains in BCR 8 (Robert et al. 2000; Robert et al. 2002; Robert et al. 2008a).

BCR 8 probably supports close to 390,000 breeding pairs (Table 5).

7.3.3 Moulting

Although there is a paucity of knowledge on moulting waterfowl in general, we can provide some information on species that regularly frequent BCR 8 to moult:
Geese (1): Canada Goose (Resident Population)
Dabbling ducks (2): Wood Duck and American Black Duck
Sea ducks (8): Common Eider (*dresseri*), Harlequin Duck, Surf Scoter, White-winged Scoter, Black Scoter, Barrow's Goldeneye, Hooded Merganser and Red-breasted Merganser
TOTAL = at least 11 species

Highlights of moulting period:
- Wood Duck and Hooded Merganser moult on Sainte-Marguerite 3 Reservoir (Morneau 2003).
- American Black Ducks moult along the estuary and Gulf of St. Lawrence (including roughly 900 individuals at the mouth of the La Petite Romaine River and over 100 at the mouth of Rivière aux Canards; J.-P.L. Savard, EC–S&T, pers. comm.).
- Roughly 20,000 Surf Scoters and 5,000 White-winged Scoters moult between Sainte-Anne-de-Portneuf and Pointe-aux-Outardes, particularly between the Portneuf Sandbank and Patte de Lièvre Island, around the Jérémie Islets and off Papinachois (Rail and Savard 2003; J.-P.L. Savard, EC–S&T, unpubl. data).
- Nearly 60,000 Common Eiders moult in the area between Les Escoumins and Pointe à Boisvert (mainly offshore from Mille-Vaches Bay), between Pointe-aux-Outardes and Lebel Point, between Sainte-Geneviève Island and Watshishou MBS, and along the southern and western coastline of Anticosti Island (Rail and Savard 2003).
- As many as 150 moulting Harlequin Ducks have been counted off Pointe du Sud-Ouest (Southwest Point) on Anticosti Island (S. Craik, pers. comm.; Gilliland et al. 2002; Robert et al. 2008b; Savard et al. 2008c).
- Two females from the Eastern Population of Barrow's Goldeneye implanted with a satellite transmitter moulted in the lower estuary (Savard 2009).
- Over 3,000 Red-breasted Mergansers moult along the shoreline of the western half of Anticosti Island (S. Craik, pers. comm.).

7.3.4 Wintering

Dabbling ducks (2): American Black Duck and Mallard
Diving ducks (1): Greater Scaup
Sea ducks (9): King Eider, Common Eider (mainly *borealis*), White-winged Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Common Merganser and Red-breasted Merganser
TOTAL = 12 species

Winter highlights:
- Around 5,000 American Black Ducks overwinter in the upper and lower estuary (including close to 2,000 near Vergeronnes; Robert et al. 2003; BGTWS, ÉPOQ and CBC).
- Roughly 65,000 Common Eiders overwinter in the Gulf (mainly around the Mingan Islands and off Ouest Point and along the southeastern coastline of Anticosti Island; CETWS).
- Several thousand Long-tailed Ducks overwinter offshore between Baie-Sainte-Catherine and Les Bergeronnes (mouth of the Saguenay) and along the north shore of the Gulf of St. Lawrence (including Anticosti Island) (ÉPOQ; CWS, unpubl. data).

- Nearly 5,000 Common Goldeneye overwinter on the Alouettes flats as far as Bon-Désir (Robert et al. 2003; Robert and Savard 2006), from Pointe-des-Monts to the Mingan Islands, and around Anticosti Island (BGTWS).
- Roughly 5,000 Barrow's Goldeneye overwinter in the upper and lower estuary of the St. Lawrence (including the areas around Baie des Rochers, the Alouettes flats, Baie des Anglais and the mouth of Franquelin River), and in the Gulf of St. Lawrence (including the southern coastline of Anticosti Island; Robert et al. 2003; Robert and Savard 2006; BGTWS).
- Several thousand Red-breasted Mergansers overwinter between Tadoussac and Pointe-des-Monts (including the Godbout area and from Pointe aux Outardes to Lebel Point; Robert and Savard 2006), and between Port-Cartier and the Mingan Islands (BGTWS).
- About 100 Greater Scaup overwinter in the Sainte-Catherine Bay and Tadoussac Bay sectors (ÉPOQ and BGTWS).

BCR 8 probably supports close to 93,000 overwintering individuals (Table 5).

Table 5. Conservation objectives; numbers (IBP/463,800 km² ± standard deviation), density (IBP/100 km² ± standard deviation) and trends during the breeding season; numbers (when available; otherwise, occurrence) during the migration, moulting and overwintering periods in the Quebec portion of BCR 8 (species in red are the priority species of this BCR; see section 7.4).

BCR 8	Objective[a]	Breeding Number[b] ± s.d.	%	% cum.	Density[c] ± s.d.	Trend[d]	Spring Migration[e]	Moulting[f]	Wintering[f]
American Black Duck	120,000	93,800 ± 8,800	24	24	20.23 ± 1.89	2.9*	345,000	Yes	5,000[g]
Ring-necked Duck	63,000	56,500 ± 8,200	15	39	12.18 ± 1.77	3.1*	163,000	?	No
Common Goldeneye	56,000	50,900 ± 5,700	13	52	10.97 ± 1.24	1.1▲	155,000	?	4,700[g]
Canada Goose[h]	39,000	42,300 ± 4,700	11	63	9.12 ± 1.00	5.9*	705,000	Yes	No
Common Merganser	28,000	33,100 ± 4,900	9	72	7.15 ± 1.06	0.6	236,000	?	325[i]
Green-winged Teal	35,000	25,500 ± 3,500	7	79	5.50 ± 0.75	3.2*	110,000	?	No
Mallard	21,000	22,200 ± 6,700	6	85	4.79 ± 1.43	8.7*	50,000	?	< 50[g]
Common Eider *dresseri*	20,000[j]	20,600[k]	5	90	n. d.	Increase[k]	53,000	60,000[l]	Yes[m]
Surf Scoter	9,500	17,100 ± 5,800	4	94	3.69 ± 1.25	7.3*	> 145,000[l]	20,000[m]	No
Hooded Merganser	13,000	10,000 ± 1,700	3	97	2.16 ± 0.36	1.5	51,000	Yes	No
American Wigeon	5,100	4,200 ± 3,200	1	98	0.90 ± 0.68	n. d.	9,000	?	No
Lesser Scaup	n. d.	2,700 ± 1,300	1	99	2.28 ± 0.46	n. d.	57,000	?	No
Barrow's Goldeneye	5,000[n]	2,100[o]	<1	99	0,91 ± 0.34	0.9	6,800[p]	Yes	5,000[g]
Blue-winged Teal	1,600	1,700 ± 800	<1	100	0.37 ± 0.17	n. d.	2,800	?	No
Greater Scaup	n. d.	1,300 ± 650	<1	100	1.11 ± 0.23	n. d.	43,000	?	100[q]
Wood Duck	2,200	1,000 ± 460	<1	100	0.23 ± 0.10	12.3*	2,200	Yes	No
Bufflehead	n. d.	900 ± 510	<1	100	0.19 ± 0.11	-5.7*	4,500	?	45[g]
Northern Pintail	500	430 ± 180	<1	100	0.09 ± 0.04	n. d.	62,000	?	No
Red-breasted Merganser	n. d.	270 ± 100	<1	100	0.06 ± 0.02	1.5	389,000	3,000[r]	4,600[g]
Northern Shoveler	n. d.	170 ± 110	<1	100	0.04 ± 0.02	n. d.	400	?	No
Harlequin Duck	n. d.	50[s]	<1	100	n. d.	n. d.	Yes	150[r]	No
Gadwall	n. d.	Yes	<1	100	n. d.	n. d.	1,400	?	No
Redhead	n. d.	Yes	<1	100	n. d.	n. d.	Yes	?	No
Long-tailed Duck	n. d.	Yes	<1	100	n. d.	n. d.	119,000	?	> 7,000[g]
Ruddy Duck	n. d.	Yes	<1	100	n. d.	n. d.	Yes	?	No
Snow Goose		No					110,000[t]	No	No
Cackling Goose		No					Yes	No	No
Brant		No					15,000[u]	No	No
King Eider		No					Yes	No	< 2,500[m]
Common Eider *borealis*	90,000[v]	No					125,000	No	63,300[w]
White-winged Scoter		No					> 15,000[m]	5,000[m]	Yes
Black Scoter		No					> 52,000[l]	200[r]	No
Total	**414,000[x]**	**387,000[y]**	**100**	**100**	**82.72[z] ± 8.04**	**2.8*[aa]**	**> 3,000,000**	**> 88,000**	**> 93,000**

[a] Population objective for the BCR; unless otherwise indicated, this objective is expressed in **indicated breeding pairs (IBP)** and corresponds to the total breeding population according to the WUPL in 2000 and WSHO in 2004. n. d. = not determined.

[b] Number of **IBP** according to the total of the 2004–2007 averages for WUPL, WLOW and WSHO ± standard deviation for the entire BCR.
Yes = Species breeds in the BCR, but CWS surveys do not allow population to be calculated. Occas. = Species breeds occasionally in the BCR (every 2 to 5 years). Excep. = Species breeds exceptionally in the BCR (less than once every five years). No = Species does not breed in the BCR.

[c] Density of **IBP** per 100 km² based on mean of 2004–2007 averages for WUPL, WLOW and WSHO ± standard deviation.

[d] **Breeding population** trend based on WUPL data for 1990–2007 and expressed as the mean annual percentage of increase or decrease (-);
* = significant trend, $p < 0.05$; ▲ = nearly significant trend ($0.05 \leq p \leq 0.10$).

[e] Number of migrating **individuals** in spring. Unless otherwise indicated, this estimate is based on the total number of indicated breeding pairs in the BCR (see[b]) and IBP in the BCRs located north of this BCR; all IBP were multiplied by a factor (2.67 for geese; 2.10 for dabbling ducks; 2.63 for diving ducks and 2.56 for sea ducks) to take account of nonbreeding individuals. For less abundant species, Yes = Species occurs in the BCR, but in unknown numbers. No = Species does not occur in the BCR.

[f] Number of **individuals**, according to various sources. For species listed without a number, Yes = Species occurs in the BCR, but in unknown numbers; No = Species does not occur in the BCR; ? = It is not known whether the species occurs in the BCR.

[g] Number of **individuals** according to BGTWS in 2009 (CWS, unpubl. data).

[h] Includes Atlantic and North Atlantic populations for objective and migration. For breeding, includes Atlantic (estimated at 25,400 IBP approx.), North Atlantic (estimated at 12,700 IBP approx.) and Resident (estimated at 4,200 IBP approx.) populations. For moulting, consists of Resident Canada Geese.

[i] Number of **individuals** according to Robert et al. 2003.

[j] Objective in **breeding pairs** from *Quebec Management Plan for the Common Eider* Somateria mollissima dresseri (Joint Working Group on the Management of the Common Eider 2004).

[k] Number of **breeding pairs** and trend from Quinquennial Census of Seabird Populations in the Sanctuaries of the North Shore of the Gulf of St. Lawrence, 2009 (CWS, unpubl. data) and BIOMQ 2009 (CWS, unpubl. data).

[l] Number of **individuals** according to Rail and Savard 2003.

[m] See species account in *Status of Quebec Waterfowl Populations, 2009* ([Lepage and Bordage 2013])

[n] Objective expressed as the number of **individuals** (to be obtained in wintering grounds in BCR 8) adapted from Environment Canada 2011.

[o] Number of **breeding pairs** according to Environment Canada 2011.

[p] According to the 2009 BGTWS survey, there are 6,800 **individuals** (5,000 in BCR 8, however) that overwinter in the estuary and Gulf of St. Lawrence, around 6,200 in Quebec and 600 in New Brunswick (CWS, unpubl. data). These individuals very likely migrate through BCR 8 in spring, since most of the breeding pairs were found in this BCR.

[q] According to ÉPOQ.

[r] Number of **individuals** counted in 2005 on Anticosti Island (S. Craik, pers. comm.).

[s] Rough estimate of the number of **breeding pairs** based on Robert et al. 2001 and Savard et al. 2008c.

[t] Number of **individuals** according to 2008 data from Greater Snow Goose Spring Survey in Quebec (CWS, unpubl. data).

[u] Rough estimate of the number of **individuals** based on a telemetry study (New Jersey Division of Fish and Wildlife 2003), surveys in the St. Lawrence estuary in 2002 and 2003 (CWS, unpubl. data) and 2004–2007 WSHO data (CWS, unpubl. data).

[v] Objective expressed as the number of **individuals** (to be obtained on the wintering grounds in BCR 8), adapted from Eastern Habitat Joint Venture 2007.

[w] Number of **individuals** obtained from CETWS in 2006 (CWS, unpubl. data).

[x] This number corresponds to the total of the objectives for **breeding populations** only.

[y] Standard deviation not available for total breeding population due to lack of standard deviation for breeding population of the Common Eider and Barrow's Goldeneye.

[z] Density of all species of breeding waterfowl, except for Common Eider and species that occur in small numbers.

[aa] Trend for all species of breeding waterfowl for which this statistic could be calculated.

7.4 Priority species in BCR 8

Priority species in BCR 8 were selected using *objective* prioritization methods (see section 2.5 and Appendix 16.2), combined with the *subjective* experience of CWS specialists. A conservation objective has been set for each priority species (see section 7.5).

High priority	Medium priority
Barrow's Goldeneye: Objective 2 American Black Duck: Objective 3 Common Eider (*dresseri*): Objective 4 Hooded Merganser: Objective 5	Harlequin Duck: Objective 6 Surf Scoter: Objective 7 Canada Goose (North Atlantic Pop.): Objective 8 Canada Goose (Atlantic Pop.): Objective 8 Common Goldeneye: Objective 5 Blue-winged Teal: Objective 9 Common Eider (*borealis*): Objective 10 Long-tailed Duck: Objective 11 Red-breasted Merganser: Objective 11

7.5 Conservation objectives and actions recommended for priority species in BCR 8

Objective 1 comprises actions that apply to a number of the priority species. Objectives 2 to 11 comprise actions targeting a specific priority species or group of species.

Objective 1
Ensure the conservation of high-priority and medium-priority species at the BCR level.

Monitoring and surveys

Action 1 Continue WUPL and WLOW, which provide baselines for determining breeding population objectives.
► Barrow's Goldeneye, American Black Duck, Hooded Merganser, Surf Scoter, Harlequin Duck, Canada Goose, Common Goldeneye, Blue-winged Teal

Action 2 Continue the pre-season banding program to monitor harvest rates, document birds' movements and obtain indices of reproductive success of priority species.
► American Black Duck, Blue-winged Teal

Action 3 Institute a survey of priority species that nest later in the breeding season (particularly sea ducks).
► Barrow's Goldeneye, Surf Scoter

Action 4 Institute a survey of priority species in major moulting areas.
► Common Eider, Surf Scoter, Harlequin Duck

Knowledge acquisition

Action 5 Determine the most important parameters (e.g., adult survival by season, productivity) in the annual cycle of priority species in order to guide monitoring and conservation efforts.

► Barrow's Goldeneye, American Black Duck, Common Eider, Hooded Merganser, Surf Scoter, Harlequin Duck, Canada Goose, Common Goldeneye, Blue-winged Teal, Long-tailed Duck, Red-breasted Merganser

Action 6 Determine local factors (e.g., habitat characteristics, food resources) that have an impact on the breeding of priority species.

► Barrow's Goldeneye, American Black Duck, Common Eider (*dresseri*), Hooded Merganser, Surf Scoter, Harlequin Duck, Canada Goose, Common Goldeneye, Blue-winged Teal

Action 7 Determine regional factors (e.g., climate, food resources) that have an impact on the overwintering of priority species.

► Barrow's Goldeneye, American Black Duck, Common Eider (*borealis*), Common Goldeneye, Long-tailed Duck, Red-breasted Merganser

Action 8 Determine regional factors (e.g., food resources) that have an impact on moulting in priority species.

► Common Eider (*dresseri*), Surf Scoter, Harlequin Duck

Action 9 Determine the links between breeding grounds, moulting areas and wintering grounds (delineation of populations).

► Common Eider, Hooded Merganser, Surf Scoter, Harlequin Duck, Blue-winged Teal, Long-tailed Duck, Red-breasted Merganser

Action 10 Quantify the potential for overlap between the activities of the commercial fishery and aquaculture industry on one hand and the use of the marine environment by priority species of sea ducks on the other; determine potential areas of conflict between these activities and priority species and formulate recommendations to prevent or lessen conflicts.

► Common Eider, Surf Scoter

Active surveillance

Action 11 Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to priority species.

► Barrow's Goldeneye, American Black Duck, Common Eider, Hooded Merganser, Surf Scoter, Harlequin Duck, Canada Goose, Common Goldeneye, Blue-winged Teal, Long-tailed Duck, Red-breasted Merganser

Action 12 Continue the Harvest Questionnaire Survey and the Species Composition Survey (Wingbee) to monitor harvest rates of priority species.

► American Black Duck, Canada Goose, Blue-winged Teal

Action 13 Ensure the efficacy of the CWS Oil Spill Emergency Response Plan to prevent and limit mortality of priority species in the event of an oil spill.

► Barrow's Goldeneye, American Black Duck, Common Eider, Surf Scoter, Harlequin Duck, Canada Goose, Long-tailed Duck, Red-breasted Merganser

Action 14 Ensure the efficacy of the CWS Avian Mortality Events Emergency Response Plan, and make improvements if necessary, to prevent and limit mortality in priority species in the event of an outbreak of avian disease (e.g., avian cholera).

► American Black Duck, Common Eider, Surf Scoter, Canada Goose

Action 15 Institute a special sea duck harvest survey to be able to estimate as accurately as possible the harvest of priority species.

► Barrow's Goldeneye, Common Eider, Hooded Merganser, Surf Scoter, Common Goldeneye, Long-tailed Duck, Red-breasted Merganser

Action 16 Institute a survey on the migratory bird harvest and egg collecting by Aboriginal people, to assess the harvest of priority species.

► Barrow's Goldeneye, American Black Duck, Common Eider, Hooded Merganser, Surf Scoter, Harlequin Duck, Canada Goose, Common Goldeneye, Long-tailed Duck, Red-breasted Merganser

Environmentally sustainable practices

Action 17 Increase awareness among the authorities responsible for forest management and harvesting on preserving riparian strips (e.g., when certain species are present, protect a strip over 20 m wide and keep a certain percentage of the strips intact; in strips where logging activities are carried out, aim to maintain the attributes of old-growth forests).

► Barrow's Goldeneye, American Black Duck, Hooded Merganser, Surf Scoter, Canada Goose, Common Goldeneye

Action 18 Increase awareness among the authorities responsible for forest management and harvesting on the importance of maintaining sufficient numbers of large trees (DBH of 30 cm or more) and protecting trees with nesting cavities (snags and live mature trees) for cavity-nesting ducks.

► Barrow's Goldeneye, Hooded Merganser, Common Goldeneye

Action 19 Increase awareness among the authorities responsible for hydroelectric development on the importance of conserving wetlands, lakes and rivers suitable for priority species.

► Barrow's Goldeneye, American Black Duck, Hooded Merganser, Surf Scoter, Harlequin Duck, Canada Goose, Common Goldeneye

Action 20 Promote awareness among aquaculture operators of the issue of conflicts with certain species of sea ducks; some species can cause significant damage to commercial aquaculture operations (e.g., Common Eider), while others may lose their foraging areas due to aquaculture activities.

► Common Eider, Surf Scoter

Action 21 Promote sustainable, ecological agriculture that ensures the presence of suitable waterfowl habitat (riparian strips, healthy aquatic habitats, etc.) during both the nesting and brood-rearing periods; for instance, encourage private programs such as the program by Fondation de la faune du Québec and the Union des producteurs agricoles to enhance watercourse biodiversity in agricultural environments (*Programme de mise en valeur de la biodiversité des cours d'eau en milieu agricole*) and Nature Québec's zero-carbon farm initiative (*Agriculture et climat: Vers des fermes 0 carbone*).

► American Black Duck, Blue-winged Teal

Action 22 Raise awareness among commercial peatland users of the importance of leaving strips of residual vegetation at least five metres wide for nesting American Black Ducks (Bélanger et al. 1994).

► American Black Duck, Canada Goose

Habitat measures

Action 23 In the case of key wintering areas used by priority species that are designated as a WGA (e.g., mouth of the Franquelin River), extend protection to this critical period of the birds' annual cycle; in the case of these areas that have no protection at all (e.g., Baie des Anglais), ensure they are protected by having them designated as a WGA or Marine Wildlife Area, for example.

► Barrow's Goldeneye, American Black Duck, Common Eider, Common Goldeneye, Long-tailed Duck, Red-breasted Merganser

Action 24 In the case of key moulting areas used by priority species that are designated as a WGA, extend protection to this critical period of the birds' annual cycle; in the case of these areas that have no protection at all, ensure they are protected by having them designated as a WGA or Marine Wildlife Area, for example.

► Barrow's Goldeneye, Common Eider, Surf Scoter, Harlequin Duck

Action 25 Acquire, restore or protect natural peatlands (e.g., on the Manicouagan Peninsula).

► American Black Duck, Canada Goose

Objective 2

Ensure the conservation of the Eastern Population of Barrow's Goldeneye; maintain the breeding population at no less than 2,100 indicated breeding pairs and the wintering population at no less than 5,000 individuals (Table 5). In addition, maintain the ecological integrity of foraging areas used during the moulting period. Ultimately, allow the population to be removed from the list of species designated under the *Species at Risk Act* and the list of species at risk (threatened and vulnerable species) established by the Quebec government.

► **Key habitats (breeding):** presence of tree cavities (snags and living mature trees) in the balsam fir–white birch or black spruce–feather moss forest near small (< 15 ha), high-elevation (> 500 m) fishless lakes

► **Key habitats (moulting):** lakes and tidal flats in the upper and lower estuary, particularly at river mouths

► **Key habitats (wintering):** broad tidal flats in the upper and lower estuary

► **Primary conservation issues:** habitat loss (logging, scarcity of mature trees and snags with potential cavities), stocking of fishless lakes, oil spills, harvest rates, inter- and intraspecific competition for nesting cavities, climate change (possible impact on wintering)

Note: Consult the *Management Plan for the Barrow's Goldeneye (*Bucephala islandica*), Eastern Population, in Canada* (Environment Canada 2011) for the complete list of recommendations on this population.

Other actions specifically targeting Barrow's Goldeneye in BCR 8:

Monitoring and surveys

Action 26 Continue the BGTWS.

Action 27 Consider the addition of WUPL plots further north in the Côte-Nord region to provide better coverage of the breeding range of Barrow's Goldeneye.

Knowledge acquisition

Action 28 Determine the northern limit of the species' breeding range in Quebec.

Action 29 Complete the work to locate moulting areas used by the species.

Action 30 Determine the longevity of snags (depending on the type) and the recruitment rate of this essential component for breeding in the species.

Action 31 Determine contaminant levels in immature and adult birds overwintering in the Baie des Anglais.

Active surveillance

Action 32 Ensure adequate surveillance in areas where the goldeneye congregate during the sport hunt.

Environmentally sustainable practices

Action 33 Raise awareness among outfitters and land managers (e.g., ZECs, Quebec national parks, ecological reserves) who stock fishless lakes of the potential impacts of this practice on Barrow's Goldeneye; the species prefers fishless lakes due to the abundant invertebrates found in these lakes precisely because of the lack of fish, which also feed on invertebrates.

Action 34 Increase awareness among the responsible authorities (natural resource exploitation) to prevent the construction of roads near fishless lakes (200 m) to prevent access to the lakes.

Action 35 Make hunters aware of current regulations in effect on the season and daily bag and possession limits for Barrow's Goldeneye.

Action 36 Make hunters aware of the importance of knowing how to reliably distinguish Barrow's Goldeneye from Common Goldeneye in the field (http://publications.gc.ca/site/eng/344768/publication.html).

Habitat measures

Action 37 Offset the lack of snags in areas of intensive logging or where measures to maintain snags have not been effective by establishing a network of artificial nest boxes and monitoring them.

Objective 3
Ensure the conservation of the American Black Duck; increase the breeding population to 120,000 indicated breeding pairs and maintain this population (Table 5).

- ► **Key habitats (breeding):** marshes; beaver ponds; peatlands; swamps; the shoreline of lakes, rivers and streams
- ► **Key habitats (brood rearing):** cordgrass marshes and other salt marshes
- ► **Primary conservation issues:** habitat loss and modification (logging [loss of protective cover in riparian strips and increased predation, among other things], hydroelectric development [flooding of wetlands], drainage of farmland, draining and filling of wetlands, peatland exploitation, cottage and resort development [shoreline encroachment]), harvest rates

Note: In addition, consult the Population Monitoring Implementation Plan (Black Duck Joint Venture 2008b) and the Research Program Implementation Plan (Black Duck Joint Venture 2008c) for a list of BDJV recommendations for the American Black Duck.

Other actions specifically targeting the American Black Duck in BCR 8:

Monitoring and surveys

Action 38 Institute a survey of productivity in the American Black Duck.

Action 39 Institute a survey of a series of key wetlands used by the American Black Duck (along the shoreline of the St. Lawrence as well as inland) at different periods of its annual life cycle; determine the wetland losses and modifications that occur.

Action 40 Institute a monitoring program of wintering American Black Duck to document changes and assess if they are related to climate change (this survey and the effects of global warming are identified in the BDJV 2010 Research Program Implementation Plan).

Knowledge acquisition

Action 41 Determine the abundance and distribution of the American Black Duck during the breeding season according to wetland type and wetland location in the BCR; locate priority habitats that face threats and develop strategies to curb these threats.

Action 42 Determine the origin of the thousands of American Black Ducks that overwinter in the St. Lawrence estuary.

Habitat measures

Action 43 Acquire or protect key cordgrass marshes that do not yet have protected status.

Objective 4

Ensure the conservation of the *dresseri* subspecies of Common Eider; maintain the breeding population at 20,000 breeding pairs (Table 5). In addition, maintain the ecological integrity of foraging areas used during the moulting period.

- **Key habitats (breeding):** islands and islets along the coast of the Gulf of St. Lawrence and the upper and lower estuary that contain open areas with sparse vegetation, tallgrass meadows, areas of low shrubs or coniferous forest edges
- **Key habitats (moulting):** coastal waters of the lower estuary (sectors between Les Escoumins and Pointe à Boisvert [particularly off Mille-Vaches Bay] and between Pointe-aux-Outardes and Pointe-Lebel) and the Gulf (sectors between Sainte-Geneviève Island and Watshishou MBS, and west and south of Anticosti Island)
- **Primary conservation issues:** epidemics, oil spills, predation (foxes and gulls), harvest rates, human disturbance (e.g., pleasure boating), accidental trapping of birds in fishing nets, habitat loss due to aquaculture, poaching

Note: In addition, see the *Plan for the Common Eider* Somateria mollissima dresseri (Joint Working Group on the Management of the Common Eider 2004) for a list of strategic measures proposed for the subspecies.

Other actions specifically targeting the* dresseri *subspecies of the Common Eider in BCR 8:

Monitoring and surveys

Action 44 Continue the Quinquennial Census of Seabird Populations in the Sanctuaries of the North Shore of the Gulf of St. Lawrence.

Action 45 Encourage the continuation of the annual survey of estuary colonies carried out as part of eiderdown harvesting activities.

Action 46 Maintain the eider banding program and expand it in order to monitor harvest rates, document movements, quantify survival rates and obtain indices of reproductive success.

Knowledge acquisition

Action 47 Develop an effective survey technique for monitoring eider colonies (e.g., counting males) that can be used throughout the *dresseri* subspecies' breeding range, so that the survey methods used by the various authorities responsible for managing this subspecies can be standardized.

Action 48 Complete the work to locate moulting areas used by the species.

Action 49 Determine the impact of predation on colonies in the Lower North Shore.

Action 50 Determine if the subspecies *dresseri* should be managed under different populations, and if so, develop models for these populations.

Active surveillance

Action 51 Ensure adequate surveillance in the North Shore migratory bird sanctuaries during the breeding season, since the level of surveillance determines the condition of colonies (Joint Working Group on the Management of the Common Eider 2004).

Environmentally sustainable practices

Action 52 Increase awareness among Innu to ensure that down harvesting is carried out according to best practices (see Bédard et al. 2008 in this regard), to prevent excessive disturbance of the hens and to ensure that the resource is managed sustainably.

Action 53 Promote awareness among Innu who collect eggs about the potential repercussions of this activity (significant disturbance of colonies and reduction in eider productivity).

Action 54 Raise awareness among pleasure boaters and kayakers of the importance of not landing or coming ashore on islands containing colonies and of not disturbing eiders during the critical incubation and brood-rearing periods; establish or continue partnerships with local organizations to increase the chances of success of this action.

Habitat measures

Action 55 Acquire or protect key nesting sites that do not yet have protected status (the North Shore MBSs and the Mingan Archipelago National Park Reserve of Canada protect nearly 70% of the breeding population in BCR 8).

Action 56 Propose the creation of Marine Wildlife Areas (or other means of legal protection) for the main brood-rearing areas.

Objective 5
Ensure the conservation of cavity-nesting ducks; increase the breeding population of Common Goldeneye to 56,000 indicated breeding pairs and that of Hooded Merganser to 13,000 indicated breeding pairs, and maintain both populations (Table 5).

- ► **Key habitats (breeding):** presence of tree cavities (snags and living mature trees) in mature forests near lakes, ponds, streams, flooded forest, swamps and beaver ponds
- ► **Primary conservation issues:** habitat loss and modification (natural resource exploitation: logging leading to a scarcity of mature trees and snags with cavity potential, hydroelectric development [flooding of wetlands]), inter- and intraspecific competition for nesting cavities, harvest rates

There are no other specific actions targeting Common Goldeneye and Hooded Merganser in BCR 8 other than those listed under objective 1.

Objective 6
Ensure the conservation of the Eastern Population of the Harlequin Duck; institute a survey to monitor the breeding population and maintain the ecological integrity of foraging areas used during the moulting period. Ultimately, allow it to be removed from the list of species designated under the *Species at Risk Act* and the list of species at risk (threatened and vulnerable species) established by the Quebec government.

- ► **Key habitats (breeding):** fast-flowing rivers on the North Shore
- ► **Key habitats (moulting):** coastal waters around Sud-Ouest Point of Anticosti Island
- ► **Primary conservation issues:** hydroelectric development, poaching, recreational activities on rivers near where the species nests, exploitation (aquaculture and fisheries) and use (boating activities) of coastal areas, oil spills

Note: Consult the *Management Plan for the Harlequin Duck (*Histrionicus histrionicus*) Eastern Population, in Atlantic Canada and Québec* (Environment Canada 2007c) for the complete list of recommendations on this population.

Other actions specifically targeting the Harlequin Duck in BCR 8:

Monitoring and surveys

Action 57 Institute a breeding pair survey specially tailored to the Harlequin Duck.

Environmentally sustainable practices

Action 58 Promote awareness among outfitters, fishing guides and whitewater guides of the importance of not disturbing Harlequin Ducks during the nesting and brood-rearing periods.

Action 59 Make hunters aware of the importance of respecting current regulations prohibiting the hunting of the Harlequin Duck.

Objective 7
Ensure the conservation of the Surf Scoter; maintain a breeding population of at least 9,500 indicated breeding pairs. Maintain the ecological integrity of foraging areas used during the moulting and migration periods.

- **Key habitats (breeding):** mature spruce or balsam fir stands along the edge of shallow lakes, generally smaller than 10 ha; the presence of islands in such lakes is also a characteristic sought by the species, as well as the presence of abundant woody debris on the ground in the riparian strip along the lakeshore (nest can be up to 50 m from the lake)
- **Key habitats (moulting):** coastline of the northern portion of the lower estuary (sector between Sainte-Anne-de-Portneuf and Pointe-aux-Outardes, particularly between the Portneuf Sandbank and Patte de Lièvre Island, around the Jérémie Islets and off Papinachois)
- **Key habitats (migration):** coastline along the northern portion of the lower estuary and Gulf of St. Lawrence
- **Primary conservation issues:** habitat loss and modification (logging [loss of protective cover in riparian strips and resulting increase in predation, among other issues], hydroelectric development [flooding of small lakes]), oil spills, harvest rates, potential wind farms in the marine environment, potential oil and gas exploration in the St. Lawrence, potential aquaculture operations

Other actions specifically targeting the Surf Scoter in BCR 8:

Monitoring and surveys
Action 60 Institute a spring survey of migrating scoters.

Habitat measures
Action 61 Protect key staging areas used by the species in migration that do not have protected status by designating them as WGAs or Marine Wildlife Areas, for example.

Objective 8
Ensure the conservation of the North Atlantic and Atlantic populations of the Canada Goose; maintain a breeding population (both populations combined) of 39,000 indicated breeding pairs (Table 5).

- **Key habitats (breeding):** peatlands, grassy islands and islets in rivers and streams within forested areas, rivers, lakes, ponds
- **Primary conservation issues:** harvest rates, peatland exploitation, hydroelectric development

Note: In addition, see the report *A management plan for the Atlantic Population of Canada Geese* (Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008) for a complete list of measures proposed for this population.

There are no other actions specifically targeting the Atlantic and North Atlantic populations of the Canada Goose in BCR 8 other than those listed under Objective 1.

Objective 9
Ensure the conservation of the Blue-winged Teal; maintain a breeding population of at least 1,600 indicated breeding pairs (Table 5).

- **Key habitats (breeding):** agricultural watercourses and ponds, agricultural wildland (abandoned fields), herbaceous riparian strips, marshes, beaver ponds
- **Primary conservation issues:** habitat loss (drainage of farmland, draining and filling of small wetlands), harvest rates

Other actions specifically targeting the Blue-winged Teal in BCR 8:

Environmentally sustainable practices
Action 62 Raise hunters' awareness of the importance of respecting regulations on daily bag and possession limits for Blue-winged Teal.

Objective 10
Ensure the conservation of the *borealis* subspecies of the Common Eider; increase the wintering population to 90,000 individuals and maintain this population (Table 5).

- **Key habitats (wintering):** ice-free pelagic zones in the Sept-Îles Archipelago, the area around the Mingan Islands, both ends of Anticosti Island and in Natashquan Bay, depending on conditions in a given winter
- **Primary conservation issues:** oil spills, potential wind farms in the marine environment, potential oil and gas exploration in the St. Lawrence, climate change, harvest rates

Other actions specifically targeting the* borealis *subspecies of the Common Eider in BCR 8:

Monitoring and surveys
Action 63 Continue the CETWS.

Knowledge acquisition
Action 64 Determine if climate change is having effects on the eiders' wintering habits.

Active surveillance
Action 65 Ensure special surveillance during spring migration along the Lower North Shore.

Objective 11
Ensure the conservation of sea ducks wintering offshore in the Gulf of St. Lawrence (including Long-tailed Duck and Red-breasted Merganser); maintain overwintering in Quebec.

► **Key habitats (wintering):** ice-free pelagic zones in the Gulf of St. Lawrence
► **Primary conservation issues:** oil spills, potential wind farms in the marine environment, potential oil and gas exploration in the St. Lawrence, harvest rates, climate change

Other actions specifically targeting the Long-tailed Duck and Red-breasted Merganser in BCR 8:

Monitoring and surveys

Action 66 Institute a monitoring program of overwintering sea ducks in ice-free pelagic zones in the St. Lawrence (other than Common Eider).

Knowledge acquisition

Action 67 Determine food sources for Long-tailed Ducks and Red-breasted Mergansers on their wintering grounds to determine if they are limited or threatened and to guide monitoring and conservation actions.

8. Taiga Shield and Hudson Plains (BCR 7)

8.1 General description

BCR 7, which lies wholly within Canada, forms a broad strip extending across the southeastern portion of the Northwest Territories; to southern Nunavut; parts of northern Manitoba, Saskatchewan and Ontario; central Quebec and almost all of Labrador (Figure 1). This BCR corresponds to the transition zone between the boreal forest and the Arctic tundra, and also takes in the Hudson Plains, which extend from northeastern Manitoba to western Quebec (Wiken et al. 1996; Environnement Canada 2005b; Environnement Canada 2005a; Parcs Canada 2009). The Quebec portion of the BCR covers 561,721 km^2, or 37% of the province's land mass (Figure 2). Consequently, it is the largest of Quebec's BCRs.

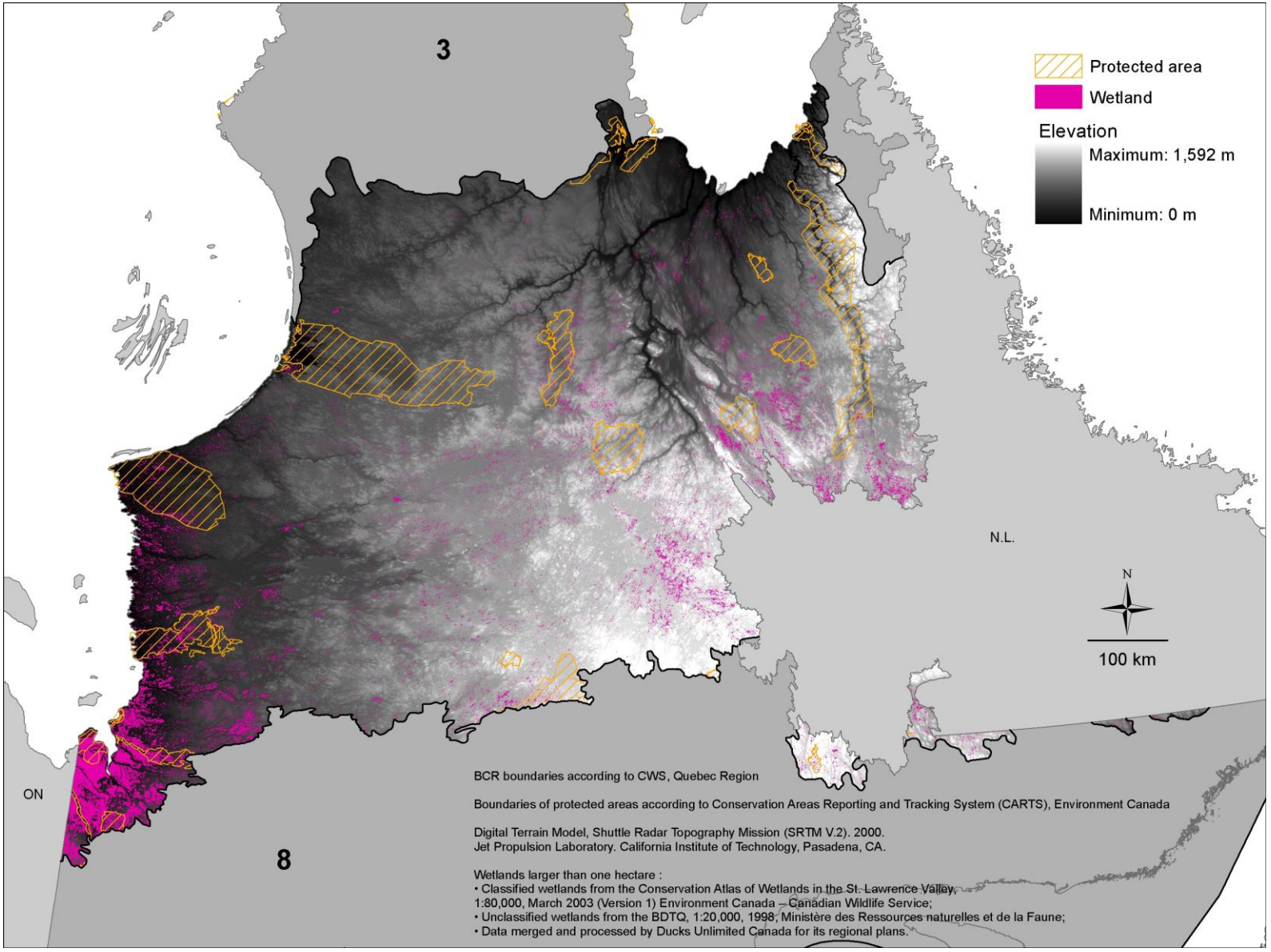
In Quebec, BCR 7 extends in the north from Hudson Bay to Ungava Bay (from Minto Lake in the west to the mouths of the Rivière aux Feuilles and George River in the east) and, in the south, from James Bay to Schefferville (Figure 12). The taiga dominates the landscape, with the Hudson Plains only occupying the lowlands south of James Bay (Environnement Canada 2005b). This BCR's northern boundary corresponds to the tree line in Quebec (Environnement Canada 2005b).

Note that, although the islands near the east coast of James Bay and Hudson Bay are under the jurisdiction of Nunavut, the natural resources found there, including waterfowl populations, are managed by the Quebec Crees and Inuit (the Eeyou and Nunavik marine regions respectively). Consequently, for the purposes of this document, these islands are considered to be in the Quebec portion of BCR 7.

In the southwestern portion of the BCR (La Grande River sector), the terrain is hummocky with elevations ranging from 150 m near the coast to 450 m in the Caniapiscau Reservoir region. Further east, the Caniapiscau River Plateau consists of steep hills ranging in elevation from 350 m to over 750 m, and even 915 m in places, with bare rock outcrops common in this region. Even further east, in the Ungava Bay Basin, elevations range from 360 m (in the north) to 730 m (in the centre and south), and bare rock outcrops are also common. In the Rivière à la Baleine lowlands, the terrain is irregular with ridges and hills ranging in elevation from 150 m in the north to 600 m further south. Lastly, in the northern part of BCR 7 (southern part of the Ungava Peninsula), the terrain is undulating, with elevations ranging from 100 m to 300 m, occasionally reaching 500 m. The highest peaks include Mount Geren (860 m), the Hadès Hills (group of hills reaching roughly 600 m in elevation) and Mount Nuvulialuk, Mount Kaminiskutau and Apituwawakach Mountain, all over 300 m (Direction générale de l'information géographique 2001; Environnement Canada 2005a).

BCR's northern location makes it one of the most sparsely populated regions of Quebec, despite its large area. It has roughly 15,000 inhabitants, mostly Aboriginal, divided among 13 communities located mainly along James Bay, Hudson Bay, Ungava Bay and near the hydroelectric complexes. The main population centres include Chisasibi (over 3,800 inhabitants) and Waskaganish (over 2,000 inhabitants) (Affaires indiennes et du Nord Canada 2009). BCR 7 has the largest hydroelectric complex in the world, the James Bay Complex, which consists of 5 reservoirs with a total area of 11,900 km^2, which is equivalent in size to half of Lake Ontario (Environnement Canada 2005b).

Figure 12. Location of BCR 7 in Quebec and distribution of wetlands and protected areas



BCR 7 has a subarctic climate. Summers are short and cool, with long periods of sunshine, and winters are long and very cold. The mean annual temperature generally ranges between -1°C and -5°C in the Quebec portion of the BCR, with mean annual precipitation ranging from 500 mm to 800 mm. Mean summer temperatures are 6–11°C, and winter, from -11°C to -24.5°C. The snow cover lasts from six to eight months of the year (Wiken et al. 1996; Environnement Canada 2005b).

In the Taiga Shield, the forest is more or less continuous and has a composition similar to that of the boreal forest, except the canopy is more open and the trees are stunted. These open forests, which are dominated by several highly adaptable tree species such as black spruce and jack pine, arise due to the climatic conditions and arid soils (Environnement Canada 2005a). In the taiga, the air is cool, the growing season is short, and there is discontinuous but extensive permafrost (Wiken et al. 1996; Environnement Canada 2005b; Environnement Canada 2005a). The landscape is also influenced by frequent forest fires, sometimes affecting vast areas. These fires are beneficial since they maintain the mosaic of vegetation of different species and ages characteristic of the taiga. The presence of scattered stands of white birch and trembling aspen, open shrubland, sedge meadows and bare rock outcrops covered with lichens adds to the diversity of the landscape (Environnement Canada 2005a).

Since the taiga is associated with subarctic regions of the Canadian Shield, it has greater ecological diversity than the Arctic tundra (where the climate is more arid), but less than the boreal forest. Roughly 600 plant species and over 200 animal species, many of which are present year-round, occur here (Redpath Museum 2009). Animal species found in the taiga include in particular the Arctic fox, a major predator on waterfowl (eggs, young and adults) (Service canadien de la faune and Fédération canadienne de la faune 1990; Environnement Canada 2005a).

Although it is well represented in the rest of Canada, the Hudson Plains ecozone only occurs in a small area of Quebec: the James Bay lowlands in the southern James Bay region (Environnement Canada 2005b). The main characteristic of this ecozone is the abundant wetlands. This is particularly apparent at the Canadian scale since most of Canada's wetlands are located in this ecozone. It is all the more important since Canada has roughly 25% of the world's wetlands (Environnement Canada 2005a). In addition, the Hudson Plains ecozone ranks third in the world in terms of wetland area, and the ecozone has the largest continuous stretch of wetlands in the world (Abraham and Keddy 2005).

In Quebec, the Hudson Plains take the form of flat, poorly drained plains dominated by peatlands. Stunted, open canopy forests are also present. The poorly drained terrain has isolated pockets of permafrost (Environnement Canada 2005b). Dominant plant species include black spruce and tamarack, found in association with sedges, mosses and lichens (Environnement Canada 2005b).

BCR 7 is drained by an extensive river system, with a number of major rivers, including the Caniapiscau, Rupert, aux Mélèzes, aux Feuilles, à la Baleine, George, Eastmain, La Grande and Grande rivière de la Baleine (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002h). It also contains a number of sizeable lakes and reservoirs as large as 400,000 ha (i.e., Caniapiscau, Robert-Bourassa [La Grande 2], La Grande 3, Mistassini, à l'Eau Claire, Opinaca, Bienville, La Grande 4, Sakami, Guillaume-Delisle and aux Feuilles) (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002h). BCR 7 also has very extensive coastline (James, Hudson and Ungava bays) with many islands and islets (Canards Illimités Canada 2009b).

Wetlands are estimated to cover roughly 6,000,000 ha of the Quebec portion of BCR 7. This is a very rough estimate, however, since the current data are not very accurate (Eastern Habitat Joint Venture 2007; Canards Illimités Canada 2009a; J. Beaulieu and P. Dulude, Ducks Unlimited Canada, pers. comm.). Of all the province's BCRs, BCR 7 and BCR 8 have the largest area of wetlands (Canards Illimités Canada 2009a). Both the Taiga Shield and Hudson Plains ecozones contain an abundance of wetlands and aquatic environments (peatlands, lakes, ponds, swamps, pools, streams, rivers, etc.) providing high-quality habitats for waterfowl.

The municipality of Baie-James (the largest in Quebec, with an area of 33,300,000 ha) has the most wetlands, with around 3,130,000 ha, or 84% of all the wetlands in BCR 7 (Canards Illimités Canada 2009a; Canards Illimités Canada 2009b). The James Bay lowlands host vast bog-fen complexes (sometimes extending up to 100 km inland) and marshes. Along the edge of Hudson Bay and Ungava Bay, palsa bogs (influenced by the presence of permafrost) are present. There are also extensive wetlands around Rupert Bay; here, vast peatlands, mainly fens, create a landscape unique in Quebec.

Along the James Bay coast, extensive intertidal marshes (saltwater, brackish-water or freshwater) occur, which are preferred habitat for waterfowl. Furthermore, the James and Hudson bay coasts also contain a number of eelgrass beds, extremely important habitat for many species of waterfowl and fish. In addition, in BCR 7, beavers help to create and maintain wetlands in forested areas (Canards Illimités Canada 2009a). Whether during the breeding, migration or moulting periods, waterfowl take advantage of the bays, lakes, marshes, peatlands, eelgrass beds, ponds and other wetlands found in BCR 7, both along the coast (including islands) and inland.

Protected areas containing suitable waterfowl habitat include a single migratory bird sanctuary, the Boatswain Bay MBS. This MBS, located on the east coast of James Bay, covers roughly 16,000 ha, of which around 9,500 ha is in Quebec (the rest belongs to Nunavut). Other protected areas containing aquatic habitat include the planned Tursujug National Park (Quebec provincial park formerly known as Lacs-Guillaume-Delisle-et-à-l'Eau-Claire National Park) and areas set aside as protected areas, all provincially owned (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002j). There are no WGAs in BCR 7.

8.2 Characteristics of conservation issues in BCR 7

The issues discussed below are those for which we were able to provide additional information in BCR 7. The environmental impacts of these issues on waterfowl and recommended mitigation measures are discussed in Chapter 3.

8.2.1 Hydroelectric power generation

Currently, hydroelectric power generation is the main conservation issue affecting waterfowl and natural habitats in BCR 7. The watershed of the La Grande hydroelectric complex covers roughly 177,000 km² (Hydro-Québec 2001), or roughly one third of the Quebec portion of the BCR; the construction of the complex resulted in the flooding of 9,900 km² of terrestrial habitats (Laserre 2003).

In addition, the Eastmain-1-A/Sarcelle/Rupert complex was under construction at the time of publishing this document, with the commissioning of the first powerhouses slated for 2012. Since

the Quebec government has announced plans to add further hydroelectric capacity (Gouvernement du Québec 2011b), some projects could be built in BCR 7. In addition, Hydro-Québec is studying the possibility of using other generating technologies, such as underwater generators that use the power of tides or currents to produce electricity (Hydro-Québec 2009).

Another possible environmental impact on waterfowl not described in the discussion of hydropower in section 3.2.7 is the effect of reduced salinity on eelgrass. A study has attributed the decline in eelgrass in James Bay north of La Grande River to decreased salinity in the water, owing to the larger and more frequent discharges of freshwater resulting from the management of the hydroelectric facilities further upstream on this river (Short 2008). According to other authors, however, the commissioning of the La Grande-2-A generating station has had no negative impacts on eelgrass beds along the northeast coast of James Bay, and the decline in eelgrass can probably be attributed instead to isostatic uplift, climate change and periodic outbreaks of eelgrass wasting disease caused by the pathogen *Labyrinthula zosterae* (Lalumière and Lemieux 2002). The decrease in eelgrass in this location has repercussions on populations of Brant and other species, which feed in these submerged aquatic beds during migration.

8.2.2 Mining

Mining discoveries in recent years have confirmed the high mineral potential of several areas of northern Quebec, including portions of BCR 7. Given the Quebec government's mineral strategy—which plans to accelerate mining development in northern Quebec while enforcing stricter environmental standards (Ministère des Ressources naturelles et de la Faune du Québec 2009c)—a number of mining companies should become interested in the subsurface of northern Quebec in the coming years. Mineral development activities in BCR 7 are currently centred in three main areas: (1) James Bay/Eeyou Istchee (Éléonore gold deposit in the area north of the Opinaca Reservoir, lithium mining projects, etc.); (2) north of the Otish Mountains (Renard diamond deposit); and (3) Labrador Trough, which runs from north of Schefferville to Ungava Bay and contains iron, copper, zinc and nickel deposits, among others (Ministère des Ressources naturelles et de la Faune du Québec 2011e).

8.2.3 Wind power generation

There are no wind farms in operation in BCR 7, but considering that Nord-du-Québec is the region with the greatest wind generation potential in the province (Hélimax Énergie and AWS Truewind 2005) and that the Quebec government has announced plans to make Quebec a world power in clean, renewable energy (Gouvernement du Québec 2011b), wind farm projects may crop up in the short or medium term in this BCR.

8.2.4 Road transportation and infrastructures

Since one objective of the Plan Nord announced in 2011 was to facilitate access to the North, several projects for rail and road links in BCR 7 are under study, including a possible link from Kuujjuaq southward, perhaps as far as Schefferville (a distance of roughly 600 km), either by road or rail (Gouvernement du Québec 2011c). The possibility of a road link between Whapmagoostui-Kuujjuarapik and Radisson is also being examined. Lastly, the extension of Highway 167, which is discussed under BCR 8, will also affect BCR 7.

8.2.5 Shipping and shipping infrastructures

The creation of a deep-water port in Whapmagoostui-Kuujjuarapik in Hudson Bay was under study in 2011 (Gouvernement du Québec 2011c).

8.2.6 Logging

BCR 7 is located north of the current northern limit on commercial timber allocations in Quebec. However, this limit could be called into question. The government's action priorities in forestry include acquiring knowledge on vegetation north of the 53rd parallel and continuing the work on the northern limit of commercial timber allocations (Gouvernement du Québec 2011e). In addition, the government has also expressed its intent to draft a sustainable forest management strategy adapted to the distinct social and ecological characteristics of the North in order to provide a framework for the sustainable management of the territory's forest resources (Gouvernement du Québec 2011e). Forest exploitation in BCR 7 could become a reality in the future.

8.3 Use of BCR 7 by waterfowl

8.3.1 Migration

Geese (4): Snow Goose (Lesser and Greater), Brant, Cackling Goose and Canada Goose (Atlantic and North Atlantic populations)
Swans (1): Tundra Swan
Dabbling ducks (6): Wood Duck, American Wigeon, American Black Duck, Mallard, Northern Pintail and Green-winged Teal
Diving ducks (3): Ring-necked Duck, Greater Scaup and Lesser Scaup
Sea ducks (12): King Eider, Common Eider (*borealis* and *sedentaria*), Harlequin Duck, Surf Scoter, White-winged Scoter, Black Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser
TOTAL = 26 species

Highlights of migration period:

- Almost the entire population of Greater Snow Geese (> 1,000,000 birds) migrate through the inland portion of BCR 7 to reach their breeding grounds in Nunavut (CWS, unpubl. data).
- In spring, around 50,000 Brant (Atlantic Population) stage (for up to four or five weeks; New Jersey Division of Fish and Wildlife 2003) along the coast of James Bay before moving to their breeding grounds in Foxe Basin (Reed 1996; Tecsult Environnement inc. 2004) and birds use the same area again during fall migration. According to the local Aboriginal communities, however, Brant numbers in migration in these locations are much lower than they used to be (German 2008).
- Several tens of thousands of Canada Geese (Atlantic Population) congregate in Rupert Bay (up to 17,000 individuals), Opinaca Reservoir (up to 44,000 individuals), and Boyd and Sakami lakes (up to 19,000 individuals) (Tecsult Environnement inc. 2004); the geese also migrate along the coasts of James and Hudson bays.
- Aside from geese, Rupert Bay also hosts large flocks of migrating ducks, including up to 10,000 Northern Pintail, 4,000 Green-winged Teal and 1,200 *Aythya* spp. (Lesser and Greater scaup and Ring-necked Duck) (Tecsult Environnement inc. 2004).
- In spring, Northern Pintails also congregate inland, in the Saindon Lakes region as far as Minto Lake, as well as along the coast of Ungava Bay, particularly on both sides of the Koksoak River (Malecki et al. 2006).
- The many large lakes and reservoirs in BCR 7 (lakes Boyd, Sakami, Bienville, Lac à l'Eau Claire and Guillaume-Delisle; and Opinaca, Robert-Bourassa, La Grande 3, La Grande 4, Laforge 1, Laforge 2 and Caniapiscau reservoirs) undoubtedly host large contingents of

migrating waterfowl (see Tecsult Environnement inc. 2004 and others). However, the reservoirs are most likely used only during a short period as resting areas during migration, except for some fish-eating species.

More than 3,100,000 geese, swans and ducks are estimated to migrate through BCR 7 in spring (Table 6).

8.3.2 Breeding

Geese (1): Canada Goose (Atlantic and North Atlantic populations)
Dabbling ducks (6): Wood Duck, American Wigeon, American Black Duck, Mallard, Northern Pintail and Green-winged Teal
Diving ducks (3): Ring-necked Duck, Greater Scaup and Lesser Scaup
Sea ducks (11): Common Eider (*borealis* and *sedentaria*), Harlequin Duck, Surf Scoter, White-winged Scoter, Black Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser

TOTAL = 21 species

Breeding season highlights:

- Atlantic Population Canada Geese breed in high densities in the coastal lowlands around Ungava Bay (Malecki and Trost 1990; Harvey and Rodrigue 2005).
- The Rupert diversion bay sector is an enclave with an extremely high breeding density of American Black Ducks (52 indicated breeding pairs/100 km²; Tecsult Environnement inc. 2004).
- The taiga and forest tundra in BCR 7 form the heart of the breeding range of Greater Scaup, Lesser Scaup, Surf Scoter, Black Scoter (roughly 15% of the North American Population) and Red-breasted Merganser (over 20% of the North American Population) in Quebec.
- Breeding colonies of Common Eider (*borealis* subspecies) can be found on most coastal islands in Ungava Bay, while colonies of the *sedentaria* subspecies can be found on islands along the coasts of Hudson and James bays (Goudie et al. 2000; Joint Working Group on the Management of the Common Eider 2004; Nakashima and Murray 1988).
- Roughly 75% of the Eastern Population of the Harlequin Duck breed near rivers with turbulent rapids in the huge watersheds of Hudson Bay (particularly Petite rivière de la Baleine [Little Whale River], Lac des Loups-Marins, Rivière à l'Eau Claire, and the Nastapoka and Boutin rivers; Consortium Gauthier & Guillemette – G.R.E.B.E. 1993; Morneau et al. 2008) and Ungava Bay (Rivière aux Mélèzes and the George, False, Koksoak, Qurlutuq, Caniapiscau and Dancelou rivers; Brodeur et al. 2002; Savard et al. 2008c; SOS-POP 2008).
- The northeastern coast of James Bay is an enclave with very high breeding densities of White-winged Scoters (48 IBP/100 km²; Benoit et al. 1993).

BCR 7 probably supports close to 320,000 breeding pairs of waterfowl (Table 6).

8.3.3 Moulting

Although the information presented below is incomplete since it is based on only a few studies, BCR 7 most certainly has a strong potential for supporting moulting birds. The following waterfowl species are known to moult here regularly:
Geese (1): Canada Goose (Atlantic and Resident populations)
Dabbling ducks (1): American Black Duck
Diving ducks (3): Ring-necked Duck, Greater Scaup and Lesser Scaup
Sea ducks (12): King Eider, Common Eider (*borealis* and *sedentaria*), Surf Scoter, White-winged Scoter, Black Scoter, Long-tailed Duck, Bufflehead, Common Goldeneye, Barrow's Goldeneye, Hooded Merganser, Common Merganser and Red-breasted Merganser
TOTAL = at least 17 species

Highlights of moulting period:
- Many Resident Canada Geese from the Atlantic Flyway moult on the hydroelectric reservoirs of the La Grande complex, along the east coast of Hudson Bay (Brousseau and Gagnon 2004) and along the coast of Ungava Bay (P. Brousseau, CWS, pers. comm.).
- American Black Ducks probably moult in large numbers in the Boyd and Sakami lakes sector, the Opinaca Reservoir, Rupert Bay (Tecsult Environnement inc. 2004), in the region between Rivière au Castor and Point Louis-XIV (Benoit et al. 1994; 1995), and in Manitounuk Sound (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990b).
- The northeastern part of James Bay (from Bay of Many Islands to Point Louis-XIV) hosts large numbers of diving and sea ducks in moult, including several thousand Ring-necked Duck, good numbers of Lesser and Greater scaup, nearly 35,000 scoter (all three species combined), Bufflehead, Hooded Merganser, Common Merganser and Red-breasted Merganser (Benoit et al. 1992; Benoit et al. 1993; Benoit et al. 1994; Reed et al. 1996).
- Some of the *borealis* Common Eiders that breed in Ungava Bay also moult there, in locations such as the False River estuary (Driver 1958).
- Manitounuk Sound in Hudson Bay is probably a moulting area for Surf Scoter (Consortium Gauthier & Guillemette – G.R.E.B.E. 1990b) while the coast of Ungava Bay is thought to be used by all three species of scoter to moult (J.-P.L. Savard, EC–S&T, pers. comm.).
- Male Long-tailed Ducks moult in flocks along the coasts of James and Hudson bays (Lamothe 1996).
- Some males in the Eastern Population of Barrow's Goldeneye undertake a moult migration along the east coast of Hudson Bay to reach their moulting grounds in the Salikuit and Belcher islands (Nunavut), while others moult in the southern part of Ungava Bay as well as inland (Benoit et al. 2001; Robert et al. 2002); among five Eastern Population females that were equipped with a satellite transmitter in 2009, three moulted in Nunavik—one on a coastal lake near James Bay, one near Kuujjuaq (south of Ungava Bay) and the third roughly 200 km north of Caniapiscau Reservoir (Savard 2009).
- Hooded Merganser also moult in the Petite rivière de la Baleine (Little Whale River) and Grande rivière de la Baleine (Great Whale River) region (roughly 14,300 individuals; Consortium Gauthier & Guillemette – G.R.E.B.E. 1990a).

8.3.4 Wintering

According to the information currently available, no waterfowl species overwinter regularly in BCR 7.

Table 6. Conservation objective; numbers (IBP/561,700 km² ± standard deviation), density (IBP/100 km² ± standard deviation) and trends during the breeding season; numbers (when available; otherwise, occurrence) during the migration, moulting and overwintering periods in the Quebec portion of BCR 7 (species in red are the priority species of this BCR; see section 8.4).

BCR 7	Objective[a]	Breeding Number[b] ± s.d.	%	% cum.	Density[c] ± s.d.	Trend[d]	Spring Migration[e]	Moulting[f]	Wintering[f]
Red-breasted Merganser	n. d.	60,700 ± 8,900	20	20	10.81 ± 1.58	n. d.	389,000	Yes	No
Common Merganser	n. d.	55,100 ± 7,200	18	38	9.81 ± 1.27	n. d.	151,000	Yes	No
American Black Duck	n. d.	42,900 ± 8,100	14	52	7.63 ± 1.45	n. d.	148,000	Yes	No
Canada Goose[g]	29,000[h]	31,300 ± 3,200	10	62	5.58 ± 0.58	n. d.	592,000	Yes	No
Black Scoter	n. d.	24,200 ± 3,800	8	70	4.31 ± 0.67	n. d.	112,000	Yes	No
Surf Scoter	n. d.	22,900 ± 1,800	7	77	4.08 ± 0.32	n. d.	59,000	Yes	No
Lesser Scaup	n. d.	19,200 ± 3,900	6	83	3.41 ± 0.69	n. d.	50,000	Yes	No
Common Eider *borealis*	n. d.	10,000[i]	3	86	n. d.	n. d.	125,000	Yes	No
Hooded Merganser	n. d.	9,900 ± 1,200	3	89	1.77 ± 0.21	n. d.	25,000	Yes	No
Green-winged Teal	n. d.	9,700 ± 2,200	3	92	1.73 ± 0.39	n. d.	57,000	?	No
Greater Scaup	n. d.	8,700 ± 1,600	3	95	1.56 ± 0.29	n. d.	40,000	Yes	No
Common Goldeneye	n. d.	8,600 ± 2,200	3	97	1.54 ± 0.38	n. d.	25,000	Yes	No
Ring-necked Duck	n. d.	5,600 ± 700	1	98	1.00 ± 0.12	n. d.	15,000	Yes	No
Northern Pintail	n. d.	5,200 ± 1,000	1	99	0.92 ± 0.17	n. d.	61,000	?	No
Common Eider *sedentaria*	n. d.	3,000[j]	< 1	99	n. d.	n. d.	26,000	Yes	No
Wood Duck	n. d.	Yes	< 1	100	n. d.	n. d.	Yes	?	No
American Wigeon	n. d.	Yes	< 1	100	n. d.	n. d.	Yes	?	No
Mallard	n. d.	Yes	< 1	100	n. d.	n. d.	2,900	?	No
Harlequin Duck	n. d.	Yes[k]	< 1	100	n. d.	n. d.	Yes	?	No
White-winged Scoter	n. d.	Yes	< 1	100	n. d.	n. d.	Yes	Yes	No
Long-tailed Duck	n. d.	Yes	< 1	100	n. d.	n. d.	119,000	Yes	No
Bufflehead	n. d.	Yes	< 1	100	n. d.	n. d.	2,200	Yes	No
Tundra Swan		Occas.[l]					2,700	?	No
Blue-winged Teal		Occas.[m]					No	No	No
Northern Shoveler		Occas.[n]					No	No	No
Gadwall		Probable[o]					No	No	No
Cackling Goose		No					Yes	?	No
Snow Goose	500,000–750,000[p]	No					1,000,000[q]	No	No
Brant		No					> 50,000[r]	No	No
King Eider		No					1,200	Yes	No
Barrow's Goldeneye		No					No	Yes	No
Total	**n. d.**	**317,000[s]**	**100**	**100**	**54.63[t] ± 4.42**	**n. d.**	**> 3,100,000**	**?**	**0**

[a] Objectives not determined since, due to the lack of regular surveys in this BCR, a baseline year cannot be chosen.

[b] Total number of **indicated breeding pairs (IBP)** according to the 1991 CWS waterfowl survey in the Grande-Baleine complex ± standard deviation for the entire BCR. Yes = Species breeds in the BCR, but 1991 CWS survey does not allow population to be calculated. Occas. = Species breeds occasionally in the BCR (every 2 to 5 years). Excep. = Species breeds exceptionally in the BCR (less than once every five years). Probable = One or two pairs were observed during the breeding season, but no breeding evidence was found. No = Species does not breed in the BCR.

[c] Density of **IBP** per 100 km² according to the 1991 CWS waterfowl survey in the Grande-Baleine complex ± standard deviation.

[d] Trends in **breeding population** not determined since survey was only carried out for one year (1991).

[e] Number of migrating **individuals** in spring. Unless otherwise indicated, this estimate is based on the total number of indicated breeding pairs in the BCR (see[b]) and IBP in the BCRs located north of this BCR; all IBP were multiplied by a factor (2.67 for geese; 2.10 for dabbling ducks; 2.63 for diving ducks and 2.56 for sea ducks) to take account of nonbreeding individuals. For less abundant species, Yes = Species occurs in the BCR, but in unknown numbers. No = Species does not occur in the BCR.

[f] Number of **individuals**, according to various sources. For species listed without a number, Yes = Species occurs in the BCR, but in unknown numbers; No = Species does not occur in the BCR; ? = It is not known whether the species occurs in the BCR.

[g] Consists of Atlantic Population Canada Geese for objective. For breeding, includes Atlantic (estimated at 26,400 IBP approx.) and North Atlantic (estimated at 4,900 IBP approx.) populations. For migration, includes Atlantic and North Atlantic populations. For moulting, consists of Resident Canada Geese.

[h] Objective in **breeding pairs** for the Atlantic Population in BCR 7. Calculated from the objective set for the entire area surveyed in WNOR (225,000 IBP; covers BCR 3 and the northern part of BCR 7; see Figure 5), from Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008.

[i] Number of **breeding pairs** adapted from Chapdelaine et al. 1986: of the 48,700 pairs breeding in Ungava Bay and along the Quebec coast of Hudson Strait, roughly 20% are in BCR 7.

[j] Number of **breeding pairs** adapted from Nakashima and Murray 1988: of the 10,700 pairs breeding along the east coast of Hudson Bay, roughly 30% are in BCR 7.

[k] According to Morneau et al. 2008, a few thousand **individuals** breed in the Nord-du-Québec region.

[l] Breeding evidence cited in Benoit et al. 1991; Benoit et al. 1993; Alvo 1996.

[m] Breeding evidence cited in Benoit et al. 1991.

[n] A brood observed in August 2006 at Qikirtajuaq Island in Ungava Bay (P. May, Makivik Corporation, pers. comm.).

[o] Indicated breeding pairs observed during the breeding season according to the following sources: (1) CWS waterfowl survey in 1991 in the Grande-Baleine complex; (2) Kakassituq Point in 1990 (Benoit et al. 1991); and (3) in the central and southwestern parts of the BCR (USFWS waterfowl survey; see Guérette-Montminy et al. 2009).

[p] Objective for the entire population (and not just this BCR) of the Greater Snow Goose in **migration**, expressed as the number of **individuals**, from Bélanger and Lefebvre 2006.

[q] Number of **individuals** according to 2008 data from the Greater Snow Goose Spring Survey in Quebec (CWS, unpubl. data).

[r] Number of **individuals** according to Tecsult Environnement inc. 2004.

[s] Standard deviation not available for total breeding population due to lack of standard deviation for breeding population of the Common Eider.

[t] Density of all species of breeding waterfowl, except for Common Eider and species that are found in small numbers.

8.4 Priority species in BCR 7

Priority species in BCR 7 were selected using *objective* prioritization methods (see section 2.5 and Appendix 16.2), combined with the *subjective* experience of CWS specialists. A conservation objective has been set for each priority species (see section 8.5).

High priority	Medium priority
Harlequin Duck: Objective 2 American Black Duck: Objective 3	Barrow's Goldeneye: Objective 4 Brant: Objective 5 Canada Goose (Atlantic Pop.): Objective 6 Canada Goose (North Atlantic Pop.): Objective 6 Black Scoter: Objective 7 Surf Scoter: Objective 7 Red-breasted Merganser: Objective 8

8.5 Conservation objectives and actions recommended for priority species in BCR 7

Objective 1 comprises actions that apply to a number of the priority species. Objectives 2 to 8 comprise actions targeting a specific priority species or group of species.

Objective 1
Ensure the conservation of high-priority and medium-priority species.

Monitoring and surveys

Action 1 Institute a monitoring program of breeding priority species in the Hudson Plains and taiga (south of the WNOR survey area).
► Harlequin Duck, American Black Duck, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 2 Locate moulting areas of priority species in James Bay, Hudson Bay and Ungava Bay and institute a monitoring program of individuals in key areas.
► Barrow's Goldeneye, American Black Duck, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 3 Institute a banding program in Northern Quebec for priority species other than Canada Goose to monitor harvest rates, document movements, quantify survival rates and obtain indices of reproductive success.
► American Black Duck, Red-breasted Merganser, Black Scoter, Surf Scoter

Knowledge acquisition

Action 4 Determine the most important parameters (e.g., adult survival by season, productivity) in the annual cycle of priority species in order to guide monitoring and conservation efforts.

► Harlequin Duck, American Black Duck, Barrow's Goldeneye, Brant, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 5 Determine local factors (e.g., habitat characteristics, food resources) that have an impact on the breeding of priority species.

► Harlequin Duck, American Black Duck, Barrow's Goldeneye, Brant, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 6 Determine regional factors (e.g., food resources) that have an impact on moulting in priority species.

► American Black Duck, Barrow's Goldeneye, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 7 Determine links between breeding grounds, moulting areas and wintering grounds (delineation of populations).

► Harlequin Duck, American Black Duck, Barrow's Goldeneye, Brant, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 8 Quantify the effect of isostatic uplift on coastal habitats in James Bay.

► American Black Duck, Barrow's Goldeneye, Brant, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Active surveillance

Action 9 Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to priority species.

► Harlequin Duck, American Black Duck, Barrow's Goldeneye, Brant, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 10 Institute a survey on the migratory bird harvest and on egg collecting by the Crees, Inuit and Naskapis to assess the harvest of priority species.

► Harlequin Duck, American Black Duck, Barrow's Goldeneye, Brant, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 11 Ensure the efficacy of the CWS Oil Spill Emergency Response Plan to prevent and limit mortality of priority species in the event of an oil spill.

► Harlequin Duck, American Black Duck, Barrow's Goldeneye, Brant, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 12 Ensure the efficacy of the CWS Avian Mortality Events Emergency Response Plan, and make improvements if necessary, to prevent and limit mortality in priority species in the event of an outbreak of avian disease (e.g., avian cholera).

► American Black Duck, Brant, Barrow's Goldeneye, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Environmentally sustainable practices

Action 13 Increase awareness among the authorities responsible for hydroelectric development on the importance of conserving wetlands, lakes and rivers suitable for priority species.

► American Black Duck, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 14 Increase awareness among mining authorities on the effects of this activity on priority species, particularly the potential contamination of watercourses by mine tailings.

► Harlequin Duck, American Black Duck, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Action 15 In the event that shipping traffic is likely to increase in Hudson Strait (to meet the needs of future natural resource development in Nunavut and Nunavik) or if coastal development (e.g., port facilities) is envisaged (e.g., Ungava Bay), act proactively by raising awareness among the responsible authorities regarding the requirements of priority species during the migration and moulting periods.

► Harlequin Duck, Barrow's Goldeneye, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Habitat measures

Action 16 Propose the creation of Marine Wildlife Areas (or other means of legal protection) to protect key moulting areas used by priority species.

► American Black Duck, Barrow's Goldeneye, Canada Goose, Red-breasted Merganser, Black Scoter, Surf Scoter

Objective 2

Ensure the conservation of the Eastern Population of the Harlequin Duck; institute a survey of the breeding population and maintain the ecological integrity of foraging areas used during the moulting period. Ultimately, allow it to be removed from the list of species designated under the *Species at Risk Act* and the list of species at risk (threatened and vulnerable species) established by the Quebec government.

► **Key habitats (breeding):** fast-flowing rivers in the Hudson Bay and Ungava Bay watersheds

► **Primary conservation issues:** hydroelectric development (modification of river flow), Aboriginal harvest, mining

Note: Consult the *Management Plan for the Harlequin Duck (*Histrionicus histrionicus*) Eastern Population, in Atlantic Canada and Québec* (Environment Canada 2007c) for the complete list of recommendations on this population.

Other actions specifically targeting the Harlequin Duck in BCR 7:

Monitoring and surveys

Action 17 Institute a breeding pair survey specially tailored to the Harlequin Duck.

Objective 3

Ensure the conservation of the American Black Duck; maintain a breeding population of at least 43,000 indicated breeding pairs (Table 6).

► **Key habitats (breeding):** marshes; peatlands; edges of lakes, rivers and streams

► **Primary conservation issues:** hydroelectric development (flooding of wetlands), Aboriginal harvest, mining

Note: In addition, consult the Population Monitoring Implementation Plan (Black Duck Joint Venture 2008b) and the Research Program Implementation Plan (Black Duck Joint Venture 2008c) for a list of BDJV recommendations for the American Black Duck.

Other actions specifically targeting the American Black Duck in BCR 7:

Monitoring and surveys

Action 18 Institute a survey of a series of key wetlands used by the American Black Duck to determine the extent and nature of wetland losses and modifications.

Objective 4
Ensure the conservation of the Eastern Population of Barrow's Goldeneye; verify the presence of a breeding population and maintain the ecological integrity of foraging areas used during the moulting period. Ultimately, allow it to be removed from the list of species designated under the *Species at Risk Act* and the list of species at risk (threatened and vulnerable species) established by the Quebec government.

► **Key habitats (moulting):** coastal zone of James Bay, Hudson Bay and Ungava Bay
► **Potential key habitats (breeding):** presence of tree cavities (snags and living mature trees) in the balsam fir–white birch or black spruce–feather moss forest near small (< 15 ha), high-elevation (> 500 m) fishless lakes
► **Primary conservation issues:** oil spills, harvest rates, possible increase in shipping traffic along coasts, potential coastal development

Note: Consult the *Management Plan for the Barrow's Goldeneye (*Bucephala islandica*), Eastern Population, in Canada* (Environment Canada 2011) for the complete list of recommendations on this population.

Other actions specifically targeting Barrow's Goldeneye in BCR 7:

Monitoring and surveys

Action 19 Carry out an inventory of potential breeding lakes (fishless lakes at an elevation of over 500 m) in the southeastern quarter of the BCR to determine if Barrow's Goldeneye breeds there. If the species breeds here, consider implementing a monitoring program of the breeding population.

Knowledge acquisition

Action 20 Determine the northern limit of the species' breeding range in Quebec.
Action 21 Complete the work to locate moulting areas used by the species.

Objective 5
Ensure the conservation of the Atlantic Population of the Brant; maintain the ecological integrity of staging sites.

► **Key habitats (migration):** eelgrass beds
► **Primary conservation issues:** habitat quality (condition of eelgrass beds), Aboriginal harvest, climate change, sport harvest rates

Other actions specifically targeting the Brant in BCR 7:

Monitoring and surveys

Action 22 Institute a survey of migrating Brant in James Bay.

Action 23 Institute a survey of a series of key eelgrass beds used by Brant in James Bay.

Knowledge acquisition

Action 24 Determine the cause or causes responsible for the local decline of eelgrass in James Bay (e.g., isostatic uplift, freshwater discharges from the La Grande complex, climate change) in order to guide conservation actions for the Brant.

Action 25 Determine causes promoting the appearance of the pathogen *Labyrinthula zosterae,* responsible for eelgrass wasting disease.

Objective 6
Ensure the conservation of the Atlantic and North Atlantic populations of the Canada Goose; for the Atlantic Population, increase the breeding population to 29,000 indicated breeding pairs and maintain this population (Table 6).

► **Key habitats (breeding):** peatlands; grassy islands and islets in rivers, streams, lakes and ponds
► **Primary conservation issues:** hydroelectric development (flooding of wetlands), Aboriginal harvest, mining

Note: In addition, see the report *A management plan for the Atlantic Population of Canada Geese* (Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008) for a complete list of measures proposed for the Atlantic Population.

Other actions specifically targeting the Canada Goose in BCR 7:

Monitoring and surveys

Action 26 Continue the Canada Goose banding program to monitor harvest rates, document movements, quantify survival rates and obtain indices of reproductive success.

Objective 7
Ensure the conservation of the Black Scoter and Surf Scoter; at a minimum, maintain breeding populations of at least 24,000 indicated breeding pairs and 23,000 indicated breeding pairs of the Black Scoter and Surf Scoter respectively (Table 6). In addition, maintain the ecological integrity of foraging areas used by these species during the moulting and migration periods.

► **Key habitats (breeding):** taiga and forest tundra along shallow lakes and ponds, usually less than 30 ha in size. The presence of islands in these water bodies is a characteristic sought by the species.
► **Key habitats (moulting):** coastal zone of James Bay and Hudson Bay
► **Key habitats (migration):** coastal zone of James Bay

► **Primary conservation issues:** hydroelectric development (flooding of wetlands), Aboriginal harvest, mining, possible increase in shipping traffic along coasts, potential coastal development

There are no other actions specifically targeting scoters in BCR 7 other than those listed under Objective 1.

Objective 8
Ensure the conservation of the Red-breasted Merganser; at a minimum, maintain a breeding population of 60,000 indicated breeding pairs (Table 6).

► **Key habitats (breeding):** shoreline of small or medium-sized lakes; the bays of large lakes or rivers; shoreline of lagoons and estuaries
► **Primary conservation issues:** hydroelectric development (flooding or draining of wetlands), Aboriginal harvest, mining

There are no other actions specifically targeting the Red-breasted Merganser in BCR 7 other than those listed under Objective 1.

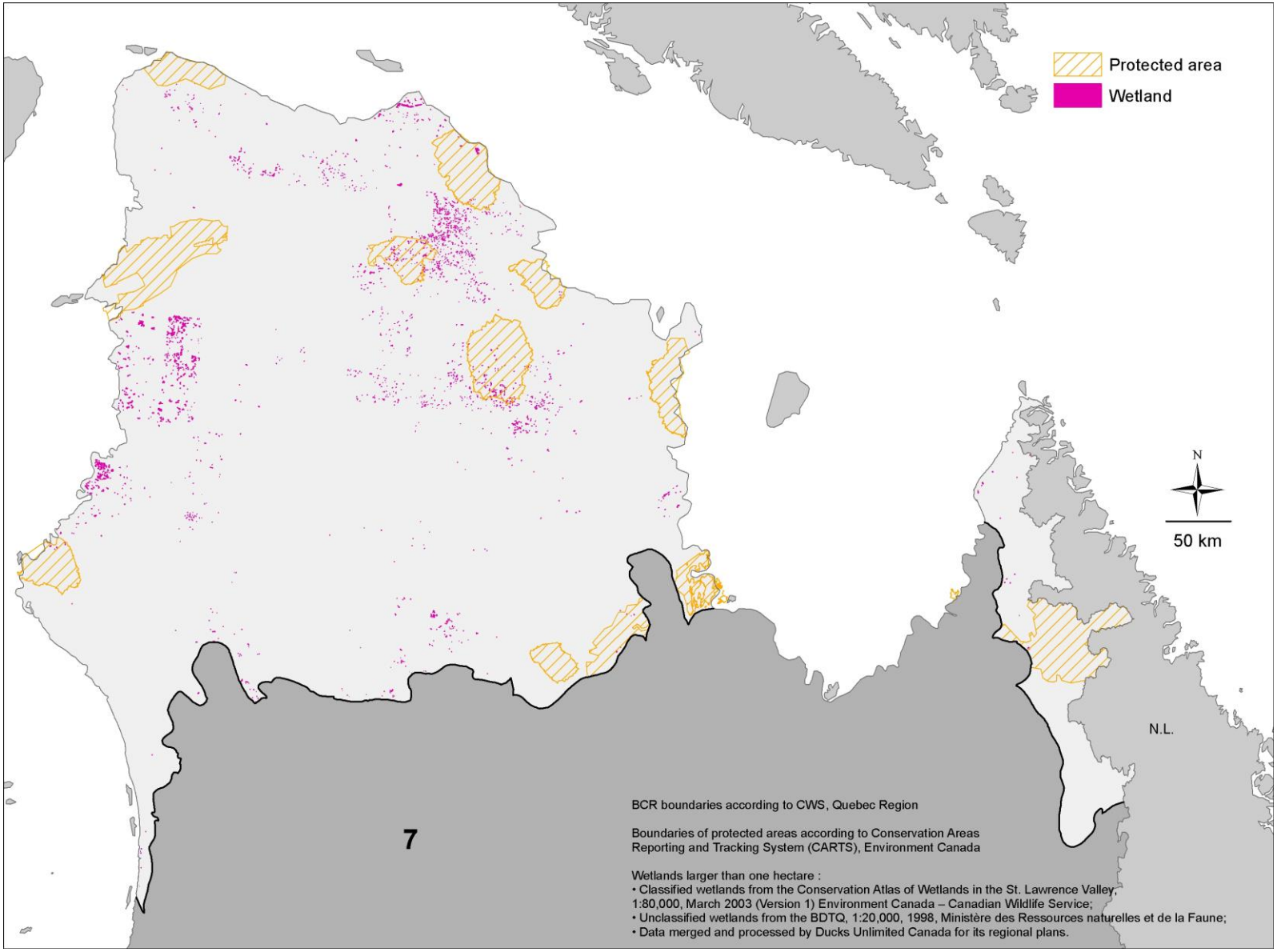
9. Arctic Plains and Mountains (BCR 3)

9.1 General description

BCR 3, the northernmost of Canada's BCRs, crosses the country from west to east (Figure 1). It includes the northern fringe of Yukon, the northern portion of Northwest Territories (including the Canadian Arctic Archipelago), almost all of Nunavut, northern Quebec and the mountainous region straddling Quebec and Labrador at the eastern tip of Ungava Bay. This BCR represents one of the largest Arctic ecosystems on the planet (Wiken et al. 1996; Environnement Canada 2005b; Environnement Canada 2005a). In Quebec, BCR 3 occupies roughly 207,400 km^2, or 14% of the province's territory (Figure 2), making it the third largest of the province's six BCRs. It encompasses all of northern Quebec from the coast of Hudson Bay to the Ungava Bay coast, as well as a part of the mountainous region that lies along the border with northern Labrador (Figure 2).

To facilitate its description, BCR 3 can be divided into three parts, the southern and northern portions of the Ungava Peninsula and an eastern portion, separated from the first two, on the Labrador–Quebec border (Figure 13). In the southern part of the Ungava Peninsula (Low Arctic), the terrain is undulating, reaching an elevation of 500 m in places. Bare rock outcrops are common and the permafrost is continuous, with a low ground-ice content. The northern part of the Ungava Peninsula (High Arctic) consists of a series of ridges and valleys oriented east-west. The ridges are fairly high in the west, but lower in the east. The average elevation is around 100 m, and increases northward. For example, Maurepas Head (Promontoire Maurepas) and the Puvirnituq Mountains reach elevations of 600 m and 693 m respectively. Bare rock outcrops are also common in this northern portion, and the permafrost, which has a low ground-ice content, is continuous. The eastern part of the BCR, in the Torngat Mountains, is part of the vast Arctic Cordillera. The Torngats are the highest mountain range in eastern North America, with

Figure 13. Location of BCR 3 in Quebec and distribution of wetlands and protected areas



some peaks reaching over 1,000 m in elevation, including Mount D'Iberville, the highest point in Quebec (1,652 m), as well as mounts Jacques-Rousseau (1,261 m), Haywood (730 m) and Qarqaaluk (1,070 m). The permafrost is continuous in this part of the BCR (Ressources naturelles Canada 2009b). Note that, although the islands in the eastern portion of Hudson Bay, the southern half of Hudson Strait and Ungava Bay (e.g., Akpatok Island) are under the legal jurisdiction of Nunavut, the natural resources found there, including waterfowl populations, are managed by the Nunavik Inuit (Nunavik marine region). Consequently, these islands are considered to be in the Quebec portion of BCR 3 for the purposes of this document.

BCR 3, the least populated of the six BCRs in Quebec, has close to 5,500 inhabitants. The population is mainly Inuit, who live in nine communities. The largest are Inukjuak, Puvirnituq and Salluit, each with between 1,100 and 1,200 inhabitants (Affaires indiennes et du Nord Canada 2009).

The mean annual temperature ranges from -6°C to -8.5°C, with a mean summer temperature of 3–4°C and a winter mean of -16.5°C to -20°C (the coldest temperatures are recorded in the northern part of the Ungava Peninsula, where they can go as low as -50°C). Mean annual precipitation ranges from 200 mm to 300 mm in the northern portion of the BCR, from 400 mm to 500 mm in the southern portion and from 400 mm to 700 mm in the Torngat Mountains. In the northern part of the Ungava Peninsula, shore ice and fog persist for long periods in the summer (Environnement Canada 2005b).

The arid conditions found in BCR 3 (low precipitation; extremely low temperatures; constant cold, dry winds; continuous permafrost) are not conducive to the growth of plants. Only very hardy species can survive in this climate, particularly in the northern part of the BCR, where the vegetation is sparse and stunted. At these latitudes, species of vascular plants are scarce but non-vascular plants (mosses and lichens) are well represented. Woody plants include ground-hugging species like Arctic willow. Purple saxifrage and Arctic poppy are among the most common species and are highly adapted to this northern environment (Environnement Canada 2005b; Environnement Canada 2005a).

In the southern portion of the BCR, small clumps of stunted spruces grow in warmer, sheltered sites, forming a dense cushion less than a metre high called krummholz. Low shrubs like willows, shrub birch and Labrador tea are also found. In places where the soil is sufficiently developed, these shrubs form vast shrublands, while on the more exposed sites, a carpet of lichens, mosses and ground-hugging shrubs such as mountain cranberry and least willow occurs. Dwarf birch, Labrador tea and shrubs of the genus *Vaccinium* are found in both the northern and southern part of the BCR (Environnement Canada 2005b; Environnement Canada 2005a).

In the Arctic Cordillera, the landscape is dominated by ice and rock. The sparse ground cover of vegetation is made up of lichens, mosses, arctic sedge and grasses. Patches of Arctic conifers and deciduous shrubs occur on sheltered, south-facing valley slopes. In the uplands, roughly half the ground is covered by bare rock with no vegetation and the other half by tundra. On the less stable scree, white birch and willow thickets form a transition zone between the tundra and very open spruce forests. In bogs and other poorly drained sites, Arctic black spruce, accompanied by mixed evergreen and deciduous shrubs underlain with a carpet of moss, is found (Environnement Canada 2005b; Environnement Canada 2005a).

The drainage system of BCR 3 includes a number of major rivers: the Arnaud, Puvirnituq, Kogaluc, Innuksuac, Kovik, Déception and Mariet (Canards Illimités Canada 2009a). Large lakes

are also found, including Payne, Nantais, Faribault and Tasiat (ranging in size from roughly 200 km^2 to 500 km^2) (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002h). Due to the continuous permafrost and freeze-thaw cycles, ponds (often small) are abundant. Wetlands are estimated to cover roughly 1 million hectares. This estimate is very rough since the data available are highly inaccurate (Eastern Habitat Joint Venture 2007; Canards Illimités Canada 2009a; J. Beaulieu and P. Dulude, Ducks Unlimited Canada, pers. comm.).

Protected areas with suitable waterfowl habitat include the following Quebec national parks (provincially owned): Pingualuit (1,500 km^2) and Kuururjuaq (formerly known as Monts-Torngat-et-de-la-Rivière-Koroc; 3,400 km^2). Planned Quebec national parks include Baie-aux-Feuilles (2,000 km^2), Monts-de-Puvirnituq (3,000 km^2) and Cap-Wolstenholme (1,263 km^2) (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2002j).

9.2 Characteristics of conservation issues in BCR 3

The issues discussed below are those for which we were able to provide additional information in BCR 3. The environmental impacts of these issues on waterfowl and recommended mitigation measures are discussed in Chapter 3.

9.2.1 Climate change

Scientists generally agree that the effects of climate change will be felt most acutely in the Arctic, including the increase in temperatures expected from global warming. Increased precipitation in northern Quebec is also anticipated (Forget et al. 2003). Consequently, the Quebec portion of BCR 3 is expected to experience significant environmental changes in the coming decades. Based on the scenario of the doubling of atmospheric CO_2, the southern limit of the tundra could shift 500 km to the north (Environnement Canada 2007b). In addition, changes in temperature and precipitation would have a particularly strong impact on wetlands in the region, which are dependent on permafrost. This layer of ice acts as an impermeable barrier that retains the surface water in the wetlands. If the permafrost thaws, the water in lakes and ponds would run off or percolate into the water table, resulting in the shrinking or disappearance of these wetlands (Environnement Canada 2007b). Climate change and the accelerated thawing of permafrost would also very likely alter geochemical processes in northern aquatic environments and consequently modify the structure of food chains as well as primary and secondary production (Wrona et al. 2006). Overall, these changes could have significant effects on waterfowl (occurrence, migration routes, competition with species that usually breed further south), which would very likely cause changes to community structure (Wrona et al. 2006).

9.2.2 Mining

The Quebec government adopted a mineral strategy in 2009, under which mineral development in northern Quebec is encouraged while stricter environmental standards, such as the guaranteed restoration of mining sites and the adoption of best practices, will be enforced (Ministère des Ressources naturelles et de la Faune du Québec 2009c). Currently, the only mine found in the Quebec portion of BCR 3 is the Raglan property (nickel and copper mining) (Ministère des Ressources naturelles et de la Faune du Québec 2011e). In the context of the mineral strategy, the mineral resources in BCR 3 could be developed more intensively in the fairly near future.

9.2.3 Shipping and shipping infrastructures

In the coming years, navigation is expected to increase in Hudson Bay, Hudson Strait and Ungava Bay, owing to the fact that climate change will result in ice-free water in these areas for a greater portion of the year. This will facilitate natural resource development in Nunavut and Nunavik and result in increased industrial activities in the Arctic in general. Indeed, one mining project under study in the Arctic, Mary River on Baffin Island, involves the transport of the ore by ship to Europe, with one trip/1.8 days (204 trips/year) planned along a year-round shipping route through Foxe Basin and Hudson Strait (Nunatsiaq News 2011). This potential Arctic shipping route would bring icebreakers in winter, as well as the presence of large ships and a clear increase in shipping traffic in Hudson Strait. A number of species of waterfowl use these waters as moulting areas, among other things. Therefore, it is conceivable that increased shipping traffic could cause a certain amount of disturbance to these birds, not counting the increased risks of accidental oil spills.

Furthermore, the Government of Quebechas announced its desire to accelerate the development of Quebec's territory north of the 49th parallel (Ministère des Ressources naturelles et de la Faune du Québec 2009b) and position itself strategically on this new sea route (the Northwest Passage) (Gouvernement du Québec 2011c).

9.2.4 Hydroelectric and wind power generation

Hydroelectric and wind farm projects can be expected in BCR 3 in the foreseeable future, considering previous Government of Quebec announcements (Gouvernement du Québec 2011b). Among Quebec's administrative regions, Nord-du-Québec has the greatest wind power potential (Hélimax Énergie and AWS Truewind 2005).

9.3 Use of BCR 3 by waterfowl

9.3.1 Migration

Geese (3): Snow Goose (Lesser and Greater), Cackling Goose and Canada Goose (Atlantic and North Atlantic populations)
Swans (1): Tundra Swan
Dabbling ducks (4): American Black Duck, Mallard, Northern Pintail and Green-winged Teal
Diving ducks (1): Greater Scaup
Sea ducks (6): King Eider, Common Eider (*borealis* and *sedentaria*), Black Scoter, Long-tailed Duck, Common Merganser and Red-breasted Merganser

TOTAL = 15 species

Highlights of migration period:

- Almost the entire population of Greater Snow Geese (> 1,000,000 birds) passes inland through BCR 3 to reach their breeding grounds in Nunavut (CWS, unpubl. data).
- During spring migration, Northern Pintail congregate at sites along the east coast of Hudson Bay (Malecki et al. 2006).

More than 2,200,000 geese, swans and ducks are estimated to migrate through BCR 3 (Table 7).

9.3.2 Breeding

BCR 3 has the fewest number of waterfowl species during the breeding season of all the Quebec BCRs. Regular breeders consist of the following:
Geese (2): Snow Goose (Lesser) and Canada Goose (Atlantic and North Atlantic populations)
Swan (1): Tundra Swan
Dabbling ducks (3): American Black Duck, Northern Pintail and Green-winged Teal
Diving ducks (1): Greater Scaup
Sea ducks (5): King Eider, Common Eider (*borealis* and *sedentaria*), Black Scoter, Long-tailed Duck and Red-breasted Merganser

TOTAL = 12 species

Breeding season highlights:
- Slightly over 75% of the Atlantic Population of the Canada Goose breeds in this BCR; breeding pair density is high in the coastal lowlands of Hudson and Ungava bays (WNOR; Malecki and Trost 1990; Harvey and Rodrigue 2005; Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008). Cackling Goose and Lesser Snow Goose also breed in these lowlands in small numbers (CWS, unpubl. data).
- The coastal strip (roughly 50 to 100 km inland) in the western part of the Ungava Peninsula has particularly rich waterfowl habitat, including small shallow ponds, lakes and rivers where Tundra Swan, American Black Duck, Northern Pintail, Green-winged Teal, Greater Scaup, King Eider, Black Scoter and Long-tailed Duck breed along the shoreline (WNOR).
- Roughly 40,000 pairs of the *borealis* subspecies of the Common Eider (or close to 20% of the North American Population) breed in colonies on coastal islands in Ungava Bay and along the Quebec side of Hudson Strait (Chapdelaine et al. 1986; Falardeau et al. 2003), and occasionally on islands inland (Chapdelaine et al. 1986).
- Roughly 7,000 pairs of *sedentaria* Common Eiders breed in colonies on the islands along the east coast of Hudson Bay (Nakashima and Murray 1988).
- Over 30% of the North American Population of Red-breasted Merganser probably breed on the Ungava Peninsula (WNOR). This species likes to nest on the edges of small and medium-sized lakes or the bays of large lakes, as well as along some rivers; it is scarcer along the coastal shoreline (J. Rodrigue, CWS, pers. comm.).

BCR 3 probably supports over 470,000 breeding pairs (Table 7).

9.3.3 Moulting

Given our lack of knowledge on waterfowl at these northern latitudes, the following information is incomplete. During the moulting period, species occurring regularly comprise:
Geese (1): Canada Goose (Atlantic and Resident populations)
Dabbling ducks (3): American Black Duck, Mallard and Northern Pintail
Sea ducks (6): King Eider, Common Eider (*borealis* and *sedentaria*), Long-tailed Duck, Common Goldeneye, Common Merganser and Red-breasted Merganser

TOTAL = at least 10 species

Highlights of moulting period:
- Atlantic Population Canada Geese and Resident birds from the Atlantic and Mississippi Flyways moult in Hudson and Ungava bays (J. Rodrigue, CWS, pers. comm.; Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008).

- A portion of the *borealis* Common Eiders that breed in Ungava Bay also moult there, although our knowledge of the actual moulting areas used is very sketchy. Bell Inlet, a deep bay on the east coast of Ungava Bay, is known to attract large congregations of moulting males (Nakashima 1986). On the west coast of Ungava Bay, flocks of males are found in such places as the deepwater bays between Jean-Talon and De Champigny points (west of Quaqtaq; BCR 3) (Nakashima 1986).
- Male Long-tailed Ducks moult in flocks along the coast of Hudson Bay (Lamothe 1996).

9.3.4 Wintering

At these latitudes, only eiders overwinter regularly in the cold northern waters.
Sea ducks (2): King Eider and Common Eider (*borealis* and *sedentaria*)

TOTAL = 2 species

Winter highlights:
- Several thousand eiders (King Eider and *borealis* Common Eider) overwinter off the northern tip of Labrador, near Killiniq (Nakashima 1986; Mosbech et al. 2006).
- Small numbers of King Eider are probably also present near Aupaluk and Kangiqsujuaq, while small numbers of Common Eider probably overwinter around Salluit (Nakashima 1986).
- Roughly 210,000 *sedentaria* Common Eiders winter in the Belcher Islands (Nunavut; S. Gilliland, CWS, pers. comm.).

The Quebec portion of BCR 3, including polynia in Hudson Bay that are not very far from the coast of Quebec, probably hosts close to 200,000 individuals during the winter period (Table 7).

Table 7. Conservation objectives; numbers (IBP/207,400 km² ± standard deviation), density (IBP/100 km² ± standard deviation) and trends during the breeding season; numbers (when available; otherwise, occurrence) during the migration, moulting and overwintering periods in the Quebec portion of BCR 3 (species in red are the priority species of this BCR; see section 9.4).

BCR 3	Objective[a]	Breeding Number[b] ± s.d.	%	% cum.	Density[c] ± s.d.	Trend[d]	Spring Migration[e]	Moulting[f]	Wintering[f]
Canada Goose[g]	196,000[h]	190,500 ± 11,900	40	40	91.83 ± 5.74	Increase	509,000	Yes	No
Red-breasted Merganser[i]	84,000	91,200 ± 13,400	19	59	43.98 ± 6.47	Increase	233,000	Yes	No
Long-tailed Duck	54,000	46,600 ± 5,500	10	69	22.49 ± 2.63	Increase	119,000	Yes	No
Common Eider *borealis*	n. d.	40,000[j]	8	77	n. d.	n. d.	125,000	Yes	Yes
American Black Duck	28,000	27,700 ± 4,400	6	83	13.36 ± 2.12	Increase	58,000	Yes	No
Northern Pintail	25,000	24,000 ± 3,300	5	88	11.56 ± 1.61	Increase	50,000	Yes	No
Black Scoter[k]	14,000	19,500 ± 4,900	4	92	9.41 ± 2.34	Increase	50,000	?	No
Green-winged Teal	20,000	17,400 ± 4,800	4	96	8.37 ± 2.31	Increase	36,000	?	No
Common Eider *sedentaria*	n. d.	7,000[l]	2	98	n. d.	n. d.	13,000	Yes	210,000[m]
Greater Scaup	8,000	6,400 ± 1,600	1	99	3.07 ± 0.78	n. d.	17,000	?	No
Tundra Swan	1,000	1,000 ± 250	<1	99	0.48 ± 0.12	n. d.	3,000	?	No
King Eider	n. d.	Yes	<1	100	n. d.	n. d.	1,200	Yes	Yes
Snow Goose[n]	500,000–750,000[o]	Yes[p]	<1	100	n. d.	n. d.	1,000,000[q]	No	No
Cackling Goose		Occas.[r]					Yes	?	No
Mallard		Occas.[s]					No	Yes	No
Northern Shoveler		Occas.[t]					No	No	No
American Wigeon		Probable[u]					?	?	No
Harlequin Duck		Probable[v]					?	?	No
Common Merganser		Probable[w]					?	Yes	No
Common Goldeneye		No					No	Yes	No
Total	**459,000**[x]	**471,000**[y]	**100**	**100**	**208.56**[z] **± 25.20**	**Increase**[aa]	**> 2,200,000**	**?**	**> 210,000**

[a] Population objective for the BCR; unless otherwise indicated, this objective is expressed in **indicated breeding pairs (IBP)** and corresponds to the median of the 2004–2006 WNOR numbers. n. d. = not determined.

[b] Number of **IBP** according to the 2004–2006 average for WNOR ± standard deviation for the entire BCR.
Yes = Species breeds in the BCR, but CWS surveys do not allow the population to be calculated. Occas. = Species breeds occasionally in the BCR (every 2 to 5 years). Excep. = Species breeds exceptionally in the BCR (less than once every five years). No = Species does not breed in the BCR.

[c] Density of **IBP** per 100 km² based on 2004–2006 average for WNOR ± standard deviation.

[d] **Breeding population** trend based on slope of the trend line for WNOR 1993-2006 data.

[e] Number of migrating **individuals** in spring. Unless otherwise indicated, this estimate is based on the total number of indicated breeding pairs in the BCR (see[b]) multiplied by a factor (2.67 for geese; 2.10 for dabbling ducks; 2.63 for diving ducks and 2.56 for sea ducks) to take account of nonbreeding individuals. For less abundant species, Yes = Species occurs in the BCR, but in unknown numbers. No = Species does not occur in the BCR.

[f] Number of **individuals**, according to various sources. For species listed without a number, Yes = Species occurs in the BCR, but in unknown numbers; No = Species does not occur in the BCR; ? = It is not known whether the species occurs in the BCR.

[g] Consists of Atlantic Population Canada Geese for objective. For breeding, includes Atlantic (estimated at 177,100 IBP approx.) and North Atlantic (estimated at 13,300 IBP approx.) populations. For migration, mostly consists of Atlantic Population (> 90%). For moulting, consists of Resident and Atlantic populations.

[h] Objective in **breeding pairs** for the Atlantic Population in BCR 3. Calculated from the objective set for the entire area surveyed in WNOR (225,000 IBP; covers BCR 3 and

the northern part of BCR 7; see Figure 5), from Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008.

[i] Includes mergansers not identified to species.

[j] Number of **breeding pairs** adapted from Chapdelaine et al. 1986: of the 48,700 pairs breeding in Ungava Bay and along the Quebec side of Hudson Strait, roughly 80% are found in BCR 3.

[k] Although no breeding evidence has been obtained yet for this species in BCR 3, the many pairs observed every year in the WNOR surveys suggests that the species in fact breeds in this BCR. For this reason, we consider the Black Scoter as a breeder in BCR 3 (although, in actual fact, it is a "probable" breeder).

[l] Number of **breeding pairs** adapted from Nakashima and Murray 1988: of the 10,700 pairs breeding along the east coast of Hudson Bay, roughly 70% are in BCR 3.

[m] Number of **individuals** obtained from survey of *sedentaria* Common Eiders in 2003 (S. Gilliland, CWS, pers. comm.).

[n] Greater Snow Goose for objective and migration; for breeding, Lesser Snow Goose.

[o] Objective for the entire population (and not just in BCR 3) of the Greater Grande Snow Goose in **migration**, expressed as the number of **individuals**, from Bélanger and Lefebvre 2006.

[p] See species account for Lesser Snow Goose in *Status of Quebec Waterfowl Populations, 2009* (Lepage and Bordage 2013).

[q] Number of **individuals** according to 2008 data from the Greater Snow Goose Spring Survey in Quebec (CWS, unpubl. data).

[r] Based on observations of broods and family groups during Canada Goose banding activities by CWS (CWS, unpubl. data). In addition, see species account in *Status of Quebec Waterfowl Populations, 2009* (Lepage and Bordage 2013).

[s] Breeding evidence from Bannon et al. 2002.

[t] Based on observation of a brood of five ducklings on July 27, 2003 near the Polemond River, roughly 100 km north of Inukjuak (CWS, unpubl. data). Pairs have been seen every year since 1999 during the WNOR surveys (CWS, unpubl. data).

[u] Pair observed in June 2006 at Puvirnituq Lake (ÉPOQ).

[v] Two pairs observed on June 24, 2007 near Parc National des Pingualuit (Pingualuit provincial park) (Robert 2007) and, according to Morneau et al. 2008, a few thousand individuals breed in the Nord-du-Québec region.

[w] Pairs have been observed annually since 1998 during the WNOR surveys (CWS, unpubl. data) and a drake was observed on Puvirnituq River on June 23, 2007 (Robert 2007).

[x] This number corresponds to the total of the objectives for **breeding populations** only.

[y] Standard deviation not available for total breeding population due to lack of standard deviation for breeding population of the Common Eider.

[z] Density of all species of breeding waterfowl, except for Common Eider and species that are found in small numbers.

[aa] Trend for all species of breeding waterfowl, based on the slope of the trend line for the WNOR 1993–2006 data.

9.4 Priority species in BCR 3

Priority species in BCR 3 were selected using *objective* prioritization methods (see section 2.5 and Appendix 16.2), combined with the *subjective* experience of CWS specialists. A conservation objective has been set for each priority species (see section 9.5).

High priority	Medium priority
Canada Goose (Atlantic Pop.): Objective 2 Common Eider (*borealis*): Objective 3	Common Eider (*sedentaria*): Objective 3 Red-breasted Merganser: Objective 4 Long-tailed Duck: Objective 5 Greater Scaup: Objective 5 Black Scoter: Objective 5

9.5 Conservation objectives and actions recommended for priority species in BCR 3

Objective 1 comprises actions that apply to a number of the priority species. Objectives 2 to 5 comprise actions targeting a specific priority species or group of species.

Objective 1
Ensure the conservation of high-priority and medium-priority species.

Monitoring and surveys

Action 1 Continue WNOR, which provides a baseline for determining breeding population objectives; however, a helicopter component must be added to calculate the species identification correction factor.
- ► Canada Goose, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 2 Determine moulting areas of priority species in Hudson Strait and elsewhere along the coast of the Ungava Peninsula and institute a monitoring program of individuals in key moulting sites.
- ► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 3 Institute a banding program in Northern Quebec for priority species other than the Canada Goose to monitor harvest rates, document movements, quantify survival rates and obtain indices of reproductive success.
- ► Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Knowledge acquisition

Action 4 Determine the most important parameters (e.g., adult survival by season, productivity) in the annual cycle of priority species in order to guide monitoring and conservation efforts.

► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 5 Determine local factors (e.g., annual climatic conditions) that have an impact on the breeding of priority species.

► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 6 Determine regional factors (e.g., food resources) that have an impact on moulting in priority species.

► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 7 Determine links between breeding grounds, moulting areas and wintering grounds (delineation of populations).

► Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Active surveillance

Action 8 Encourage consultation with CWS specialists during environmental assessment processes in order to obtain recommendations related to priority species.

► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 9 Institute a survey on the Inuit migratory bird harvest and egging, to assess the harvest of priority species.

► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 10 Ensure the efficacy of the CWS Oil Spill Emergency Response Plan to prevent and limit mortality of priority species in the event of an oil spill.

► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 11 Ensure the efficacy of the CWS Avian Mortality Events Emergency Response Plan, and make improvements if necessary, to prevent and limit mortality in priority species in the event of an outbreak of avian disease (e.g., avian cholera).

► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Environmentally sustainable practices

Action 12 Increase awareness among mining authorities on the impacts of this activity on priority species, particularly the potential contamination of watercourses by mine tailings.

► Canada Goose, Red-breasted Merganser, Long-tailed Duck, Greater Scaup, Black Scoter

Action 13 In the event that shipping traffic will likely increase in Hudson Strait (to meet the needs of future natural resource development in Nunavut) or if coastal development (e.g., port facilities) is envisaged (e.g., Ungava Peninsula), act proactively by raising awareness among the responsible authorities regarding the requirements of priority species during the migration and moulting periods.

► Canada Goose, Common Eider, Red-breasted Merganser, Long-tailed Duck, Black Scoter

Habitat measures

Action 14 Propose the creation of Marine Wildlife Areas (or other means of legal protection) to protect key moulting areas used by priority species.

► Common Eider, Red-breasted Merganser, Black Scoter

Objective 2
Ensure the conservation of the Atlantic Population of the Canada Goose; increase the breeding population to 196,000 pairs and maintain this population (Table 7).

► **Key habitats (breeding):** wet sedge meadows; edges of water bodies; islands and islets in ponds, lakes and rivers
► **Primary conservation issues:** Aboriginal harvest, mining, climate change

Note: In addition, see the report *A management plan for the Atlantic Population of Canada Geese* (Canada Goose Committee – Atlantic Flyway Council Game Bird Technical Section 2008) for a complete list of measures proposed for this population.

Other actions specifically targeting the Atlantic Population of the Canada Goose in BCR 3:

Monitoring and surveys

Action 15 Continue the Canada Goose productivity monitoring and banding programs to monitor harvest rates, document movements, quantify survival rates and obtain indices of reproductive success.

Knowledge acquisition

Action 16 Determine if the presence of moulting Resident Canada Geese in BCR 3 is having an impact on the habitat's carrying capacity, in order to guide conservation actions for the Atlantic Population of the Canada Goose.

Objective 3
Ensure the conservation of the *borealis* and *sedentaria* subspecies of the Common Eider; at a minimum, maintain a *borealis* breeding population of 40,000 pairs and a *sedentaria* breeding population of 7,000 pairs (Table 7).

► **Key habitats (breeding):** *borealis* – islands along the coast of Ungava Bay and the Quebec side of Hudson Strait; *sedentaria* – islands along the east coast of Hudson Bay
► **Primary conservation issues:** Aboriginal harvest, egging, commercial harvest of *borealis* in Greenland, avian epidemics, climate change, possible increase in shipping traffic along the coasts, potential coastal development

Other actions specifically targeting the Common Eider* (borealis *and* sedentaria *subspecies*) *in BCR 3:

Monitoring and surveys

Action 17 Institute a monitoring program of the main colonies to determine population trends in the two subspecies and quantify populations.

Knowledge acquisition

Action 18 Study the dynamics of avian cholera and the proximate causes promoting epidemics.

Action 19 Determine if climate change is having an impact on the breeding of eiders in order to guide conservation and monitoring activities.

Action 20 Develop an effective technique for surveying colonies (e.g., counting drakes) that will be applicable throughout the breeding range of *borealis* and *sedentaria*, so that the survey methods used by the various authorities in charge of managing these two subspecies can be standardized.

Environmentally sustainable practices

Action 21 Increase awareness among Inuit to ensure that down harvesting is carried out according to best practices (see Bédard et al. 2008 in this regard), to prevent excessive disturbance to the hens and to ensure that the resource is managed sustainably.

Action 22 Promote awareness among Inuit eggers of the potential effects of egging (significant disturbance in colonies and reduction in eider productivity).

Action 23 Raise awareness among all authorities responsible for managing populations of *borealis* Common Eider on the conservation of this subspecies.

Habitat measures

Action 24 Ensure that the main colonies have protected status.

Objective 4
Ensure the conservation of the Red-breasted Merganser; at a minimum, maintain a breeding population of 84,000 indicated breeding pairs (Table 7).

► **Key habitats (breeding):** shorelines of small or medium-sized lakes, bays of large lakes and rivers; shorelines of lagoons and estuaries
► **Primary conservation issues:** Aboriginal harvest, mining, climate change

There are no other actions specifically targeting the Red-breasted Merganser in BCR 3 other than those listed under Objective 1.

Objective 5
Ensure the conservation of the other priority species of breeding ducks; at a minimum, maintain a Greater Scaup breeding population of 8,000 indicated breeding pairs, a Black Scoter breeding population of 14,000 indicated breeding pairs and a Long-tailed Duck breeding population of 54,000 indicated breeding pairs (Table 7).

► **Key habitats (breeding):** edges of ponds and small lakes
► **Primary conservation issues:** Aboriginal harvest, mining, climate change

There are no other actions specifically targeting these species in BCR 3 other than those listed under Objective 1.

10. Social and economic importance of waterfowl

Chapter 10 outlines the social and economic importance of waterfowl, information that we believe is crucial to the *Quebec Waterfowl Conservation Plan, 2011*. Whether we are referring to the economic spinoffs or social aspects of birdwatching or the Aboriginal and sport harvests, all these activities depend, to various degrees, on the health and long-term survival of Quebec's waterfowl populations.

10.1 Birdwatching

Wildlife watching, and particularly birdwatching, is a very popular activity in Canada and Quebec. According to statistics compiled by MRNF, over a million Quebecers go on outings to carry out non-consumptive wildlife-related recreational activities (birdwatching and wildlife watching and photography; Ministère des Ressources naturelles et de la Faune du Québec 2007). Many people also watch birds at home by putting up bird feeders or bird houses. These activities generate significant economic spinoffs, both from equipment purchases (binoculars, field guides, bird seed, etc.) and travel-related expenses (gas, lodging, restaurants, etc.).

Among waterfowl species, Snow Geese and Canada Geese are no doubt the species that attract the most attention and interest from the public in Quebec. Spectacular flocks of these species can be seen during migration from a number of locations that are easy to access and therefore very popular: Cap Tourmente NWA (55,000 visitors annually), the Baie-du-Febvre area on Lake Saint-Pierre (75,000 visitors), the Montmagny region (213,000 visitors, 98,000 of whom are birdwatching) and the Parc National de Plaisance (provincial park) in the Outaouais region (10,000 visitors; Groupe conseil Genivar inc. 2005). According to a visitors' survey at Cap Tourmente NWA, 65% of visitors were there to observe waterfowl, spending an average of $40 per visit (gas, lodging, food, etc.). In comparison, 90% of visitors to the Baie-du-Febvre interpretation centre were there primarily to observe waterfowl; these people spent roughly $90 on average per trip (Groupe conseil Genivar inc. 2005).

In addition, these massive flocks of geese have prompted several cities and towns, including Montmagny, Saint-Joachim and Saint-Fulgence, to hold an annual festival with a bird-related theme. At Montmagny's snow goose festival (Festival de l'Oie blanche), nearly half (46%) of the roughly 200,000 participants also spend time there watching birds (Groupe conseil Genivar inc. 2005). Among the roughly 6,000 people who come to Saint-Joachim's snow goose festival, some also probably visit Cap Tourmente NWA, where several tens of thousands of Snow Geese can be seen at this time. The increased visitation is an extremely important economic engine for these rural municipalities, which are located well away from major urban centres.

10.2 Harvesting

In Quebec, two types of waterfowl harvests occur, the Aboriginal (or subsistence) harvest and the sport harvest. The sport harvest is a recreational activity, and hunters must purchase a federal migratory game bird hunting permit, habitat conservation stamp and provincial small game hunting licence. Thanks to a partnership with Environment Canada's CWS, part of the revenues from stamp sales go to Wildlife Habitat Canada to fund habitat conservation programs. Aboriginal people, on the other hand, are not required to purchase a permit.

In Canada, the federal hunting permits were introduced in 1966 as a way of estimating the number of migratory game bird sport hunters (Boyd et al. 2002). Figure 14 shows the changes in the number of permits sold over the years, and therefore changes in the number of waterfowl hunters in Quebec and Canada. A significant increase in the number of sport hunters in Quebec was observed between 1966 and 1980, when as many as 76,133 permits were sold. Subsequently, beginning in 1980, there was a steady drop—roughly 4.6% a year—in numbers, which bottomed out at 27,060 in 2006. The same trends were seen in Canada as a whole, with a peak of 524,946 permits in 1978 and a minimum of 165,700 permits in 2005 (Gendron and Collins 2009). The situation is similar in the United States, with a few notable differences. First, the peak in the number of hunters was reached earlier (1971), both in the U.S. as a whole (roughly 2.4 million hunters) and in the Atlantic Flyway (roughly 500,000 hunters); in the Mississippi Flyway, the peak occurred in 1970 (close to 1 million hunters). Secondly, after a steady drop for 20 years, the number of active hunters began to increase again significantly, beginning in the early 1990s in the U.S. (from roughly 1.3 million to 1.7 million in 2000) and in the Mississippi Flyway (from 575,000 to 750,000 in 1999), with numbers increasing slightly in the Atlantic Flyway between 1995 and 2003 (from roughly 270,000 to 310,000; Figure 15) (U.S. Fish and Wildlife Service 2003).

Figure 14. Number of migratory game bird hunting permits sold in Quebec and Canada, 1966–2008 (data from Gendron and Collins 2009)

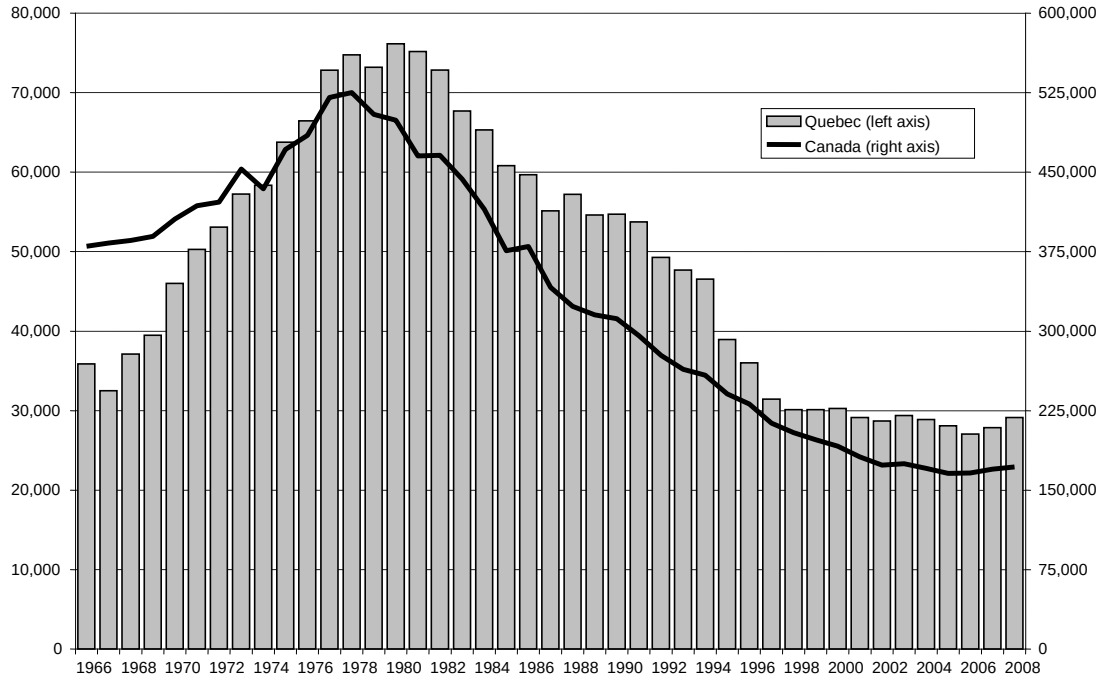
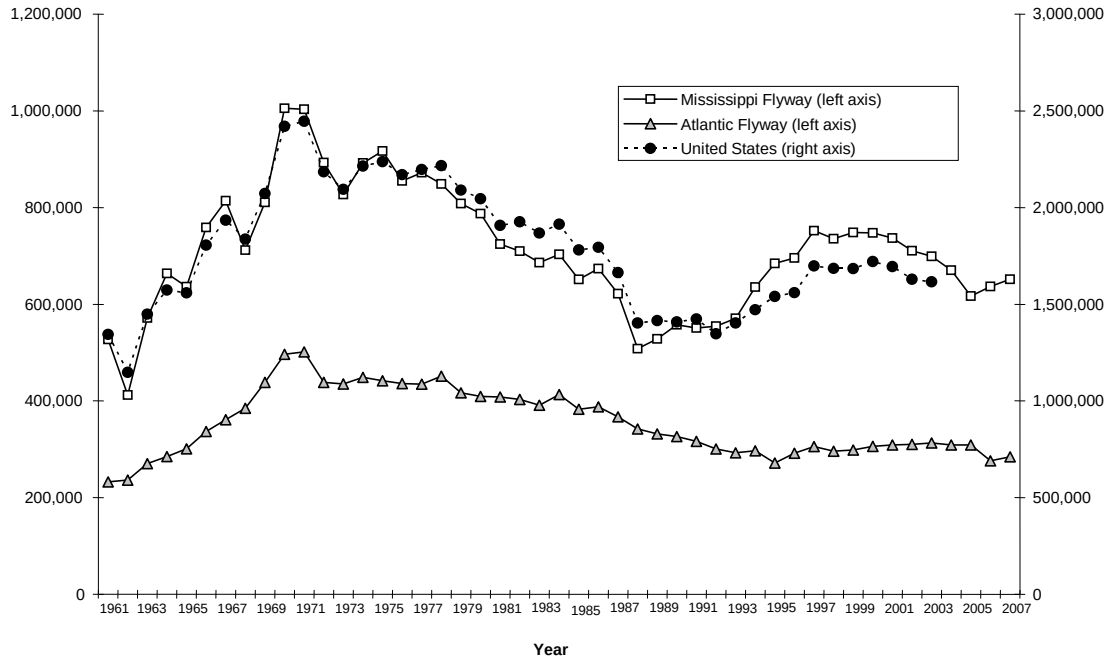


Figure 15. Number of migratory game bird hunting permits sold in the United States and the Atlantic and Mississippi flyways, 1961–2007 (data from U.S. Fish and Wildlife Service 2003)



Data collected from the Harvest Questionnaire Survey and Species Composition Survey (Wingbee) provide a profile of waterfowl hunters and their hunting success. In Canada, data for 1986–1996 show that the number of young people aged 15 to 24 who bought a permit decreased sharply from 78,000 to only 35,700 during this period (Boyd et al. 2002). The number of permits purchased by men in the age groups of 25–34 years, 35–44 years, 45–54 years and 55–64 years also fell, while those bought by men 65 and over increased. Permit holders no longer have to indicate if they are men or women, and therefore this information could not be obtained after 1971. At the time, fewer than 5% of hunters were women. In 1996, another Canadian survey estimated the number of female waterfowl hunters at 17,700, or 7.5% of waterfowl hunters that year.

The mean seasonal kill of ducks per hunter in Quebec during the periods of 1985–1988 and 1993–1998 did not change, and was around one dozen, while the mean seasonal kill of geese was roughly 10 in 1998 (Boyd et al. 2002).

The economic spinoffs from all waterfowl hunting in Quebec are difficult to quantify. A study was carried out on behalf of the Canadian Wildlife Service in 2003 and 2004 in order to obtain a detailed portrait of the socio-economic impacts associated with migrating Greater and Lesser Snow Geese in southern Quebec. According to this study, on average, waterfowl hunters make 6 hunting trips less than 24 hours long per year, in groups of 3 people. Average expenditures (gas, food, guide, miscellaneous) were $23 per trip, ranging from $18 for duck hunters to $30 for Snow Goose hunters, who usually have to travel further from home to hunt (Groupe conseil Genivar inc. 2005). Respondents reported taking an average of 2.3 hunting trips longer than 24 hours per year, 80% of which were 2 days long or less. Average expenditures on the longer trips were $156 per trip, ranging from $118 for duck hunters to $194 for Canada Goose hunters. Equipment purchases by waterfowl hunters (guns, ammunition, clothing, outdoor equipment, etc.) represented an average annual cost of $523, although almost half of respondents (46%) reported spending no more than $100 (Groupe conseil Genivar inc. 2005). These numbers clearly demonstrate that hunting is an important economic engine in the regions where it takes place, given that in 2003, CWS estimated the number of hunting days to be roughly 175,000, 52% (91,000) of which were attributable to duck hunting and 48% (84,000) to goose hunting (CWS, unpubl. data).

10.3 Eiderdown harvesting

Environment Canada's CWS authorizes eiderdown harvesting through the issuance of eiderdown permits under the *Migratory Birds Regulations*. Annual world eiderdown production is between four and five tonnes, with Iceland being the primary producer; in comparison, the annual eiderdown harvest in the St. Lawrence estuary is estimated at 150–200 kg. Two organizations have a eiderdown permit, the Société Duvetnor and the Société protectrice des eiders de l'estuaire (Joint Working Group on the Management of the Common Eider 2004). Annual net revenues from the sale of eiderdown by the two organizations—which range from $50,000 to $100,000—are partially reinvested in the protection of nest sites. A few individuals on the Lower North Shore also have permits, but eiderdown harvesting is much less significant there. Inuit also collect eiderdown, although the exact quantities are not documented.

10.4 Aboriginal peoples

The Aboriginal and treaty rights of the Aboriginal peoples of Canada are recognized and affirmed by the *Constitution Act, 1982* and by various rulings by the Supreme Court of Canada. Aboriginal and treaty rights differ from one Aboriginal group to another, and from one nation to another.

The 1995 Parksville Protocol amends the *Migratory Birds Convention Act, 1994* to ensure respect for the Aboriginal and treaty rights of the Aboriginal peoples of Canada. This protocol allows Aboriginal people to harvest authorized migratory bird species and their eggs year-round in an agreed-upon geographical area, while ensuring the conservation of the resource.

In Quebec, the 1975 James Bay and Northern Québec Agreement and the 1978 Northeastern Québec Agreement recognized the right of the Crees, Inuit and Naskapi to practice traditional activities within a defined territory. With respect to migratory birds, these two agreements established guaranteed harvest levels for each of the three nations—in other words, a minimum kill for species that can be harvested. Therefore, some species of waterfowl are hunted whenever they occur in northern Quebec, regardless of the season.

Several other First Nations in Quebec are in the process of negotiating comprehensive land and self-government claims. For example, the three Atikamekw communities and certain Innu communities are engaged in discussions with the provincial and federal governments regarding comprehensive land claims and self-government agreements. In the case of the Atikamekw, this involves the negotiation of an agreement in principle. On the Innu side, the Agreement-in-Principle of a General Nature (commonly referred to as the Common Approach) was signed in 2004 by Quebec, Canada and the Mamuitun Mak Nutashkuan Tribal Council, an organization representing four of the nine Innu communities in Quebec (Gouvernement du Québec 2004), and the parties were negotiating a final agreement involving three communities (Mashteuiatsh, Essipit and Natashquan) at the time of publishing this document.

In addition, the Gespeg Micmacs have signed sectoral agreements on hunting and fishing with the Quebec government. A similar agreement (i.e., one that is administrative in nature) could also be signed on migratory birds. In general, in modern treaties, measures are included to encourage Aboriginal participation in the management of natural resources.

Hunting is an important activity in Aboriginal communities from an economic, social and cultural point of view. Although the way of doing things and the use of the resource have changed over the years in communities, the spring and fall hunts are still an important cultural practice. For example, in Cree villages, schools are often closed to allow students to take part in the “Goose Break” (Canada Goose hunt).

In addition to the use of meat for subsistence purposes, the feathers and certain other parts of birds may be used for crafts or in spiritual and traditional ceremonies. Birds, eggs and down may also be utilized for trading and bartering within the community or with other communities. Under their Aboriginal or treaty rights, Aboriginal people also have the right to sell any inedible by-products or eiderdown harvested.

11. Other conservation plans and initiatives

A review of waterfowl conservation plans formulated to date allows the conservation issues raised and actions undertaken to be viewed in a broader perspective. This chapter will therefore contain a brief summary of the 1978 and 1986 plans produced by CWS experts.

While the NAWMP and joint ventures have had, and continue to have, an unquestionable impact on waterfowl conservation, the same is also true of certain other initiatives, which may not necessarily have been established to meet the needs of waterfowl but have had significant repercussions on the conservation and management of, and advancement of knowledge on, this group of birds. The St. Lawrence Action Plan is one such example, and will be discussed along with the CWS plans in the following sections.

11.1 Canadian Waterfowl Management Plan–Quebec (1978)

This unpublished report written by Austin Reed in 1978 (Reed 1978) is particularly noteworthy due to its estimates of breeding, migrant and wintering populations, and Aboriginal and sport harvests for all of Quebec. This information was supported whenever possible by the existing fragmentary survey data, which were carefully extrapolated to cover the entire province—for the time, a very demanding and obviously approximate exercise, given the scarcity of data available on the vast and diverse territory of Quebec. Despite all this, some of these estimates, particularly those of breeding populations in the six subdivisions of the province, were used in their entirety in the subsequent (1986) management plan (Canadian Wildlife Service and Ministère du Loisir de la Chasse et de la Pêche 1986). In the case of a few waterfowl species in which surveys now allow more statistically solid estimates to be made, notably the Canada Goose and American Black Duck, the current numbers have confirmed the accuracy of the estimates made in 1978. The 1986 management plan also contains recommended harvest levels for certain species based on population dynamics parameters estimated in the 1978 plan.

11.2 Quebec Waterfowl Management Plan (1986)

The 1986 plan was written and published by the CWS and the former Ministère du loisir, de la chasse et de la pêche du Québec (Canadian Wildlife Service and Ministère du Loisir de la Chasse et de la Pêche 1986). It updated some of the information in the previous plan, particularly harvest data, and put particular emphasis on the distribution and size of wetlands and other suitable waterfowl habitat in Quebec. A significant portion of the document deals with the goals of waterfowl management and measures to address the problems raised, and it includes a prioritized list of the different measures proposed. This section is particularly interesting in that it allows us to look back at the scope of the management measures recommended 20 years ago and assess the progress made in achieving them 20 years later. Overall, the results are positive, since most of the priority measures identified in 1986 have been implemented.

11.3 St. Lawrence Action Plan

Since 1988, the governments of Quebec and Canada have worked together to conserve, restore and develop the St. Lawrence through the St. Lawrence Action Plan (SLAP). SLAP was renewed for a fifth phase (2011–2026) under an agreement signed by both governments. The

plan has gone through a number of versions: the St. Lawrence Action Plan in 1988–1993 (phase I), St. Lawrence Vision 2000 in 1993–2003 (phases II and III), and finally the St. Lawrence Plan in 2005–2010 (phase IV). SLAP 2011–2026 has 18 government partners (departments and agencies) and numerous contributors from the private and community sectors, all strongly committed to ensuring the health of the St. Lawrence (Plan d'action Saint-Laurent 2011).

During the first phase, the partners succeeding in achieving a greater than 90% reduction in toxic effluent discharges in the St. Lawrence (from the 50 plants that were the biggest polluters) and managed to protect 5,000 hectares of natural habitats, more than half in the Montréal and Lake Saint-Pierre regions (Saint-Laurent Vision 2000, 2002). Another achievement of this phase was the determination of the boundaries of the Saguenay–St. Lawrence Marine Park. During the second phase, 56 plants were added to the toxic effluent discharge reduction program, an additional 7,000 ha of natural habitats were protected and a network of partners in the field, the ZIP committees (ZIP is short for zone d'intervention prioritaire), was established. The second phase also included several pilot projects to restore marshes in the Lower St. Lawrence region (Saint-Laurent Vision 2000, 2004). In the third phase, the State of the St. Lawrence Monitoring Program and the Sustainable Navigation Strategy for the St. Lawrence were launched. Lastly, in the fourth phase, which featured six major areas of action (ecological integrity, agriculture, navigation, community involvement, awareness and monitoring the state of the St. Lawrence River), the groundwork was laid for the Integrated Management of the St. Lawrence initiative, the goal of which is to establish a new form of governance for the river (Plan Saint-Laurent 2008).

The many different measures taken under SLAP over the years have unquestionably benefitted waterfowl, from the protection of natural habitats (mainly wetlands) to the cleanup of pollution in the St. Lawrence to the funding of the Waterfowl Survey of the St. Lawrence Shoreline (WSHO) and the Greater Snow Goose Spring Survey (GSGOS). Clearly, the health of the St. Lawrence, which is closely monitored under SLAP, is essential to the health of waterfowl populations in Quebec.

12. Laws, regulations and policies

The objective of this chapter is to present the primary regulatory tools (legal or ministerial) with a major impact on waterfowl populations and their conservation in Quebec. Therefore, a summary of the most important laws, regulations and policies is provided, rather than an exhaustive review of all legislation and policies.

12.1 *Migratory Birds Convention Act, 1994* (original 1917 law amended in 1994 and 2005)

In 1916, the United Kingdom (for Canada) and the United States signed the Migratory Birds Convention. The Convention was established to ensure the long-term conservation of certain species of migratory birds shared by both countries that had "great value as a source of food or in destroying insects which are injurious to forests and forage plans on the public domain, as well as to agricultural crops." One of the measures included in the Convention is a ban on hunting certain species during a closed season corresponding to the period of their breeding activities (geese and ducks) or during the entire year (migratory insectivorous birds and other migratory non-game birds).

One year later, in 1917, Canada passed the *Migratory Birds Convention Act* to implement the provisions of the Convention. Under this Act, no person shall (1) be in possession of a migratory bird or nest; or (2) buy, sell, exchange or give a migratory bird or nest or make it the subject of a commercial transaction. These protective measures apply at all times, except for cases allowed under the *Migratory Birds Regulations*, which authorize the hunting of migratory game birds under certain conditions. The text of the law and Convention were amended in 1994 to ensure effective measures to better protect migratory birds. The *Migratory Birds Convention Act, 1994* is of paramount importance to waterfowl populations, since it grants them protection during the breeding season. In 2005, amendments were made to the 1994 act to strengthen its ability to protect migratory birds from pollution.

12.2 *Migratory Birds Regulations*

The *Migratory Birds Regulations* arise under the *Migratory Birds Convention Act, 1994*. They lay out regulatory requirements on the hunting of migratory birds, including conditions for issuing hunting permits, daily bag and possession limits, and rules on sales, gifts and purchases of migratory birds. In addition, the regulations set forth conditions applying to other activities involving migratory birds, such as taxidermy, scientific permits, aviculture and eiderdown permits.

These regulations have a huge impact on the status of waterfowl populations. Waterfowl hunting (sport hunt) is practiced by close to 30,000 Quebecers (see section 10.2), and more than 300,000 ducks and geese are bagged annually in Quebec by permit holders (see Table 3 in *Status of Quebec Waterfowl Populations, 2009* [Lepage and Bordage 2013]).

12.3 *Migratory Bird Sanctuary Regulations*

The *Migratory Bird Sanctuary Regulations* arise under the *Migratory Birds Convention Act, 1994.* Under these regulations, the Canadian government can designate areas, known as migratory bird sanctuaries (MBS), which serve to protect birds from hunting or all other disturbances while they are on their breeding grounds and in their other staging areas. MBSs form a series of habitats of national importance to migratory birds, where disturbing, destroying or taking the nests of these birds is prohibited, as is carrying out any activity that is harmful to the eggs, nests or habitat of migratory birds. The minister may issue a permit for activities such as scientific research under certain conditions.

There are almost 90 MBSs in Canada, including 28 in Quebec. Most of the Quebec sanctuaries are located along the St. Lawrence, mainly in the Montréal region, on islands in the St. Lawrence and on the Lower North Shore. Nearly two thirds were given this designation to protect the habitat of waterfowl species, with the other third protecting seabird habitat.

12.4 *Species at Risk Act* and *An Act respecting threatened or vulnerable species*

The *Species at Risk Act* (SARA) was proclaimed in Canada on June 5, 2003. SARA is a fundamental tool for protecting and conserving biodiversity in Canada. Its objectives are to prevent wildlife species from becoming extinct, to assist in the recovery of endangered, threatened and extirpated species and to ensure that species of special concern do not become threatened or endangered. The status of species are determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent body of specialists who assess each species' situation and recommend a designation to the Minister of the Environment, who in turn decides whether species are to be put on the List of Wildlife Species at Risk (Schedule 1 of SARA). SARA provisions concerning protection and recovery apply to species once they are listed.

SARA recognizes in particular that protecting the habitat of a species at risk is essential to its conservation. In addition, SARA recognizes the knowledge and experience of Aboriginal peoples and requires that Aboriginal traditional knowledge be taken into account when COSEWIC assesses a species. It also requires consultations to be held with Aboriginal people and that, when Aboriginal people are to be affected by a recovery program, action plan, management plan or critical habitat measures, the program, plan or measures must be prepared in cooperation with the Aboriginal communities concerned.

In 2012, 69 of the terrestrial species listed in Schedule 1 of SARA occured in Quebec. Waterfowl are largely absent from the list, with only the Eastern populations of Harlequin Duck and Barrow's Goldeneye included, both of which are designated as species of special concern.

Several provincial jurisdictions have their own laws on species at risk, including Quebec. In 1989, the Quebec government adopted *An Act respecting threatened or vulnerable species.* The objectives of this law, among others, are to prevent species living in Quebec from becoming extinct and to ensure the conservation of habitats of species designated as threatened or vulnerable. Following the coming into force of the Act, the government established a list of species likely to be designated as threatened or vulnerable. The assessment process is fairly similar to that used at the federal level under SARA.

As of the end of 2009, 38 wildlife species (or populations) were legally recognized as threatened or vulnerable in Quebec, including Harlequin Duck and Barrow's Goldeneye (Gouvernement du Québec 2009a). In addition, as of March 2010, 115 other wildlife species were listed as likely to be designated as threatened or vulnerable (Gouvernement du Québec 2010a).

12.5 *Canada Wildlife Act*

The *Canada Wildlife Act* was proclaimed in 1973. Among other things, it gives the Minister of the Environment of Canada the authority to (1) recommend, promote and undertake measures for the encouragement of public cooperation in wildlife conservation and interpretation; (2) enter into agreements with the provinces to provide for wildlife research, conservation and interpretation programs, particularly measures to protect endangered species; and (3) undertake programs for wildlife research and investigation. One example of these activities is the establishment of the *Species at Risk Act* Public Registry (SARA; Gouvernement du Canada 2010). The Public Registry provides access to information and documents related to species at risk in Canada (status reports, recovery plans, etc.) and also allows the public to make comments on documents.

The *Canada Wildlife Act* has a broad scope since it applies to all wildlife species in Canada, including both plants and animals. It also has an impact on waterfowl since the Minister can acquire land for research, conservation and interpretation concerning migratory birds and other wildlife. The *Wildlife Area Regulations* arise under the Act (see section 12.6 below). The Minister may also delegate any person to act as a wildlife officer to enforce the Act and the regulations.

12.6 *Wildlife Area Regulations*

The *Wildlife Area Regulations* arise under the *Canada Wildlife Act.* The purpose of wildlife areas, better known as National Wildlife Areas (NWA), is the conservation of critical habitats for migratory birds or other wildlife. Within the reserves, recreational activities such as hiking and birdwatching are only permitted when carried out in accordance with the regulations set by Environment Canada's CWS. Harvesting activities such as trapping, hunting and fishing require a permit and are not authorized unless allowed under certain management plans. NWAs are also places where the government promotes public education and research.

Canada has 51 NWAs, including eight in Quebec, located along the St. Lawrence to protect critical wetland habitat. NWAs are of paramount importance to waterfowl, which use them for nesting and staging during migration.

12.7 *Canadian Environmental Assessment Act, 2012*

The *Canadian Environmental Assessment Act, 2012* (CEAA 2012) offers an approach that aims to modernize the regulatory system and allows for natural resources to be developed in a responsible and timely way for the benefit of all Canadians. Under CEAA 2012, an environmental assessment focuses on potential adverse environmental effects that are within federal jurisdiction, including migratory birds, fish and their habitat, other aquatic species, effects that cross provincial or international boundaries, and effects that impact Aboriginal peoples. An

environmental assessment will consider a comprehensive set of factors that include cumulative effects, mitigation measures and comments received from the public.

In Quebec, important projects like natural resources development, including mineral, oil and gas, as well as projects of transportation infrastructure or energy generation, could require an environmental assessment under CEAA 2012.

At the end of an environmental assessment, the Minister of the Environment determines whether the project is likely to cause significant adverse environmental effects, taking into account mitigation measures that were identified during the environmental assessment. If it is determined that a project is likely to cause significant adverse environmental effects, the federal Cabinet will then decide whether these effects are justified in the circumstances. A decision statement is issued that sets out the decision and associated conditions with which the proponent must comply.

Follow-up programs are mandatory after all environmental assessments. These programs are intended to verify the accuracy of the predictions regarding potential environmental effects and to determine if mitigation measures are working as intended.

12.8 Federal Policy on Wetland Conservation

In May 1981, the Canadian government signed the Ramsar Convention, an international treaty that provides a framework for the conservation of internationally significant wetlands. Under the Convention, each signatory nation must adopt a wetland conservation policy. As a result, in 1991, the government issued the Federal Policy on Wetland Conservation, the main objective of which is to “promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future.” It should be noted that this policy only applies to federal lands. To achieve this objective, seven strategies were identified, including (1) managing wetlands on federal lands and waters and in other federal programs; (2) promoting wetland conservation in federal protected areas; and (3) conserving wetlands of significance to Canadians.

Wetlands are of critical importance to waterfowl, which use them for breeding, foraging and resting. Consequently, any initiative promoting the protection of wetlands will have a positive impact on this group of birds.

12.9 National Policy on Oiled Birds and Oiled Species at Risk

The National Policy on Oiled Birds and Oiled Species at Risk specifies the roles and approaches to be taken by various government authorities in the event of an oil spill or the presence of oiled migratory birds or oiled species at risk. Environment Canada’s CWS is responsible for implementing this policy, which targets all species of migratory birds and their terrestrial, freshwater, marine and inter-tidal habitats. As a fundamental principle, efforts are to be concentrated on preventing further damage to wildlife, for example by scaring unoiled birds away from the contaminated site.

Species most often affected by oil spills are those that dive under water to feed, such as alcids and sea ducks. The extent of damage to bird populations is influenced by such factors as the quantity and type of product spilled, as well as the location and time of year of the spill.

Because the risk of major oil spills is real in Quebec, the CWS has developed the Oil Spill Emergency Response Plan, under which it can ask non-governmental organizations or groups to undertake the recovery, rehabilitation or euthanization of oil-contaminated birds.

12.10 CWS Policy for the Management of Non-Indigenous Anatidae

This interim working policy was approved by CWS management in April 2003. It has two objectives: (1) to prevent the introduction and establishment of wild populations of species of Anatidae not native to Canada; and (2) to control, if necessary, wild populations of non-native Anatidae already established in Canada in order to protect native species.

The CWS drafted this working policy in response to concerns over the harm that could result to native migratory birds from the introduction of non-native species and their subsequent integration into wild populations. Potential problems include competition between native and non-native species for resources such as food and nesting sites; effects on the genetic integrity of native species resulting from crosses or hybridization; the introduction of diseases; predation on native species; and the development of conflicts with humans.

12.11 Law enforcement

In Quebec, Environment Canada's wildlife officers and the Quebec government's wildlife enforcement officers are responsible for enforcing the laws involving migratory species. Federal wildlife officers are mandated to enforce four laws (and their respective regulations) throughout the territory of Quebec: (1) *Migratory Birds Convention Act, 1994*; (2) *Canada Wildlife Act*; (3) *Species at Risk Act*; and (4) *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act*. Provincial wildlife enforcement officers provide support to federal officers in enforcing the *Migratory Birds Convention Act, 1994.*

Enforcement efforts involving waterfowl are concentrated during the hunting season (fall) and to a lesser degree in spring during the Snow Goose conservation hunt. Lastly, federal wildlife officers also provide general surveillance of protected areas, inspect avicultural and taxidermy operations and investigate reports of nest disturbance and sales of wild birds.

13. Main organizations involved in waterfowl conservation

Shortly after the EHJV was established in 1989, its Quebec partners agreed to work together and pool their efforts. Some of these partners are engaged directly in waterfowl conservation, while others are involved in general conservation efforts indirectly affecting waterfowl. In addition to the current EHJV partners (see section 1.4.1), a number of other organizations work to conserve waterfowl species. This section describes the major organizations involved in waterfowl conservation in the province.

13.1 Canadian Wildlife Service of Environment Canada

The CWS manages wildlife matters that are the responsibility of the federal government, including the protection and management of migratory birds and nationally significant wildlife habitat. In terms of waterfowl, the primary mandate of CWS is to administer the federal laws, regulations and policies related to various aspects of waterfowl conservation (see Chapter 12). The CWS is also directly involved in different plans, initiatives and strategies to conserve waterfowl populations at the national and international levels (see section 1.4 and Chapter 11). Lastly, the CWS carries out various monitoring activities (monitoring and surveys) to keep detailed track of changes in populations, in order to ensure that waterfowl conservation priorities reflect the current status of populations (see section 2.2).

13.2 Ministère des Ressources naturelles et de la Faune[5]

MRNF is responsible for the conservation and development of natural resources in Quebec, including wildlife and its habitat, within a framework of sustainable development and integrated management. The *Act Respecting the Conservation and Development of Wildlife* (RSQ, C-61.1) is the Department's main tool. This Act establishes various prohibitions and restrictions related to the conservation of wildlife resources and, among other things, gives the Quebec government the authority to draw up wildlife habitat plans authorizing various activities. The *Regulation respecting wildlife habitats* (C-61.1, r 18) lays out, for a vast range of habitats, different measures allowing their integrity to be maintained, to ensure that birds can complete all or part of their life cycle. The legal protection granted to fish habitat in the Act also benefits waterfowl using these lakes, marshes, swamps and floodplains. MRNF works closely with MDDEP at the various stages of the process of creating biodiversity and aquatic reserves.

The protection of land under various laws also allows the conservation of waterfowl habitats. In addition, components of the forest environment are protected under the *Regulation respecting standards of forest management for forests in the domain of the State* (F-4.1, r 7) and various administrative agreements targeting specific sites and species. MRNF also participates in a number of initiatives directly benefitting waterfowl and is one of the permanent partners of the EHJV in Quebec.

[5] See the note on the List of acronyms and abbreviations page.

13.3 Ministère du Développement durable, de l'Environnement et des Parcs[6]

MDDEP participates actively in the conservation of waterfowl habitats. Its mission is to protect the environment and conserve biodiversity in order to enhance the living environment of Quebecers.

MDDEP's mandate to protect ecosystems and biodiversity in Quebec arises under two key pieces of legislation, the *Natural Heritage Conservation Act* and *An Act respecting threatened or vulnerable species*. In order to build a network of protected areas on both private and public land, the Department can designate land as a national (i.e., provincial) park, biodiversity or aquatic reserve, ecological reserve or a "plant habitat for threatened or vulnerable species**."** Through its program "Partenaires pour la nature" (Partners for Nature), MDDEP also provides funding for conservation initiatives by non-governmental organizations to strengthen the network of protected areas on private land. Under the *Environment Quality Act* (RSQ, c Q-2), MDDEP ensures the environmental acceptability of projects affecting certain habitats such as wetlands by analyzing applications for authorizations and permits. Since 2008, MDDEP has been one of the Quebec EHJV partners.

13.4 Aboriginal organizations and Aboriginal involvement

The Aboriginal peoples have an essential role to play in species conservation. Increasingly, they are participating in conservation projects involving a number of wildlife species, including waterfowl. In addition, Aboriginal peoples have local and traditional knowledge that must be taken into consideration in waterfowl studies and research, particularly in northern Quebec. Such local and traditional knowledge is a real asset in the implementation of measures to conserve and protect natural resources.

Waterfowl harvesting has always been, and continues to be, a very important tradition for Quebec's Aboriginal peoples. Since the James Bay and Northern Québec Agreement was signed in 1975, Aboriginal organizations have played an increasingly important role in managing wildlife on their land. This agreement led to the creation of the Makivik Corporation and the Cree Regional Authority, whose mandates are to implement the conditions of the James Bay and Northern Quebec Agreement on behalf of Inuit and Crees respectively. The Resource Development Department of Makivik Corporation operates the Nunavik Research Centre at Kuujjuaq, which employs wildlife biologists and technicians to work on studies and projects related to wildlife and the environment, in collaboration with the Nunavik Hunting, Fishing and Trapping Association and various government agencies. On the Cree side, the Traditional Pursuits Agency manages the environment department of the Cree Regional Authority. This agency, which also employs biologists, works on environmental projects on Cree land or in the Cree communities, in cooperation with the Cree Trappers' Association.

Examples of conservation projects in Quebec with Aboriginal participation include:

1) Project by the Chisasibi Cree community to carry out, in collaboration with Environment Canada and other departments involved, an environmental assessment to collect, examine and interpret current information on the decline, distribution and abundance of eelgrass beds along the coast of James Bay

[6] See the note on the List of acronyms and abbreviations page.

2) Project under the Aboriginal Fund for Species at Risk to collect traditional ecological knowledge in the Cree community of Wemindji on lake sturgeon and the Harlequin Duck
3) Assessment of the waterfowl harvest by Nunavik Inuit communities
4) Project by the Huron-Wendat community under the Aboriginal Fund for Species at Risk to install nest boxes for Barrow's Goldeneye on the community's ancestral territory

In addition, over the years, a number of partnership agreements have been signed with Quebec Aboriginal organizations in order to carry out research projects directly related to the protection of migratory bird populations.

13.5 Ducks Unlimited Canada

Ducks Unlimited Canada (DUC) is a private non-profit organization whose mission is to conserve wetlands and associated habitats for North America's waterfowl and to promote a healthy environment for wildlife and people. Backed by 70 years of experience and knowledge acquired in research on waterfowl and wetlands, DUC's conservation work takes numerous forms. In the field, the organization conserves and restores wetlands and associated habitats. In the political arena, DUC presses for the adoption of measures promoting the conservation of wetlands and other habitats. It also runs environmental education programs to acquaint Canadians with wetlands and promote wetland conservation. DUC participates in a number of local, national and international initiatives, strategies and joint ventures (including EHJV) to ensure the conservation of wetlands and waterfowl populations.

13.6 Fondation de la faune du Québec

The Fondation de la faune du Québec (FFQ) was created by the Quebec government in 1984 and is under the jurisdiction of MRNF. The mission of this foundation is to promote the conservation and development of wildlife and habitats. It works to protect all of Quebec's wildlife species—birds, mammals, fish, amphibians and reptiles—whether they are at risk or not. The FFQ provides financial and technical assistance to community organizations wishing to participate in habitat conservation efforts and also contributes directly to habitat protection on private land. It is a permanent partner of the EHJV in Quebec. Since the FFQ supports wildlife conservation initiatives, its clientele comes from the wildlife, forestry, agricultural and environmental communities including wildlife territory managers, conservation organizations, hunting and fishing associations, logging companies, and agro-environmental advisory clubs.

13.7 Nature Conservancy of Canada – Quebec Section

The Nature Conservancy of Canada (NCC) is a private non-profit organization that works in partnership with landowners and individuals to directly protect Canada's most important natural heritage through property acquisition (donations, purchases, conservation servitudes and other mechanisms) and to manage these properties for the long term. As a leader in the conservation of natural habitats in the country, NCC has helped to protect over two million acres (800,000 ha) of ecologically sensitive land since 1962. In Quebec, the NCC initiative "Un fleuve, un parc" (One River, One Park)—which targeted 200 of the most biologically rich islands in the St. Lawrence River from Montréal to the Lake Saint-Pierre archipelago—resulted in the conservation of

numerous waterfowl habitats. NCC is also working to protect the Malbaie Barachois in the Gaspé region.

13.8 Société Duvetnor

A non-profit corporation, Société Duvetnor Ltée works to protect wildlife and wildlife habitats in the St. Lawrence estuary. The corporation currently owns five islands in the upper estuary totalling 1,165 ha, which host large colonies of aquatic birds. Since the 1990s, Duvetnor administrators and employees have been harvesting eiderdown from Common Eider nests every year (the hens use the down to cover the eggs and keep them warm). This activity also allows Duvetnor biologists to monitor breeding numbers and generates modest but crucial revenues, allowing the corporation to purchase the islands and recruit financial partners. These revenues have also enabled Duvetnor to enhance habitat on some islands so that it is suitable for nesting birds. In addition, it has developed several programs in line with its objectives: ecotourism development, construction of visitor facilities, habitat enhancements and scientific research on marine and terrestrial wildlife.

13.9 Wildlife Habitat Canada

Wildlife Habitat Canada (WHC) is a national conservation organization established in 1984 by Environment Canada, provincial wildlife agencies and conservation organizations working on wildlife issues. WHC is dedicated to building bridges between landowners, governments, non-governmental conservation organizations and industry. WHC's objectives are to promote the conservation, restoration and enhancement of wildlife habitat in order to maintain the diversity, distribution and abundance of wildlife; provide a funding mechanism for wildlife habitat conservation programs; and foster coordination and leadership. WHC funds habitat conservation projects with revenues from its sales of stamps and prints depicting wildlife habitat conservation in Canada. Most stamps are purchased by waterfowl hunters to validate their federal Migratory Game Hunting Permits. As well as receiving revenues from stamp and print sales, WHC solicits funding and donations from a wide range of government and private-sector partners in order to undertake conservation activities and projects.

13.10 Other organizations

We must also acknowledge the efforts of a multitude of other organizations that contribute to conservation efforts in the field in Quebec, including various regional waterfowl hunter associations, the Quebec-Labrador Foundation, Société Provancher and Société d'aménagement de la baie Lavallière, as well as many others. In addition, organizations such as Regroupement QuébecOiseaux, Observatoire d'oiseaux de Tadoussac and Bird Studies Canada manage projects to monitor waterfowl populations, providing an invaluable contribution to waterfowl conservation and the advancement of knowledge on waterfowl.

14. Implementation of the *Quebec Waterfowl Conservation Plan, 2011*

The aim of the *Quebec Waterfowl Conservation Plan, 2011* and *Status of Quebec Waterfowl Populations, 2009* (Lepage and Bordage 2013), both produced by CWS, was to review the current state of knowledge on waterfowl, waterfowl habitats and the threats faced by this group of birds. These two documents illustrate the importance of Quebec for waterfowl at the North American scale, during the nesting and other periods of the year (see species accounts and Table 2 in Lepage and Bordage 2013, and also Appendix 16.1 in this document). This importance is particularly true for the Canada Goose (Atlantic Population [100% of breeding pairs are found in Quebec] and North Atlantic Population [64%]), the American Black Duck (57%), the Common Eider (subspecies *dresseri* [32%] and *borealis* [23%]), the Harlequin Duck (Eastern Population [79%]), the Black Scoter (28%), the Barrow's Goldeneye (Eastern Population [100%]), the Hooded Merganser (28%), the Common Merganser (30%) and the Red-breasted Merganser (56%), that all have more than 20% of their population nesting in habitat in Quebec (Appendix 16.1). Furthermore, for each BCR, this Plan was also intended to determine priority species in each BCR, establish population objectives for priority species, assess the issues affecting, and the needs of, priority species, set measurable conservation objectives to help conserve priority species or groups of species, and recommend actions to be taken or maintained to fully conserve priority species.

It is now important that the listed conservation objectives and actions recommended for priority species in each of the BCR present in Quebec (chapters 4 to 9) be taken into account and utilized not only by CWS but by all stakeholders with a role to play in waterfowl conservation. Partnership and cooperation, a basic principle of NABCI, will be crucial in implementing the *Quebec Waterfowl Conservation Plan, 2011*. Coordinating conservation activities allows gains to be realized over a broader area, while avoiding duplication of effort. We believe that the BCR-based geographic framework will help us bring together all regional partners to plan and carry out bird conservation actions, but any other collaboration approach, even local, can be interesting if proposed actions are relevant. Appendix 16.1 presents a compilation of abundance and densities of waterfowl in each BCR as well as the importance of the BCRs amongst themselves concerning their contribution to waterfowl; the relative importance of the BCRs helps prioritize conservation measures at the time of their implementation.

Various partners and stakeholders can join in this effort, depending on the component and type of actions involved and their areas of expertise (see Table 8 below for a compilation of all suggested actions). CWS will take an active part in the implementation of suggested actions, as long as these actions are related to its mandate and according to available resources, budget and personnel. The recommendations issued in this document will be regularly analyzed by CWS and considered in a continuous process for improving migratory bird survey and monitoring activities.

Considering that several actions suggested under the **monitoring and surveys** component are regular recurring CWS activities, some actions go beyond, however, and CWS clearly cannot carry out all the needs listed under this component on its own (see component 1 in Table 8). Consequently, other organizations could play an important role in this area. CWS will take advantage of situations where increased collaboration is possible, for example with Aboriginal communities for northern BCRs. Aboriginal communities and organizations could, for instance, participate in the monitoring of populations of northern species by carrying out surveys and bird banding programs. Other collaborations could be established with the MRNF, which conducts

aerial surveys to document the use of WGAs even though obtaining accurate counts by species is not its objective.

Although monitoring waterfowl species is a crucial part of the **monitoring and surveys** component, habitat monitoring is equally important. In the mid-1990s, Environment Canada's St. Lawrence Centre instituted a survey of wetland vegetation in the fluvial section and part of the St. Lawrence estuary. The *Conservation Atlas of Wetlands in the St. Lawrence Valley* (Service canadien de la faune 2006) could serve to inspire a project to cover all of Quebec, including Nunavik. In addition, the Quebec section of Ducks Unlimited Canada has made a very significant contribution to habitat mapping with its highly accurate maps of the habitats in 15 of the 17 MRCs (Canards Illimités Canada 2007f), including making its efforts accessible to the public. This type of mapping project is a positive step in the long-term monitoring of habitats, including wetlands. For its part, CWS has been developing over the past few years a "landscape approach" in order to better identify the needs for habitat conservation of migratory birds. Pilot projects will provide development ideas for the future. Among other things, the establishment of collaborations, or the strengthening of existing ones, for mapping tools would be valuable. Such habitat data can be valuable in the understanding of potential changes that could affect waterfowl populations, either their distribution or abundance.

The actions recommended under the **knowledge acquisition** component for each BCR focus mainly on the ecology and population dynamics of priority species (see component 2 in Table 8); this component corresponds to the need for a "solid biological basis" as stipulated in the *Five-year Action Plan for the Implementation of the North American Bird Conservation Initiative in Québec* (Orientation 1) (Bélanger et al. 2003). One strategy to facilitate this would be to create a group of researchers from the Quebec university community and specialists from governmental and non-governmental organizations interested in waterfowl conservation and specializing in fields such as animal and plant physiology and ecology, animal health, ecotoxicology, sustainable development and ecosystem-based management. CWS could, among other things, ensure that this group is kept up to date on the various recommendations emerging from the strategic plans of the species joint ventures (BDJV, AGJV, SDJV) related to knowledge acquisition. These recommendations could provide opportunities for research projects since the joint ventures fund research. In addition, Environment Canada's Science and Technology Branch (EC–S&T) could play a role in this component since it is responsible for conducting research to better understand wildlife, biodiversity, water, air, soil, climate, environmental prediction and environmental technologies.

The **active surveillance** component mainly involves activities by CWS and Environment Canada related to the various emergency response plans (OSERP, AMEERP), harvest surveys (e.g., National Harvest Survey) and law enforcement (see component 3 in Table 8). Law and regulation enforcement is the responsibility of official agents, and Environment Canada plays an active role in this. But many other forms of surveillance exist, and other organizations can also play a role. For example, local organizations have in the past taken on the task of breeding colony surveillance, and some still occur. CWS has even observed benefits of simple human presence on some islands to prevent poaching, if this presence respects the birds' needs for tranquility (J.-F. Rail, CWS, pers. comm.). CWS could advise organizations interested in taking action in colony surveillance. Another area where contributions from experts could be particularly influential is in the evaluation of the environmental impacts of projects submitted under the *Canadian Environmental Assessment Act, 2012* and its regulations. It is desirable that CWS experts are consulted during the environmental assessment process so that they can make recommendations on species' requirements to ensure that projects do not cause any significant adverse environmental impacts. Environmental assessment is a key process in waterfowl

conservation due to its preventive nature. Lastly, several actions in this component will require increased surveillance either during the breeding season in certain MBSs and NWAs or during the hunting season.

Measures in the **environmentally sustainable practices** component almost always involve natural resource exploitation (and therefore logging, mining, oil and gas, and energy generation activities) or land use (including agriculture and industrial and urban development) (see component 4 in Table 8). If these actions are given serious consideration and are actually implemented, they will be among the measures with the greatest impact on the health of waterfowl populations and therefore on their long-term conservation. The very broad scope of these actions means that they will have a positive impact on all bird species and on biodiversity in general. The purpose of the proposed actions of this component is, in particular, to encourage the various stakeholders concerned to ensure that their practices for using and exploiting natural resources are sustainable and environmentally sound.

Federally, we should mention Fisheries and Oceans Canada's (DFO) Sustainable Development Strategy (Fisheries and Oceans Canada 2006), which aims to meet the needs of an evolving industry while recognizing the principles of sustainable development, as well as the precautionary approach and ecosystem-based management. Since fisheries and aquaculture can have an impact on marine ecosystems, DFO takes into account the effects of these activities on the other parts of the ecosystem, including other species caught incidentally and impacts on bottom habitat (management of environmental impacts). The measures proposed could certainly benefit waterfowl, particularly sea ducks, which can be affected either by overfishing of their prey or by incidental catches.

Incidental take is an issue for Environment Canada in accordance with the *Migratory Birds Regulations*. While these regulations, which arise under the *Migratory Birds Convention Act, 1994,* prohibit the harming of migratory birds and the disturbance or destruction of their nests and eggs, significant numbers of birds, nests and eggs are inadvertently destroyed by activities such as forestry, mining, agriculture, power generation, electricity transmission, fishing, infrastructure management and urban development. This type of inadvertent destruction is called incidental take and is illegal. Environment Canada is promoting compliance with the regulations by recommending, among other things, the avoidance of potentially destructive activities during key periods to reduce the risk of nest destruction (Environnement Canada 2011a). The guidelines for avoiding incidental take proposed by Environment Canada will help landowners, activity managers and industry representatives conducting activities and projects on lands and seascapes across Canada to comply with the *Migratory Birds Regulations*.

At the provincial level, the Quebec government enacted the *Sustainable Development Act* in April 2006. This law establishes a management framework for all Quebec government departments, agencies and enterprises by identifying 16 principles to be taken into account by government authorities when framing their actions. They include the following three principles, which have an impact on the environment: biodiversity preservation (species, ecosystems and natural processes that support life must be maintained in order to ensure the quality of human life); respect for ecosystem support capacity (human activities must be respectful of the support capacity of ecosystems and ensure the long-term survival of ecosystems); and responsible production and consumption (production and consumption patterns must be changed in order to make production and consumption more viable and more socially and environmentally responsible) (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2006). To administer the *Sustainable Development Act,* the Quebec government formulated the *Government Sustainable Development Strategy* (Gouvernement du Québec 2007), which

reaches over 150 government departments, agencies and government enterprises. To work towards achieving sustainable development, this strategy is asking each government department and agency to prepare and then implement an action plan establishing the means to be used to contribute to the objectives. MDDEP is responsible for coordinating all government action in the area of sustainable development and for promoting sustainable development within the government and Quebec society as a whole.

MDDEP's 2009–2014 strategic plan (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2009b) presents general directions for the Department, some of which concern waterfowl conservation. The direction entitled "combat climate change and reduce air pollution" is accompanied by the *2006–2012 Action Plan – Québec and Climate Change – A Challenge for the Future,* the goal of which is to reduce greenhouse gas emissions and put in place adaptive measures to climate change targeting the environment, natural resources and the territory (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2008). The biodiversity strategy (*Stratégie sur la diversité biologique*) of the Quebec government and the measures proposed (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2005b) could have beneficial effects on waterfowl conservation in the decades to come, since they target a substantial number of action areas (energy, wildlife, forests, agriculture, industry, mines, tourism and municipalities).

Among other governmental measures that could be beneficial to waterfowl is a new forest management model proposed by the MRNF, which incorporates innovative forest management approaches (including ecosystem-based forest management) and the impact of climate change on forests (Ministère des Ressources naturelles et de la Faune du Québec 2009a). The *Sustainable Forest Development Act* (2010) introduces changes to help strengthen this new forest management model. In the area of oil and gas exploration and development activities in the marine environment, the Quebec government has begun developing a strategic environmental assessment program aimed at providing a framework for future offshore oil and gas exploration and development (Gouvernement du Québec 2009b). The publication of the final synthesis report, which will include recommendations to protect the marine environment from the effects of future offshore oil and gas development, was expected in 2012. In the area of wind power, MRNF has implemented measures to ensure that wind farms respond to environmental concerns. To obtain project authorization, wind farm developers are now required to establish a monitoring program for birds and bats—to be carried out for three years after the wind farm is commissioned—to assess mortality in birds and their use of the wind farm. Lastly, one of the three directions of Quebec's mineral strategy, adopted in 2009 and coordinated by the MRNF, is to ensure environmentally sustainable mineral development (Ministère des Ressources naturelles et de la Faune du Québec 2009c).

In the field of agriculture, the report by the Pronovost commission on the future of agriculture and agri-foods in Quebec (Commission sur l'avenir de l'agriculture et de l'agroalimentaire québécois), which was published in 2008, has inspired a new vision of agriculture at MAPAQ. One of the action priorities established in light of the report is environmental protection (Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec 2009a). Actions taken in the following areas will have an unquestionable impact on wildlife habitat in agricultural environments: improving water quality, reviewing the phytosanitary (pest control) strategy to favour alternatives to pesticides and the wise use of pesticides, and implementation and expansion of the Prime-Vert program. The Prime-Vert funding program, which runs until 2013, was set up by MAPAQ to help farm producers meet the challenges of environmentally sound land stewardship, successful integrated land management, water quality and the reduction or prevention of greenhouse gas emissions (Ministère de l'Agriculture des Pêcheries et de

l'Alimentation du Québec 2009b). MAPAQ also intends to help aquaculture operations reduce phosphorus discharges through its freshwater aquaculture sustainable development strategy (Stratégie de développement durable de l'aquaculture en eau douce), one of the aims of which is to protect the aquatic environment (Table filière de l'aquaculture en eau douce au Québec 2003).

The 2009–2013 action plan adopted by the Ministère des Affaires municipales, des Régions et de l'Occupation du territoire (MAMROT) recommends that sustainable development concerns be integral to the review of *An Act Respecting Land Use Planning and Development* and how it is administered, and that the capacity of local municipalities, MRCs and metropolitan communities to integrate sustainable development principles into urban and land-use planning be improved (Ministère des Affaires municipales des Régions et de l'Occupation du territoire 2009). These measures could have repercussions on waterfowl conservation in urban and peri-urban environments. In addition, MAMROT publishes a collection of best practices guides on land-use planning and sustainable development.

The *Sustainable Navigation Strategy for the St. Lawrence* is a St. Lawrence Action Plan initiative arising under the third Canada–Quebec Agreement on the St. Lawrence. The aims of the strategy include harmonizing navigation activities with the protection of river ecosystems and other uses of the St. Lawrence (D'Arcy and Bibeault 2004). Some of the measures proposed in the strategy include a voluntary speed reduction measure for ships in the Montréal-Sorel section (the most sensitive stretch between Cornwall and Montmagny) to counter wake erosion and the documentation of the impact of pleasure boating on shoreline erosion in the narrow channels in Lake Saint-Pierre. The prevention of shoreline erosion of this sector preserves breeding habitat for waterfowl.

Environmental organizations, as well as governments and their departments, can participate in implementing the actions listed under the **environmentally sustainable practices** component. Examples include the pilot project launched by the Fondation de la faune du Québec to enhance biodiversity in agricultural watercourses, carried out in collaboration with the Union des producteurs agricoles and many other private and government partners (Fondation de la faune 2009). Regroupement QuébecOiseaux has produced a brochure on protecting Barrow's Goldeneye and has conducted a campaign to educate operators of fishing territories (ZECs and outfitters) about the importance of fishless lakes to this species (Regroupement QuébecOiseaux 2010). Also of interest is the existence of two funding programs dedicated to support community projects: the Community Interaction program–St. Lawrence Action Plan and the EcoAction program. The component environmentally sustainable practices also includes actions to promote awareness in the public; local organizations would be ideal partners in these types of measures, since they can tailor the message to the local audience (e.g., educating pleasure boaters about the importance of not landing on islands in the fluvial section during the nesting and brood-rearing periods).

All these measures, and others not listed, affect waterfowl directly or indirectly and respond to the concerns raised in the actions recommended under the **environmentally sustainable practices** component. To go even further, it would be important that the various networks of participants and decision-makers get inspiration through this document so that the conservation of migratory birds, including waterfowl, will be integrated in the planning of human activities.

Since, under the **habitat measures** component, a number of the objectives and proposed actions involve carrying out conservation measures in the field (see component 5 in Table 8), the EHJV appears the ideal vehicle for achieving results. The EHJV, with 20 years of experience

and expertise in this area, has a long list of conservation achievements behind it, including the protection and restoration of wetlands and adjacent upland habitats along the St. Lawrence, Ottawa and Saguenay rivers, in the Abitibi region and in the boreal forest. The EHJV has incorporated new conservation challenges targeting all bird species and not just waterfowl in its 2007–2012 strategic plan (Eastern Habitat Joint Venture 2007). Noteworthy actions taken by EHJV partners include regional conservation plans and detailed wetland mapping by Ducks Unlimited Canada to build awareness of the importance of wetlands among elected officials, land managers, land-use planning authorities, other local stakeholders and the public.

In addition to the EHJV partners, other organizations, whether government agencies or non-governmental organizations, can participate in habitat conservation actions targeting particular sites or a specific type of measure. To optimize opportunities for protecting the environment, it is important to take advantage of all existing programs—not only species joint ventures but also recovery and management plans for species at risk, the Ecological Gifts Program, Habitat Stewardship Program for Species at Risk, various federal programs (Interdepartmental Recovery Fund, Endangered Species Recovery Fund, Aboriginal Capacity Building Fund and Aboriginal Critical Habitat Measures Fund), Fondation Hydro-Québec pour l'environnement, Partenaires pour la nature and others.

Two government initiatives are particularly noteworthy in the context of waterfowl conservation. First, the Federal Marine Protected Areas Strategy, coordinated by DFO, provides a framework for the establishment of a network of marine protected areas to contribute to the health of Canada's oceans and marine environments (Fisheries and Oceans 2005). The responsibility for the network and for establishing and managing these areas is shared by DFO, Parks Canada and Environment Canada. Among the three types of protected federal areas provided in the strategy are Marine Wildlife Areas, which could be created to protect and conserve habitat for a variety of wildlife including migratory birds and endangered species. The other government initiative is the network of protected areas in Quebec overseen by MDDEP under the *Natural Heritage Conservation Act*. The objective of the Act is to safeguard the character, diversity and integrity of Quebec's natural heritage through measures to protect its biological diversity and the life-sustaining elements of natural settings (Gouvernement du Québec 2010b). Protected areas recognized by MDDEP cover a broad spectrum ranging from ecological reserves to national parks, wildlife habitats, national wildlife areas and natural habitats on private land set aside for conservation purposes. These protected areas are managed by various levels of government (Environment Canada [NWA and MBS], Parks Canada [national parks and national park reserves of Canada] and DFO [protected marine areas; none exists yet in Quebec]), corporate bodies and individuals. As of November 2009, protected areas covered 8.14% of Quebec's territory (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2009a), but new protected areas are planned since the Quebec government has announced the protection of 12% of the province by 2015 (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2009b).

Lastly, we should say a few words about waterfowl gathering areas, one of the types of protected areas recognized by MDDEP. The *Regulation respecting wildlife habitats* defines a waterfowl gathering areas as an area frequented by geese or ducks (50 birds/km) during the nesting or migration seasons. One of the actions proposed under this Waterfowl Conservation Plan is the protection of sites frequented during the moulting or wintering period. Since several waterfowl gathering areas are also moulting areas (e.g., Jérémie Islets, Mille-Vaches Bay) or wintering areas (e.g., La Malbaie, Pointe aux Ivrognes) supporting large concentrations of ducks, the possibility of including all concentrations of aquatic birds throughout the year, regardless of the period in which birds are present, should be considered.

Along with the laws, regulations and policies described in Chapter 12, most of which are administered by the federal government, other tools can be used to assist in the implementation of the **habitat measures** component. The MDDEP administers the *Politique de protection des rives, du littoral et des plaines inondables* (Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains), which was amended in 2005 to better protect the high-velocity zones of floodplains (i.e., the part of a floodplain that may be flooded during a 20-year flood event) (Gouvernement du Québec 2005). In addition, MDDEP was in the process of formulating a wetland conservation and sustainable management policy in 2007, which should help to promote, provide a framework for, and improve the sustainable management of wetlands in Quebec, particularly those on private land (Ministère du Développement durable de l'Environnement et des Parcs du Québec 2007).

To close this chapter on implementing the Waterfowl Conservation Plan, we believe it is essential to take full advantage of the potential synergy between the various conservation initiatives. Initiatives and partnerships should look beyond waterfowl and broaden their notion of conservation to include all priority bird species, which will benefit biodiversity in general. For example, the regular updates of NAWMP should be seen as opportunities to consider new ways of doing things, and the review of laws and policies as opportunities to integrate good management practices. It will also be crucial to keep Aboriginal organizations and representatives informed of actions and projects involving waterfowl conservation so that they can participate fully in conservation efforts. To conclude, even though biodiversity was the subject of an international year in 2010, let us hope that it will not get forgotten but instead that it will gather more interest and remain on the program.

Table 8. List of all actions proposed for the priority species by component and potential contributors for the implementation of the actions. The actions are described in detail in the BCR chapters where they are proposed. Under the BCR columns, check marks indicate which BCRs are concerned with the action; check marks in bold mean that the BCRs are particularly important for that action.

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 1 – Monitoring and surveys							
Continue **WUPL and WLOW**.	**√**	√	√	**√**			EC-CWS, USFWS
Continue **WNOR**.					√	**√**	EC-CWS, USFWS
Continue **BGTWS**.		√		**√**			EC-CWS
Continue **GSGOS**.	**√**	√	√	√			EC-CWS
Continue **CETWS**.		√		**√**			EC-CWS
Continue the **Quinquennial Census of Seabird Populations** (for the Common Eider) in the Sanctuaries of the North Shore of the Gulf of St. Lawrence.				**√**			EC-CWS
Encourage the continuation of the **annual survey of Common Eider colonies in the estuary** that is carried out as part of eiderdown harvesting activities.		√		√			EC-CWS, Société Duvetnor, Société protectrice des eiders de l'estuaire
Institute a **breeding pair survey specially tailored to the Harlequin Duck**.		√		√	**√**		EC-CWS
Institute a **monitoring program of the Common Eider main colonies** for the subspecies *borealis* and *sedentaria*.					√	**√**	Inuit organizations, EC-CWS
Continue the **pre-season banding program** in southern Quebec.	√	√		√			EC-CWS
Maintain and improve the Common Eider **banding program** for the subspecies *dresseri*.		**√**		√			EC-CWS, UQAM, Société Duvetnor
Continue the Canada Goose **banding program** and re-activate the Canada Goose **productivity monitoring program**.						**√**	EC-CWS, USFWS Inuit organizations
Institute a **banding program** in northern Quebec for priority species other than the Canada Goose.					√	**√**	EC-CWS, Inuit organizations
Institute a **monitoring program of sea ducks overwintering** in ice-free pelagic zones in the St. Lawrence (aside from *borealis* Common Eider).		√		√			EC-CWS
Institute a **monitoring program of breeding priority species in the Hudson Plains and Taiga** (between the areas currently surveyed by WUPL and WNOR).					**√**		EC-CWS
Institute a **monitoring program of priority species in major moulting areas** (prerequisite: locate moulting areas of priority species in James Bay, Hudson Bay, Hudson Strait and Ungava Bay).		√		√	√	√	EC-CWS, Inuit and Cree organizations
Institute a **spring survey of migrants** of priority species that do not breed in Quebec (e.g. Brant in BCR 14 and 7) and/or in key migrating sectors (e.g. James Bay).		√			√		EC-CWS, MRNF (through WGA), Inuit and Cree organizations
Institute a **survey to monitor the productivity** of priority species.	√	√	√	√	√		EC-S&T, EC-CWS
Continue the **St. Lawrence freshwater wetland monitoring program**.	**√**						EC-S&T

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 1 – Monitoring and surveys (continued)							
Institute a **survey of select key wetlands** used by certain priority species.	√	√	√	√			EC-CWS, SLAP partners, Ducks Unlimited Canada
Continue the **monitoring of water quality** in the fluvial section of the St. Lawrence and the **monitoring of toxic sediment contamination** in the St. Lawrence.	√	√	√	√			EC-S&T, MDDEP, DFO
Consider the **addition of WUPL plots** further north in the Côte-Nord region to provide better coverage of the breeding range of Barrow's Goldeneye.				√	√		EC-CWS
Carry out a survey of **potential nesting lakes** in the Gaspé region and in the southeastern quarter of BCR 7 to determine if Barrow's Goldeneye breeds there. If the species does breeds in these lakes, consider implementing a monitoring program of the breeding population.		√			√		EC-CWS
Institute a **monitoring program of wintering American Black Duck** to document changes and assess if they are related to climate change.	√		√	√			EC-CWS
Continue **fall surveys to calculate the ratio of young to adults** to be able to measure annual productivity in the Greater Snow Goose population over the long term.	√	√		√			EC-CWS
Continue to **locate neck-collared individuals** of Greater Snow Goose in spring and fall.	√	√		√			EC-CWS
Re-activate the **monitoring of bulrush marsh ecological integrity** (Cap Tourmente and Côte-du-Sud).	√						EC-CWS
Institute a **survey of select key eelgrass beds** used by Brant in James Bay.					√		EC-S&T, EC-CWS, Cree organizations
Continue **banding Resident Canada Geese**.	√						EC-CWS, UQAM
Component 2 – Knowledge acquisition							
Determine the **most important parameters** (e.g., adult survival by season, productivity) in the annual cycle of priority species in order to guide monitoring and conservation efforts.	√	√	√	√	√	√	Academic and government researchers, BDJV, SDJV
Determine **local factors** (e.g., habitat characteristics, food resources) that have an impact on the breeding of priority species.	√	√	√	√	√	√	Academic and government researchers, BDJV, SDJV
Determine **regional factors** (e.g., climate, food resources) that have an impact on the overwintering, the moulting and the migration of priority species.	√	√	√	√	√	√	Academic and government researchers, BDJV, SDJV
Determine the **abundance and distribution** of priority species according to wetland type and wetland location in the BCR; locate priority habitats that face threats and develop strategies to curb these threats.	√	√	√	√	√	√	Academic and government researchers, EHJV, BDJV, SDJV, NGOs

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 2 – Knowledge acquisition (continued)							
Determine **links between breeding grounds, moulting areas and wintering grounds** (delineation of populations) for the priority species.	√	√	√	√	√	√	Academic and government researchers, BDJV, SDJV
Determine if **moulting areas** of priority species are facing threats, and if so, develop strategies to curb these threats.		√		√	√	√	Academic and government researchers, EC-CWS, BDJV, SDJV, Inuit and Cree organizations
Locate the **best habitats** to be protected for certain priority species.	√	√	√	√	√	√	Academic and government researchers, EC-CWS, NGOs, EHJV, BDJV, SDJV, AGJV
Determine **contaminant levels** in immature and adult Barrow's Goldeneyes overwintering in the Baie des Anglais.				√			Academic and government researchers
Determine the **northern limit of the Barrow's Goldeneye's breeding range** in Quebec.				√	√		EC-CWS, academic and government researchers
Determine the **longevity of snags** (depending on the type) and the **recruitment rate** of this essential component for the Barrow's Goldeneye's breeding.			√	√			Academic and government researchers
Determine the **natal region of American Black Ducks bagged in the sport and Aboriginal harvests** to preserve local breeding populations as well as migrant and wintering populations identified as vulnerable.	√	√	√	√			EC-CWS, academic and government researchers, BDJV
Determine the **origin of the American Black Ducks that overwinter** in the St. Lawrence estuary.		√	√	√			EC-CWS, academic and government researchers, BDJV
Determine the **origin of the American Black Ducks that frequent the tidal flats around islands in the estuary in fall**.		√	√	√			EC-CWS, academic and government researchers, BDJV
Locate **key staging areas** used by the American Black Duck during spring and fall migration so that they can be protected if required.	√	√	√	√			EC-CWS, MRNF (through WGA), academic and government researchers, BDJV
Develop an **effective survey technique for monitoring eider colonies** (e.g., counting males) that can be used throughout the Common Eider *dresseri*'s breeding range.		√	√	√			EC-CWS, EC-S&T, SDJV
Determine if the Common Eider *dresseri* should be **managed under different populations**, and if so, develop models for these populations.			√	√			EC-CWS, academic and government researchers, SDJV
Determine the **impact of gull predation on duckling survival** of the Common Eider subspecies *dresseri*.			√	√			Academic and government researchers, SDJV, NGOs

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 2 – Knowledge acquisition (continued)							
Determine the **impact of predation on colonies** of the Common Eider in the Lower North Shore.				√			Academic and government researchers, SDJV, NGOs
Study the dynamics of **avian cholera** and the proximate causes promoting epidemics.			√	√	√	√	Academic and government researchers
Determine if **climate change** is having an impact on the breeding and wintering habits of Common Eider.			√	√	√	√	Academic and government researchers, SDJV
Quantify the **potential for overlap between the activities of the commercial fishery and aquaculture industry** on one hand and the use of the marine environment by priority species of sea ducks on the other.			√	√			Academic and government researchers
Determine the **food sources used by Greater and Lesser scaup** in their major staging areas to determine if these resources are limited or threatened.	√						Academic and government researchers
Compare the **current distribution and abundance of Greater and Lesser scaup in their major staging areas** with abundance and distribution in the 1970s and 1980s.	√						Academic and government researchers
Accurately determine the **specific proportion of Greater and Lesser scaup** in mixed flocks of migrants.	√			√			EC-CWS, MRNF (through WGA)
Locate the **best eelgrass beds and marshes** to be protected for Brant.	√	√	√	√	√		EHJV, EC-CWS, Cree organizations
Determine the **causes promoting the appearance of the pathogen Labyrinthula zosterae**, responsible for eelgrass wasting disease.					√		Academic and government researchers
Determine the **cause or causes responsible for the local decline of eelgrass** in James Bay.					√		Academic and government researchers, Cree organizations
Quantify the **effect of isostatic uplift** on coastal habitats in James Bay.					√		Academic and government researchers, Cree organizations
Determine **food sources** for Long-tailed Ducks and Red-breasted Mergansers on their wintering grounds.			√	√			Academic and government researchers, SDJV
Monitor **changes in the dispersal** of Greater Snow Geese in response to changes in agricultural practices and to management measures undertaken.	√	√	√	√			Academic and government researchers, EC-CWS, AGJV
Improve **models for predicting Greater Snow Goose population trends** in response to various management scenarios.	√						Academic and government researchers, AGJV
Compare the **productivity of Wood Ducks** nesting in natural cavities with conspecifics using artificial nest boxes.	√		√	√			Academic and government researchers
Determine the **importance of cavities excavated by Pileated Woodpeckers** for breeding Wood Duck.	√		√	√			Academic and government researchers

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 2 – Knowledge acquisition (continued)							
Study the **impacts of the increase in the population of Resident Canada Geese** on duck habitats and productivity.	√	√	√				Academic and government researchers
Determine if the presence of moulting Resident Canada Geese in BCR 3 is having an **impact on the habitat's carrying capacity**.						√	Academic and government researchers
Component 3 – Active surveillance							
Encourage consultation with CWS specialists during **environmental assessment processes** in order to obtain recommendations related to priority species.	√	√	√	√	√	√	EC, MDDEP
Continue the **Harvest Questionnaire Survey** and the **Species Composition Survey** (Wingbee).	√	√	√	√			EC-CWS
Institute a **special sea duck harvest survey** to be able to estimate as accurately as possible the harvest of priority species.	√	√	√	√			EC-CWS
Institute a **survey on the migratory bird harvest and egg collecting by Aboriginal people** (e.g., Innu, Crees, Inuit, Naskapis), to assess the harvest of priority species.				√	√	√	EC-CWS, Innu, Naskapi, Inuit and Cree organizations
Ensure the efficacy of the **CWS Oil Spill Emergency Response Plan**.	√	√	√	√	√	√	EC-CWS
Ensure the efficacy of the **CWS Avian Mortality Events Emergency Response Plan**.	√	√	√	√	√	√	EC-CWS
Ensure **adequate surveillance**: • in NWAs, particularly during the nesting period, in NWAs located in the fluvial section, in the Îles de l'Estuaire NWA, and in North Shore Migratory Bird Sanctuaries; • during the spring conservation hunt for the Greater Snow Goose and the fall hunt for all species (particularly along the Ottawa River); • areas where goldeneyes congregate during the sport hunt; • during the spring migration of the Common Eider along the Lower North Shore; • regarding the use by some hunters of cartridges with lead shot.	√	√	√	√			EC-Enforcement Branch
Provide advice to the **International Joint Commission** and inform it on the requirements of priority species.	√	√					EC-CWS
Continue to pursue cooperative efforts and actions put forward under the **Great Lakes Water Quality Agreement** and the **Great Lakes Air Quality Agreement**.	√	√	√	√			EC
Continue the **Greater Snow Goose spring conservation hunt** as an exceptional management measure until the objective for the population as a whole has been achieved.	√	√	√	√			EC-CWS

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 3 – Active surveillance (continued)							
Follow up on **management actions**, either long-standing or new, aiming to increase the sport harvest or control the population of Resident Canada Geese.	√	√	√	√			EC-CWS, members of the Table de concertation sur la gestion de la Grande Oie des neiges
Educate the public about **potential issues arising from the cohabitation** of Resident Canada Geese and humans.	√	√	√	√			EC-CWS
Component 4 – Environmentally sustainable practices							
Promote **sustainable, ecological agriculture** which ensures the presence of suitable waterfowl habitat (riparian strips, healthy aquatic habitats, etc.).	√	√					EC-CWS, Clubs conseils en agroenvironnement, MAPAQ, Union des producteurs agricoles, NGOs, MDDEP
Educate farmers about the **issues arising from drainage practices that are degrading cordgrass marshes** (particularly along the upper estuary between Kamouraska and L'Isle-Verte).		√					EC-CWS, Clubs conseils en agroenvironnement, MAPAQ, Union des producteurs agricoles, NGOs, MDDEP
Raise awareness among farmers of **the environmental issues associated with large-scale monocultures** (grains, soybeans, corn) to counter the loss of breeding habitats (forest patches, forested and shrubby riparian strips, agricultural wildland or abandoned fields, etc.).	√						EC-CWS, Clubs conseils en agroenvironnement, MAPAQ, Union des producteurs agricoles, NGOs, MDDEP
Raise awareness among island landowners and farmers in the fluvial section of the **need to preserve crucial breeding habitats** (particularly tallgrass meadows) on islands and to keep livestock away from the shoreline to prevent trampling, which exacerbates the erosion problem.	√						EC-CWS, Clubs conseils en agroenvironnement, MAPAQ, Union des producteurs agricoles, NGOs, MDDEP
Raise awareness among farmers and private landowners of the **importance of preserving agricultural woodlots and trees with nesting cavities**.	√	√					EC-CWS, Clubs conseils en agroenvironnement, MAPAQ, Union des producteurs agricoles, NGOs, MDDEP
Raise awareness among landowners of **old-growth forests (exceptional forest ecosystems) located on private land** of the importance of protecting them.	√	√					EC-CWS, MRNF, NGOs Clubs conseils en agroenvironnement, MAPAQ, Union des producteurs agricoles,
Increase awareness among the authorities responsible for forest management and harvesting on **preserving riparian strips**.		√	√	√			EC-CWS, MRNF
Increase awareness among the authorities responsible for forest management and harvesting on the **importance of maintaining sufficient numbers of large trees and of protecting trees with cavities for cavity-nesting ducks**.		√	√	√			EC-CWS, MRNF

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 4 – Environmentally sustainable practices (continued)							
Increase awareness among the authorities concerned by natural resource exploitation to **avoid constructing roads near fishless lakes** in order to reduce access to these lakes.			√	√			EC-CWS, MRNF, MDDEP
Raise awareness among outfitters and land managers who **stock fishless lakes of the potential impacts of this practice on Barrow's Goldeneye**.			√	√			EC-CWS, Québec Outfitters Federation, SÉPAQ, MDDEP, NGOs
Increase awareness among mining authorities on the effects of this activity on priority species, particularly the **potential contamination of watercourses by mine tailings**.				√	√	√	EC-CWS, MRNF, MDDEP
Increase awareness among the authorities responsible for hydroelectric development on the **importance of conserving wetlands, lakes and rivers** suitable for priority species.				√	√		EC-CWS, MRNF, Hydro-Québec
Raise awareness among commercial peatland users of the importance of **leaving strips of residual vegetation at least five metres wide** for nesting American Black Ducks.	√	√		√			EC-CWS, MRNF, MDDEP, Québec Peat Moss Producers Association
Encourage efforts to **reduce toxic effluent discharges by upstream industries in the fluvial section** since sediments in lakes Saint-François, Saint-Louis and Saint-Pierre are still contaminated.	√						St. Lawrence Action Plan, EC, MDDEP
In the event that **shipping traffic** is likely to increase in Hudson Strait or if coastal development is envisaged (e.g., Ungava Bay and Ungava Peninsula), raise awareness among the responsible authorities regarding the requirements of priority species during the migration and moulting periods.					√	√	EC-CWS, DFO, MDDEP, Inuit organizations
Promote awareness among **aquaculture operators** of the issue of conflicts with certain species of sea ducks.		√		√			EC-CWS, MAPAQ, NGOs
Raise awareness among the authorities responsible for land-use planning and development (residential and industrial development) of the **importance of wetlands conservation**.	√	√	√	√			EC-CWS, MAMROT, Union of Quebec Municipalities, NGOs
Raise awareness among the authorities responsible for land-use planning and development (cottage and resort development) regarding the **issues with the modification of natural shorelines**.	√	√	√	√			EC-CWS, MAMROT, Union of Quebec Municipalities, NGOs
Raise awareness among the responsible authorities of the **importance of treating wastewater before it is discharged**, which is not being done by certain municipalities in the Bas-Saint-Laurent region.		√					EC-CWS, MAMROT, Union of Quebec Municipalities, NGOs
Raise awareness among **all authorities responsible for managing populations of *borealis* Common Eider** on the conservation of this subspecies.				√	√	√	EC-CWS, EC-S&T, Nunavut, Nunatsiavut and Denmark governments, Inuit and Innu organizations
Raise hunters' awareness of the importance of respecting regulations on **daily bag and possession limits for American Black Duck and Blue-winged Teal.**	√	√	√	√			EC-CWS, Fédération québécoise des chasseurs et pêcheurs, NGOs

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 4 – Environmentally sustainable practices (continued)							
Make hunters aware of the importance **of respecting current regulations prohibiting the hunting of the Harlequin Duck**.	√	√	√	√			EC-CWS, Fédération québécoise des chasseurs et pêcheurs, NGOs
Make hunters aware of current regulations on **the season and daily bag and possession limits for Barrow's Goldeneye**.	√	√	√	√			EC-CWS, Fédération québécoise des chasseurs et pêcheurs, NGOs
Make hunters aware of the importance **of knowing how to reliably distinguish Barrow's Goldeneye from Common Goldeneye in the field**.	√	√	√	√			EC-CWS, Fédération québécoise des chasseurs et pêcheurs, NGOs
Raise awareness among hunters of the **issue of disturbing scaup in their staging areas in fall** (e.g., WGA in western part of Lake Saint-Pierre).	√						EC-CWS, Fédération québécoise des chasseurs et pêcheurs, NGOs
Promote awareness among outfitters, fishing guides and whitewater guides of the importance of **not disturbing Harlequin Ducks during the nesting and brood-rearing periods**.		√		√			EC-CWS, Québec Outfitters Federation, Fédération québécoise du canot et du kayak, NGOs
Raise awareness among canoeists and anglers of the importance of **not approaching Harlequin Ducks during the nesting and brood-rearing periods**.		√		√			EC-CWS, Fédération québécoise des chasseurs et pêcheurs, Fédération québécoise du canot et du kayak, NGOs
Ensure that **eiderdown harvesting** is carried out according to best practices (by permit holders for the St. Lawrence Estuary colonies and by Innu and Inuit).		√		√	√	√	EC-CWS, Innu and Inuit organizations, NGOs
Promote awareness among the Innu and Inuit who **collect eggs** of the Common Eider about the potential repercussions of this activity.				√	√	√	EC-CWS, Innu and Inuit organizations, NGOs
Raise awareness among pleasure boaters of the importance of **reducing their speed in channels** and when **navigating close to the shoreline** in order to lessen the impact of waves on shore erosion.	√						EC-CWS, Transport Canada, NGOs
Raise awareness among pleasure boaters and kayakers of the importance of **avoiding all disturbance to waterfowl on islands in the fluvial section in summer** (not coming ashore on islands during the nesting and brood-rearing periods and not approaching birds during the moulting period).	√						EC-CWS, Fédération québécoise du canot et du kayak, NGOs
Raise awareness among pleasure boaters and kayakers of the importance of **respecting bans on landing or coming ashore on islands in the estuary** and of not disturbing Common Eiders during the critical incubation and brood-rearing periods.		√		√			EC-CWS, Fédération québécoise du canot et du kayak, NGOs
Make pleasure boaters and kayakers aware of the importance of **not disturbing moulting Harlequin Ducks** when circulating near known moulting areas.		√					EC-CWS, Fédération québécoise du canot et du kayak, NGOs

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 4 – Environmentally sustainable practices (continued)							
Raise awareness among the public of the issue of **invasive species and practices to prevent their spread**.	√	√					EC-CWS, NGOs, MDDEP, MRNF, DFO
Educate the public about the **importance of snags for cavity-nesting ducks**.	√	√	√	√			EC-CWS, NGOs, MRNF
Component 5 – Habitat measures							
Acquire, restore or protect important **cordgrass marshes** that do not yet have protected status when possible.		√		√			EHJV, SLAP partners, municipalities/MRCs, NGOs
Acquire, restore or protect important **eelgrass beds** that do not yet have protected status when possible.		√					EHJV, SLAP partners, municipalités/MRCs, NGOs
Acquire, restore or protect **natural peatlands**, for example: • create a corridor of protected natural peatlands in the Arthabasca, Bécancour, de l'Érable, Bellechasse, Lévis and Lotbinière MRCs; • increase the connectivity between peatlands in the vicinity of the Baie de L'Isle-Verte NWA (e.g., integrate the Bois-des-Bel bog with the NWA); • create a protected buffer zone around the Baie de L'Isle-Verte NWA; • protect some of the few large unaltered peatlands in the Estrie region (e.g., hills around Lake Memphrémagog and Coaticook-Scotstown Plateau); • on the Upper and Middle North Shore (e.g., on the Manicouagan Peninsula).	√	√		√			EHJV, SLAP partners, municipalities/MRCs, NGOs
Acquire, restore or protect **emergent marshes** in the Lake Saint-Louis–Lake Saint-Pierre section (particularly the Lake Saint-Pierre archipelago); specifically, restore marshes that are choked with vegetation.	√						EHJV, MDDEP, municipalities/MRCs, NGOs
Stabilize **banks** to combat erosion and the loss of island habitat, particularly in the Îles de la Paix, Varennes and Contrecœur (particularly the barrier silands in the NWA) islands and the Lake Saint-Pierre archipelago.	√						EHJV, municipalities/MRCs, NGOs
Restore **salt marshes** where the creation of drainage canals has resulted in the drying up of the marsh and pools.		√					EHJV, municipalities/MRCs, NGOs
Restore **aboiteaus** that can be restored; removing dikes can restore exchanges between diked marshes and the St. Lawrence.		√					EHJV, municipalities/MRCs, NGOs
Conserve and protect **woodlots containing streams, ponds and lakes** in agricultural and mixed agricultural and forest landscapes.	√	√	√	√			EHJV, SLAP partners, municipalities/MRCs, NGOs
For **key moulting, wintering or staging areas** used by priority species that are designated as a waterfowl gathering area, extend protection to this critical period of the birds' annual cycle.		√		√			MDDEP, EHJV

ACTION	BCR 13	BCR 14	BCR 12	BCR 8	BCR 7	BCR 3	POTENTIAL CONTRIBUTORS
Component 5 – Habitat measures (continued)							
For **key moulting, wintering or staging areas** that have no protection at all, ensure they are protected by having them designated as a Marine Wildlife Area, for example.		√		√			EC, Parks Canada, MDDEP, DFO
Acquire or protect **key nesting sites of Common Eider** that do not yet have protected status (e.g., North Shore, around the Ungava Peninsula).				√	√	√	EC, Parks Canada, DFO, Inuit and Cree organizations
Propose the **creation of marine wildlife areas** (or other means of legal protection) **for the Common Eider's main brood-rearing areas**.		√		√			SLAP partners, EC, Parks Canada, DFO, MDDEP
Explore the possibility of **protecting rivers used by Harlequin Ducks** in the southern part of its breeding distribution (e.g., on the Gaspé Peninsula rivers other than the ones in the Parc national de la Gaspésie or salmon rivers which are already protected).		√		√			SLAP partners, MDDEP
Offset the **lack of snags** in areas of intensive logging or where measures to maintain snags have not been effective by establishing a network of artificial nest boxes and monitoring them.			√	√			MRNF, MDDEP, EHJV, Conseil de l'industrie forestière, NGOs
Support the **nest box program** run by the Société d'aménagement de la baie Lavallière, to ensure its long-term existence.	√	√	√	√			EC-CWS, Société d'aménagement de la baie Lavallière, EHJV, NGOs
Protect important **staging areas used by scaup** that currently do not have protected status by having them designated as a waterfowl gathering area or marine wildlife area, for example.	√						EC, Parks Canada, MDDEP, DFO
Plant **lure crops** on public land next to bulrush marshes used by Snow Geese to minimize browsing in marshes in fall.	√	√					Union des producteurs agricoles, EHJV, NGOs
Raise awareness among municipalities and golf course and urban park managers of landscape modification techniques that can be used to make these **green spaces less attractive** to Resident Canada Geese.	√	√					EC-CWS, EHJV, municipalities/MRCs, Association des terrains de golf du Québec
Encourage the establishment of an **invasive plant** monitoring network: use direct control or measures to prevent propagation.	√	√					SLAP partners, EHJV NGOs

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16. Appendices

16.1 Relative importance of each BCR in their contribution to waterfowl

Table 9 (below) illustrates the importance of the BCRs, relative to each other, in their **contribution for breeding of each waterfowl species**. Although incomplete, because in some BCRs breeding populations or densities of some species are not known, this table nevertheless allows us to draw some great observations.

BCR 13 provides an important contribution for dabbling ducks, despite the fact that it is the smallest BCR in Quebec, with the highest densities for six species found here (Wood Duck, Gadwall, American Wigeon, Mallard, Northern Shoveler and Green-winged Teal); however, BCR 13 is relatively unimportant with respect to size of breeding populations, with only Gadwall obtaining its largest population in this BCR. The BCR 13 appears a good candidate for developing actions for the conservation of dabbling ducks, though Quebec does not have a large amount of responsibility on a North American scale (see proportion nesting in Quebec in Table 9).

BCR 14 has neither the highest density nor the largest breeding population for any waterfowl species, although we recognize its importance for Common Eider *dresseri* colonies.

In **BCR 12**, the highest densities in Quebec for at least six species (American Black Duck, Ring-necked Duck, Bufflehead, Hooded Merganser, Common Goldeneye and Common Merganser), of which four are cavity nesting species, are found here. BCR 12 is home also to the largest numbers of breeding pairs for the Wood Duck, Bufflehead and Hooded Merganser. BCR 12 is a good candidate for the establishment of conservation actions of ducks nesting in forest areas.

For **BCR 8**, its particular importance is from hosting the largest breeding populations in Quebec for at least 10 species of waterfowl (Canada Goose "resident population" [less interesting considering that it is an "undesirable" species], American Wigeon, American Black Duck, Mallard, Blue-winged Teal, Green-winged Teal, Ring-necked Duck, Common Eider *dresseri*, Common Goldeneye and Barrow's Goldeneye), although this may in part be due to the fact that this BCR is the second largest in terms of area. In addition, the highest densities for Blue-winged Teal and Barrow's Goldeneye are found here. BCR 8 is therefore a good candidate for conservation of a wide variety of waterfowl, from dabbling and diving ducks as well as sea ducks.

BCR 7 provides an important contribution to scaup and sea ducks; six of these species have their largest breeding populations in Quebec here (Greater Scaup, Lesser Scaup, Harlequin Duck, Surf Scoter, Black Scoter and Common Merganser). It also has the highest densities for Lesser Scaup and Surf Scoter. BCR 7 could therefore have actions developed aimed at the conservation of nesting sea ducks, among others.

As for **BCR 3**, although it is the most northerly of the BCRs in Quebec, eight species or populations have their largest breeding populations here (Canada Goose Atlantic Population and North Atlantic Population, Tundra Swan, Northern Pintail, Common Eider *borealis*, Common Eider *sedentaria*, Long-tailed Duck and Red-breasted Merganser), and at least eight species—mostly the same ones—obtain their highest densities in this BCR (Canada Goose Atlantic Population and North Atlantic Population, Tundra Swan, Northern Pintail, Greater Scaup, Black Scoter, Long-tailed Duck and Red-breasted Merganser). Actions developed for BCR 3 will contribute to the conservation of a great variety of waterfowl.

In summary, the highest densities in Quebec are found in BCR 13 (dabbling ducks), BCR 12 (mostly cavity-nesting ducks) and BCR 3 (several species or populations of waterfowl), whereas the largest

breeding populations are in BCR 8 (several species of waterfowl), BCR 7 (mostly sea ducks) and BCR 3 (especially geese and sea ducks), although the large size of these three BCRs partly explains the large populations.

Table 9. Breeding population (number of individuals present in the BCR during the breeding period[a]), density (in parenthesis; number of individuals/100 km²), proportion of the BCR breeding population of the total Quebec population (%Qc) and of the total North American population (%NA) (species in red indicates it is a priority species in at least one BCR). For species without numbers, Yes = Species breeds in the BCR but there is no population data; Occas. = Species breeds occasionally in the BCR (every 2 to 5 years); Probable = One or two pairs were observed during the breeding season, but no breeding evidence was found; No = Species does not breed in the BCR. For a given species, the abundance in red and the density in green are the highest; for instance, for a given species (e.g., Wood Duck), the highest abundance can be in a different BCR than the highest density, or in other terms, a BCR can host the highest density for this species but might not have the highest number of individuals (because it depends of the BCR's area). See the specific table for each BCR for additional explanation on the numbers presented. The percentages for North America that are equal or higher than 10 are in bold to signify their importance. **Note:** This table does not present the importance a BCR could have with respect to waterfowl conservation during other periods of the annual cycle (migration, moulting and wintering).

	BCR 13 (32,200 km²)	**BCR 14** (66,500 km²)	**BCR 12** (170,100 km²)	**BCR 8** (463,800 km²)	**BCR 7** (561,700 km²)	**BCR 3** (207,400 km²)	**Entire Quebec**
Snow Goose Lesser	No	No	No	No	No	Yes	< 500[b]
Snow Goose Greater	Yes	No	No	No	No	No	< 100[b]
Cackling Goose	No	No	No	No	No	Yes	< 100[b]
Canada Goose Resident Population	5,600 **(17.4)** 20% Qc 1% NA	3,600 (5.3) 13% Qc 0% NA	7,100 (4.2) 26% Qc 1% NA	11,300 (2.4) 41% Qc 1% NA	No	No	27,700[c] 3% NA
Canada Goose Atlantic Population	No	No	1,900 (1.1) 0% Qc 0% NA	67,800 (14.6) 11% Qc **11% NA**	70,200 (12.6) 11% Qc **11% NA**	473,000 **(227.9)** 77% Qc **77% NA**	613,000[c] **100% NA**
Canada Goose North Atlantic Population	No	No	No	33,900 (7.3) 41% Qc **26% NA**	13,400 (2.4) 16% Qc **10% NA**	35,600 **(17.2)** 43% Qc **27% NA**	82,900[c] **64% NA**
Tundra Swan	No	No	No	No	Occas.	2,700 **(1.3)** 100% Qc 3% NA	2,700 3% NA
Wood Duck	4,600 **(14.3)** 35% Qc 0% NA	900 (1.3) 7% Qc 0% NA	5,400 (3.2) 42% Qc 0% NA	2,200 (0.4) 17% Qc 0% NA	Yes	No	13,000 0% NA
Gadwall	1,200 **(3.8)** 100% Qc 0% NA	Yes	Occas.	Yes	Probable	No	1,200 0% NA
American Wigeon	900 **(2.9)** 9% Qc 0% NA	600 (0.8) 6% Qc 0% NA	Yes	8,700 (1.9) 87% Qc 0% NA	Yes	Probable	10,000 0% NA

	BCR 13 (32,200 km²)	BCR 14 (66,500 km²)	BCR 12 (170,100 km²)	BCR 8 (463,800 km²)	BCR 7 (561,700 km²)	BCR 3 (207,400 km²)	Entire Quebec
American Black Duck	21,900 (68.0) 4% Qc 2% NA	29,500 (44.3) 6% Qc 3% NA	121,300 **(71.4)** 23% Qc **13% NA**	197,100 (42.4) 38% Qc **22% NA**	90,100 (16.0) 17% Qc **10% NA**	58,200 (28.1) 11% Qc 6% NA	518,000[d] **57% NA**
Mallard	36,000 **(111.7)** 27% Qc 0% NA	30,700 (46.2) 23% Qc 0% NA	18,800 (11.1) 14% Qc 0% NA	46,700 (10.1) 35% Qc 0% NA	Yes	Occas.	132,000 1% NA
Blue-winged Teal	230 (0.6) 6% Qc 0% NA	Yes	Yes	3,600 **(0.8)** 94% Qc 0% NA	Occas.	No	3,800 0% NA
Northern Shoveler	330 **(1.1)** 30% Qc 0% NA	380 (0.6) 35% Qc 0% NA	Yes	350 (0.1) 32% Qc 0% NA	Occas.	Occas.	1,100 0% NA
Northern Pintail	1,800 (5.5) 3% Qc 0% NA	260 (0.4) 0% Qc 0% NA	Yes (n. d.)	900 (0.2) 1% Qc 0% NA	10,900 (1.9) 17% Qc 0% NA	50,400 **(24.4)** 79% Qc 1% NA	64,000[d] 2% NA
Green-winged Teal	10,800 **(33.6)** 7% Qc 0% NA	6,900 (10.5) 5% Qc 0% NA	17,900 (10.5) 12% Qc 0% NA	53,600 (11.6) 37% Qc 1% NA	20,400 (3.6) 14% Qc 1% NA	36,400 (17.6) 25% Qc 1% NA	146,000[d] 4% NA
Redhead	Yes	No	No	Yes	No	No	< 100[b]
Ring-necked Duck	2,900 (8.9) 1% Qc 0% NA	28,100 (42.3) 10% Qc 1% NA	78,600 **(46.3)** 29% Qc 4% NA	148,600 (32.1) 54% Qc 7% NA	14,800 (2.6) 5% Qc 1% NA	No	273,000 **14% NA**
Greater Scaup	Occas.	Yes	No	3,400 (2.9) 8% Qc 0% NA	22,900 (4.2) 53% Qc 3% NA	16,800 **(8.2)** 39% Qc 2% NA	43,000 5% NA
Lesser Scaup	Yes	Occas.	Occas.	7,100 (6.1) 12% Qc 0% NA	50,400 **(8.9)** 87% Qc 1% NA	No	58,000 1% NA
King Eider	No	No	No	No	No	Yes	< 100[b]
Common Eider *dresseri*	1,300 (n. d.) 1% Qc 0% NA	42,000 (n. d.) 44% Qc **14% NA**	Yes	52,800 (n. d.) 55% Qc **18% NA**	No	No	96,000 **32% NA**
Common Eider *borealis*	No	No	No	No	25,600 (n. d.) 20% Qc 5% NA	102,400 (n. d.) 80% Qc **19% NA**	128,000 **23% NA**
Common Eider *sedentaria*	No	No	No	No	7,700 (n. d.) 30% Qc 3% NA	17,900 (n. d.) 69% Qc 7% NA	26,000 **10% NA**
Harlequin Duck Eastern Population	No	130	No	130	5,100[e]	Probable	5,400[e] **79% NA**
Surf Scoter	No	No	Yes	43,800 (9.5) 43% Qc 7% NA	58,600 **(10.5)** 57% Qc **10%**	No	102,000 **17% NA**
White-winged Scoter	No	No	No	No	Yes	No	1,700[b]

	BCR 13 (32,200 km²)	BCR 14 (66,500 km²)	BCR 12 (170,100 km²)	BCR 8 (463,800 km²)	BCR 7 (561,700 km²)	BCR 3 (207,400 km²)	Entire Quebec
Black Scoter	No	No	No	No	61,900 (11.0) 55% Qc **15% NA**	50,000 **(24.1)** 45% Qc **13% NA**	112,000 **28% NA**
Long-tailed Duck	No	No	No	Yes	Yes	119,400 **(57.6)** 100% Qc **12% NA**	119,000 **12% NA**
Bufflehead	No	Occas.	8,900 **(5.1)** 80% Qc 1% NA	2,300 (0.5) 21% Qc 0% NA	Yes	No	11,200 1% NA
Common Goldeneye	900 (2.8) 0% Qc 0% NA	6,300 (9.5) 3% Qc 0% NA	62,900 **(36.9)** 28% Qc 5% NA	130,200 (28.2) 59% Qc **10% NA**	22,100 (3.8) 10% Qc 2%	No	222,000 **17% NA**
Barrow's Goldeneye Eastern Population	No	No	Yes	4,900[f] **(2.3)** 100% Qc **100% NA**	?	No	4,900[f] **100% NA**
Hooded Merganser	400 (1.0) 0% Qc 0% NA	5,000 (7.7) 5% Qc 1% NA	41,000 **(24.1)** 42% Qc **12% NA**	25,600 (5.6) 26% Qc 7% NA	25,400 (4.6) 26% Qc 7% NA	No	97,000 **28% NA**
Common Merganser	4,500 (13.8) 1% Qc 0% NA	9,100 (13.6) 3% Qc 1% NA	62,100 **(36.6)** 21% Qc 6% NA	84,900 (18.4) 28% Qc 8% NA	141,000 (25.1) 47% Qc **14% NA**	Probable	302,000 **30% NA**
Red-breasted Merganser	Occas.	500 (0.8) 0% Qc 0% NA	Yes	700 (0.3) 0% Qc 0% NA	155,400 (27.6) 40% Qc **22% NA**	233,500 **(112.6)** 60% Qc **33% NA**	390,000 **56% NA**
Ruddy Duck	Yes	No	No	Yes	No	No	< 100[b]
TOTAL	**93,400** **(285)**	**163,800** **(183)**	**425,900** **(251)**	**930,400** **(198)**	**790,800** **(135)**	**1,123,400** **(519)**	**3,500,000**

[a] Calculations based on indicated breeding pairs by BCR and the conversion factors established in Lepage and Bordage 2013.

[b] Data from Table 2 in Lepage and Bordage 2013.

[c] The abundances in entire Quebec are slightly different from the ones presented in Table 2 in Lepage and Bordage 2013 because there was a need to be more precise about the distribution area of the three populations in order to obtain numbers by BCR; the total number of Canada Goose in Quebec is approximately 721,000–723,000 individuals, but the Atlantic Population would be less numerous than what was previously estimated, to the advantage of the North Atlantic Population and the Resident Population.

[d] The abundance in entire Quebec is slightly different from the one presented in Table 2 in Lepage and Bordage 2013 because it is based on the sum of abundance by BCR.

[e] Based on Table 2 and the corresponding footnote "o" in Lepage and Bordage 2013.

[f] The abundance is based on the WUPL results, for which the survey area does not cover the entire breeding area. This number is therefore different from the one presented in Table 2 in Lepage and Bordage 2013, based on the BGTWS which covers the entire Barrow's Goldeneye wintering range.

16.2 Criteria and scoring system for species prioritization

1) Species' total North American population (from North American Waterfowl Management Plan 2004)

   Points awarded (favours species that are less common in North America):

   3 = <150,000 individuals
   2 = 150,000–350,000 individuals
   1 = 350,000–1,000,000 individuals
   0 = >1,000,000 individuals
   1 = ?

2) Relative proportion of the species' breeding population in the BCR in relation to the species' total North American breeding population

   Points awarded (favours species whose population in the BCR is large in relation to the North American population):

   3 = >15%
   2 = 5–14%
   1 = 1–4%
   0 = 0
   1 = ?

3) Relative proportion of the species' breeding population in the BCR in relation to its breeding population in Quebec

   Points awarded (favours species whose population in the BCR is large in relation to the provincial population):

   3 = >15%
   2 = 5–14%
   1 = 1–4%
   0 = 0
   1 = ?

4) Breeding population trend for the species in the BCR

   Points awarded (favours species with a significant downward trend):

   3 = significant decrease
   2 = insignificant decrease
   1 = insignificant increase
   0 = significant increase
   1 = trend unknown

5) North American distribution of the species and number of habitats used by the species

Points awarded (favours species with a limited distribution that use only a small number of habitats):

3 = species with a limited distribution, occurring in a small number of habitats
2 = species with a limited distribution, occurring in a larger number of habitats
1 = widespread species, occurring in a small number of habitats
0 = widespread species, occurring in a larger number of habitats

6) Size of the harvest of the species in Quebec and in the Atlantic Flyway (United States) in relation to the North American population of the species

Points awarded (favours species with a sizeable harvest in relation to the North American population)

3 = >15%
2 = 5–14%
1 = 1–4%
0 = 0
1 = ?

7) Number of migrants of the species in the BCR in relation to the North American population of the species

Points awarded (favours species with a large flight in the BCR):

3 = >15%
2 = 5–14%
1 = 1–4%
0 = 0
1 = ?

8) Population of the species that moults in the BCR in relation to the North American population of the species

Points awarded (favours species that moult in large numbers in the BCR):

3 = >15%
2 = 5–14%
1 = 1–4%
0 = 0
1 = ?

9) Population of the species wintering in the BCR in relation to the North American population of the species

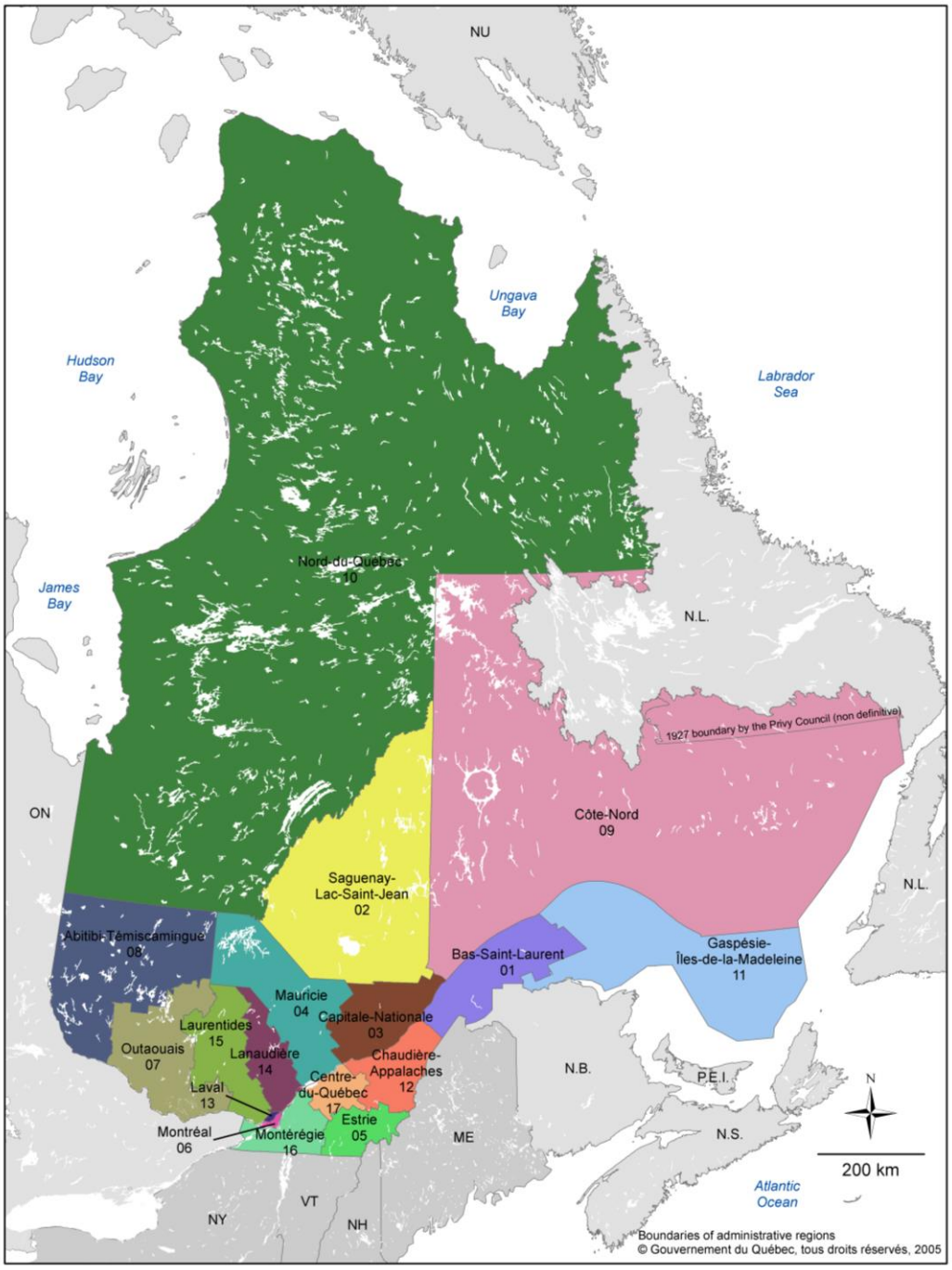
Points awarded (favours species that overwinter in large numbers in the BCR):

3 = >15%
2 = 5–14%
1 = 1–4%
0 = 0
1 = ?

16.3 English and scientific names of waterfowl species

English name	Scientific name
Greater White-fronted Goose	*Anser albifrons*
Snow Goose	*Chen cærulescens*
Ross's Goose	*Chen rossii*
Brant	*Branta bernicla*
Cackling Goose	*Branta hutchinsii*
Canada Goose	*Branta canadensis*
Mute Swan	*Cygnus olor*
Trumpeter Swan	*Cygnus buccinator*
Tundra Swan	*Cygnus columbianus*
Wood Duck	*Aix sponsa*
Gadwall	*Anas strepera*
Eurasian Wigeon	*Anas penelope*
American Wigeon	*Anas americana*
American Black Duck	*Anas rubripes*
Mallard	*Anas platyrhynchos*
Blue-winged Teal	*Anas discors*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
King Eider	*Somateria spectabilis*
Common Eider	*Somateria mollissima*
Harlequin Duck	*Histrionicus histrionicus*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Black Scoter	*Melanitta americana*
Long-tailed Duck	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Common Goldeneye	*Bucephala clangula*
Barrow's Goldeneye	*Bucephala islandica*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*

16.4 Administrative regions of Quebec



www.**ec.gc.ca**

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