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Bird Conservation Strategy for Bird Conservation Region 12 in Quebec: Boreal Hardwood Transition

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Preface

Environment Canada led the development of all-bird conservation strategies in each of Canada's Bird Conservation Regions (BCRs) by drafting new strategies and integrating new and existing strategies into an all-bird framework. These integrated all-bird conservation strategies will serve as a basis for implementing bird conservation across Canada, and will also guide Canadian support for conservation work in other countries important to Canada's migrant birds. Input to the strategies from Environment Canada's conservation partners is as essential as their collaboration in implementing their recommendations.

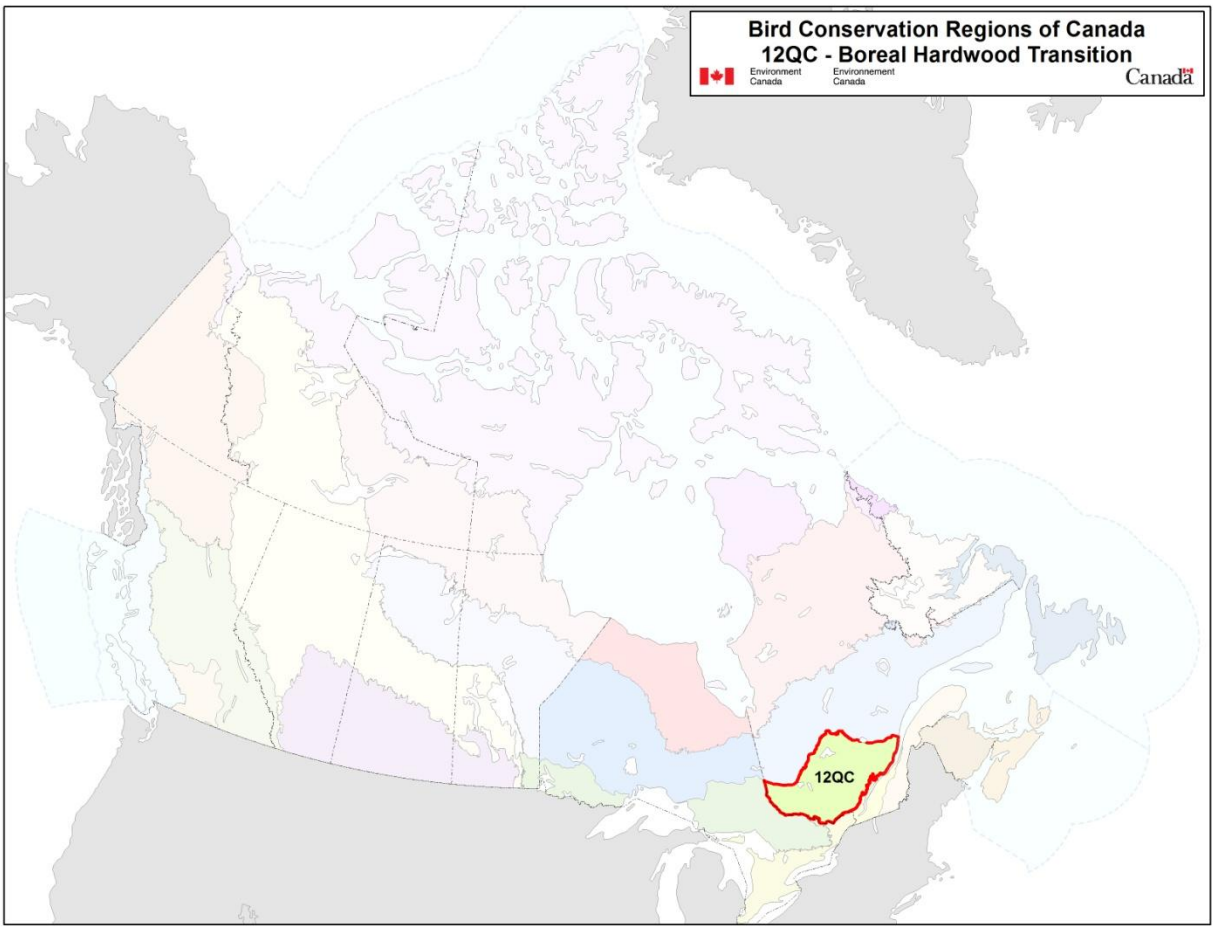
Environment Canada has developed national standards for strategies to ensure consistency of approach across BCRs. Bird Conservation Strategies will provide the context from which specific implementation plans can be developed for each BCR, building on the programs currently in place through Joint Ventures or other partnerships. Landowners including Aboriginal peoples will be consulted prior to implementation.

Conservation objectives and recommended actions from the conservation strategies will be used as the biological basis to develop guidelines and beneficial management practices that support compliance with regulations under the *Migratory Birds Convention Act*, *1994*.

Acknowledgements

Véronique Connolly, Stéphane Légaré, Benoît Audet and François Fournier were the main authors of this document. This strategy follows templates developed by Alaine Camfield, Judith Kennedy and Elsie Krebs with the help of the BCR planners in each of the Canadian Wildlife Service regions throughout Canada. However, work of this scope cannot be accomplished without the contribution of other colleagues who provided or validated technical information, commented on earlier draft versions of the strategy, and supported the planning process. We would like to thank the following people: Matthieu Allard, Yves Aubry, Luc Bélanger, Martine Benoît, Daniel Bordage, Pierre Brousseau, Vincent Carignan, Richard Cotter, Marie-France Dalcourt, Emmanuel Dalpé-Charron, Bruno Drolet, Gilles Falardeau, Patricia Houle, Benoît Jobin, Sandra Labrecque, Claudie Latendresse, Josée Lefebvre, Christine Lepage, Jean-François Rail and François Shaffer.

Bird Conservation Strategy for Bird Conservation Region 12 in Quebec: Boreal Hardwood Transition



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Executive Summary

In Quebec, the Boreal Hardwood Transition Bird Conservation Region (BCR 12) is essentially located in the southern Laurentian ecoregion and covers 170 951 km^2. Outside Quebec, BCR 12 covers the area around lakes Superior, Michigan and Huron ,and the western section of the BCR straddles the Canada–U.S. border. Most of BCR 12-QC is covered with mixed wood forests and is composed of hills, plateaus and depressions, interspersed with higher massifs. There are several rivers and small lakes, as well as some large reservoir lakes that are used for generating hydroelectric power. There are few agricultural and urban areas due to the region's rugged terrain. The flora and fauna are diverse, and birdlife is chiefly represented by forest species.

Pursuant to an assessment of the 215 bird species in BCR 12-QC, 62 species were identified as priorities in this BCR. The priority list includes species from 4 bird groups: landbirds (82%), waterfowl (8%), waterbirds (7%) and shorebirds (3%). These priority species include 20 species considered at risk either federally or provincially. Priority species use 11 habitat types in BCR 12-QC, and the habitats that attract most species are the mixed wood forests (35% of priority species), wetlands (32%), deciduous forests (27%), coniferous forests (27%) and riparian areas (21%).

Each priority species was assigned a population objective based on its population trend. Maintaining populations at current levels was the objective most often selected for priority species in BCR 12-QC (35% of priority species), while "assess/maintain" was the objective assigned to 15% of the species. Better population trend data are required for the vast majority of the species that have been assigned one of these two objectives. A recovery objective was assigned to 23% of the species (all are species at risk), and population increase objectives were also assigned to 27% of the priority species, reflecting the magnitude of the threats to bird populations in this BCR.

A threat assessment identified a number of conservation issues facing priority species in the various habitats of BCR 12-QC. Major threats include habitat loss and degradation caused by forestry and agriculture, ecosystem changes such as shrub habitats transitioning to forest habitats, as well as climate change and severe weather events. The lack of biological or demographic data on the priority species, and the presence of species at risk without recovery strategies or management plans, were also considered as significant conservation issues since 76% of the species are affected. The habitats most severely affected by the threats identified in BCR 12-QC include deciduous forests, cultivated and managed areas, urban areas, and wetlands.

Conservation objectives have been established to counter threats and provide the missing information on priority species. In BCR 12-QC, conservation objectives chiefly involve providing suitable habitat for priority species, by ensuring, among other things, that resource and land use policies maintain or improve bird habitat. Another major conservation objective is to improve bird population monitoring to gather the missing ecological and demographic information for most of the priority species in the BCR.

Conservation actions have been recommended for priority species in BCR 12-QC in order to achieve established conservation objectives. The recommended actions largely relate to population monitoring and include on-the-ground activities such as increasing the coverage of the Breeding Bird Survey (BBS), conducting specific surveys, expanding the current migration monitoring program, and maintaining waterfowl banding and survey programs. A significant portion of the recommended actions involve protecting sites and, more particularly, wetlands. These actions include protecting wetlands through mechanisms such as the creation of protected areas, stewardship, the adoption of municipal urban plans that protect wetlands and woodlands, and the protection of large tracts of mature forest.

Migratory birds found in BCR 12-QC also face threats that are difficult to analyze with the standardized methodology used in this strategy. These threats include widespread issues that may sometimes not apply to a particular habitat (e.g., collisions with human-made structures, air pollution and climate change), research needs and population monitoring, as well as threats to migratory birds when they are outside Canada. An overview of these issues, the affected species and the recommended conservation actions is also presented.

Introduction: Bird Conservation Strategies

Context

This document is one of a suite of Bird Conservation Region Strategies (BCR strategies) that have been drafted by Environment Canada for all regions of Canada. These strategies respond to Environment Canada's need for integrated and clearly articulated bird conservation priorities to support the implementation of Canada's migratory birds program, both domestically and internationally. This suite of strategies builds on existing conservation plans for the four "bird groups" (waterfowl,[1] waterbirds,[2] shorebirds[3] and landbirds[4]) in most regions of Canada, as well as on national and continental plans, and includes birds under provincial/territorial jurisdiction. These new strategies also establish standard conservation planning methods across Canada, and fill gaps, as previous regional plans do not cover all areas of Canada or all bird groups.

These strategies present a compendium of required actions based on the general philosophy of achieving scientifically based desired population levels as promoted by the four pillar initiatives of bird conservation. Desired population levels are not necessarily the same as minimum viable or sustainable populations, but represent the state of the habitat/landscape at a time prior to recent dramatic population declines in many species from threats known and unknown. The threats identified in these strategies were compiled using currently available scientific information and expert opinion. The corresponding conservation objectives and actions will contribute to stabilizing populations at desired levels.

The BCR strategies are not highly prescriptive. In most cases, practitioners will need to consult additional information sources at local scales to provide sufficient detail to implement the recommendations of the strategies. Tools such as beneficial management practices will also be helpful in guiding implementation. Partners interested in participating in the implementation of these strategies, such as those involved in the habitat Joint Ventures established under the North American Waterfowl Management Plan (NAWMP), are familiar with the type of detailed implementation planning required to coordinate and undertake on-the-ground activities.

[1] North American Waterfowl Management Plan, Plan Committee (2004); Lepage et al. (in progress).
[2] Milko et al. (2003); Chapdelaine and Rail (2004).
[3] Donaldson et al. (2000); Aubry and Cotter (2007).
[4] Rich et al. (2004); Drolet et al. (2010); Falardeau et al. (2010).

Strategy Structure

Section 1 of this strategy presents general information about the BCR and the subregion, with an overview of the six elements[5] that provide a summary of the state of bird conservation at the sub-regional level. Section 2 provides more detail on the threats, objectives and actions for priority species grouped by each of the broad habitat types in the subregion. Section 3 presents additional widespread conservation issues that are not specific to a particular habitat or were not captured by the threat assessment for individual species, as well as research and monitoring needs, and threats to migratory birds while they are outside of Canada. The approach and methodology are summarized in the appendices, but details are available in a separate document (Kennedy et al. 2012). A national database houses all the underlying information summarized in this strategy and is available from Environment Canada.

[5] The six elements are: Element 1 – priority species assessment; Element 2 – habitats important to priority species; Element 3 – population objectives; Element 4 – threat assessment; Element 5 – conservation objectives; Element 6 – recommended actions.

Characteristics of Bird Conservation Region 12-QC

The western portion of the Boreal Hardwood Transition Bird Conservation Region (BCR 12) straddles the Canada–U.S. border and covers the area around lakes Superior, Michigan and Huron. In Quebec, BCR 12 covers 170 951 km^2 and essentially corresponds to the South Laurentian ecoregion. It is located north of the St. Lawrence lowlands and extends west to the Ontario border and east to near the mouth of the Saguenay River, then north a little beyond the 49th parallel (Fig. 1).

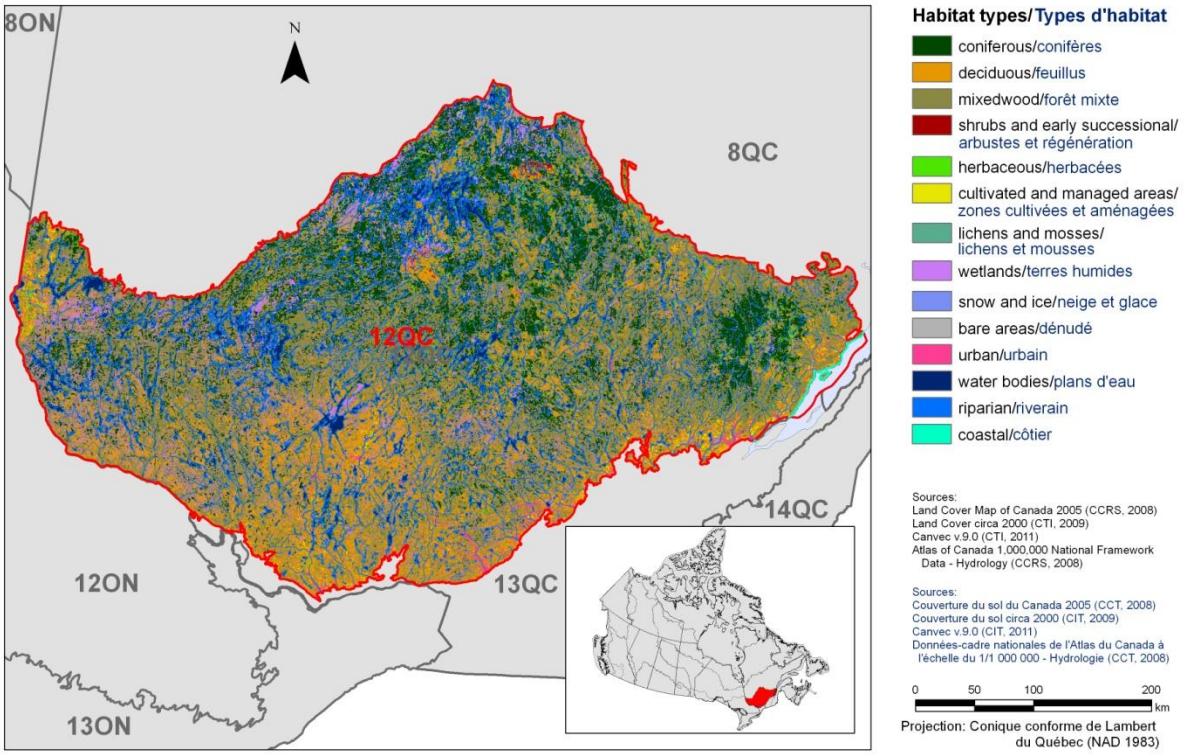

Figure 1. Land cover in BCR 12-QC: Boreal Hardwood Transition.

Physical environment

Topography

The relief of BCR 12-QC features hills, plateaus and depressions, interspersed with higher massifs (Li and Ducruc, 1999). The elevation of the massifs ranges from 600 m to over 1000 m, while the height of the rest of the area ranges from 200 m to 450 m. The highest peaks include Mont Sainte-Anne (800 m), Mont Tremblant (968 m), Mont Belle Fontaine (1151 m) and Mont Raoul Blanchard (1181 m, Natural Resources Canada, 2009).

Hydrography and Hydrology

BCR 12-QC is primarily drained by two major north-south watersheds: the Ottawa River and Saint-Maurice River watersheds (Li and Ducruc, 1999). Other major rivers include the

Montmorency, Jacques-Cartier, Batiscan, du Lièvre, Gatineau, Maskinongé and the Assomption. Lake density is average, and the lakes themselves are rather small, with the exception of a few large reservoir lakes exceeding 300 km^2 that are used to produce hydroelectricity (for example, the Cabonga, Baskatong, Gouin, Dozois and Kipawa reservoirs; Ministère du Développement durable, de l'Environnement et des Parcs, 2002).

Climate

BCR 12-QC's climate is characterized by hot summers and cold, snowy winters. The average annual temperature is about 1.5°C, while the average summer temperature is 14°C and the mean winter temperature is -11°C. The climate is warmer along the southern border of the BCR. The average annual rainfall ranges from 800 mm in the northwest to 1000 mm near Québec. In the Laurentides Wildlife Reserve, between Québec and the Saguenay-Lac-Saint-Jean region, the range is from 1200 to 1600 mm (Ecological Stratification Working Group, 1996).

Land Cover and Land Use

BCR 12-QC is mostly covered with mixed wood forests (Fig. 1). The area contains some of the best timber reserves in Quebec (Ecological Stratification Working Group, 1996), and logging is an important activity in the region. The forest is also used extensively for hunting, trapping, recreation and tourism. BCR 12's rugged terrain is not suitable for agriculture, so there is little farming in the area. Cultivated and managed land accounts for only 0.6% of the area (Fig. 1), and these are primarily in the Témiscamingue, Outaouais and Charlevoix areas. The BCR has a limited number of urban areas, most of which are concentrated in the southern part of the region, bordering the St. Lawrence lowlands (BCR 13). Wetlands account for only 2% of the land. Over half of the land occupied by BCR 12-QC is Crown land (Drolet et al. 2010).

Biological environment

Vegetation

BCR 12 includes a variety of plant communities whose range within the area depends largely on latitude and elevation. The BCR contains three subzones of vegetation that transition from the southern part of the region to the northern part as follows: hardwood forest, mixed wood forest and continuous boreal forest (Quebec's Ministère des Ressources naturelles, 2013).

The hardwood forest subzone hosts the sugar maple-basswood bioclimatic domain, characterized by diverse flora including many species at the northern limit of their range. The sugar maple is the dominant species, and other species such as the basswood, American white ash, ironwood and butternut also inhabit the area. The hardwood forest subzone also includes the sugar maple-yellow birch bioclimatic domain. The flora here is less diverse and includes several boreal species. Companion species to the sugar maple include the yellow birch, American beech, red oak and hemlock. Windfall is a key element of forest dynamics in this sub-area.

Further north, the mixed forest subzone consists of the balsam fir-yellow birch domain, which is a transition area between the deciduous and boreal forest. This domain is characterized by

mixed stands of yellow birch and conifers such as balsam fir, white spruce and cedar. The main factors of forest dynamics in this sub-area are outbreaks of spruce budworm and fires.

Finally, the continuous boreal forest subzone covers the northern portion of BCR 12-QC and is represented by two bioclimatic domains: balsam fir-white birch, and spruce-moss. The balsam fir-white birch domain is characterized by fir and white spruce mixed with white birch mesic sites, while less favourable sites include black spruce, jack pine and larch, accompanied by white birch or trembling aspen. The main factors of forest dynamics in this domain are outbreaks of spruce budworm and fires. The spruce-moss domain is clearly dominated by black spruce, but there are also balsam fir and some deciduous trees such as white birch and trembling aspen. This domain is also characterized by undergrowth covered with feather mosses and ericaceous shrubs and a limited number of herbaceous species. The fire cycle is the main element of forest dynamics in this domain.

Wildlife

BCR 12-QC provides habitats where a wide diversity of animal species can feed and reproduce. Mammalian species that are abundant or representative of the area include white-tailed deer (south), moose (north), black bear, beaver, fisher, raccoon and wolf (Li and Ducruc, 1999). BCR 12-QC hosts one of only two herds of woodland caribou (a species considered vulnerable in Quebec and threatened in Canada) south of the 49th parallel in Quebec. Species in BCR 12-QC likely to be designated threatened or vulnerable in Quebec include the least weasel, southern flying squirrel, eastern red bat, silver-haired bat and hoary bat (Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs, 2013a).

BCR 12-QC features a large variety of amphibians and reptiles. They include the wood turtle, Blanding's turtle and northern map turtle, which are species at risk in both Quebec and Canada (Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs, 2013a; Species at Risk Public Registry, 2012). There are also species likely to be designated threatened or vulnerable in Quebec such as the pickerel frog, northern water snake, brown snake and milksnake.

BCR 12-QC also features a diverse fish fauna. Representative fish species includes smallmouth bass, walleye, brook trout, lake trout and northern pike (Li and Ducruc, 1999). BCR 12 hosts the only spring cisco population in Canada, a salmonid species likely to be designated threatened or vulnerable in Quebec, which inhabits Lac des Écorces, near Mont-Laurier. Species of non-indigenous salmonids, such as rainbow trout and brown trout, are regularly stocked in some lakes in the BCR (Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs, 2013b).

Because forest covers most of the land occupied by BCR 12-QC, avifauna in this BCR includes a large percentage of forest species. The Ruffed Grouse, Broad-winged Hawk, Yellow-bellied Sapsucker, Wood Thrush, American Redstart Warbler and Black-throated Blue Warbler are among the wide variety of species that are characteristic of deciduous or mixed wood forests. In forests dominated by conifers, representative species include the Spruce Grouse, Black-

backed Woodpecker, Bicknell's Thrush, Cape May Warbler and the Blackpool Warbler. The few farming communities in BCR 12-QC are inhabited by rural species such as the Bobolink, Eastern Meadowlark, Horned Lark, Savannah Sparrow and Vesper Sparrow. Representative species of aquatic and wetland areas in BCR 12-QC include the Common Loon, American Bittern, Great Blue Heron, Pied-billed Grebe, American Black Duck, Common Goldeneye, Wood Duck and Ring-necked Duck. BCR 12-QC includes species who have a limited range within Quebec, such as the Golden-winged Warbler and Nelson's Sharp-tailed Sparrow.

Human environment

Local communities

Approximately 639 000 people live in BCR 12-QC, which represents 8% of the population of Quebec (adapted from Statistics Canada, 2012). The main population centres are Saint-Jérôme (68 456), Mont-Laurier (13 779) and La Tuque (11 227). There are 11 Aboriginal communities with an approximate total population of 9 500 in BCR 12-QC, living in 6 of the 8 administrative regions of Quebec included in the BCR (Aboriginal Affairs and Northern Development Canada, 2010). The 2 largest Aboriginal communities are the Atikamekw villages of Opitciwan and Manawan, each of which have nearly 2100 inhabitants.

Protected areas

Approximately 6% of the land in BCR 12-QC has protected area status (Fig. 2). Four Quebec national parks (responsibility of Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs) and a national park (operated by Parks Canada) are entirely located with the BCR. The parks cover a total area of 3251 km^2. They are the Jacques-Cartier, Grands-Jardins, Hautes-Gorges-de-la-rivière-Malbaie and Mont-Tremblant national parks of Quebec and the La Mauricie National Park of Canada. In addition, the BCR includes about 96% of Gatineau Park (operated by the National Capital Commission), 27% of the Fjord-du-Saguenay national park (Quebec) and 1.5% of the Saguenay-St. Lawrence Marine Park (joint responsibility of Parks Canada and Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs).

There are also 25 waterfowl gathering areas that together cover an area of 96 km^2, and 3 proposed aquatic reserves (responsibility of Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs) representing an area of 1633 km^2. Protected areas in BCR 12-QC also include 58 exceptional forest ecosystems (old-growth forests, rare forests and shelter forests, responsibility of Quebec's Ministère des Ressources naturelles) totaling 73 km^2. The only national wildlife area (Environment Canada's responsibility) in BCR 12-QC is the Cap Tourmente National Wildlife Area, half of which lies in neighbouring BCR 13.

Finally, BCR 12-QC includes 3 Important Bird Areas (IBAs) and a site designated under the Convention on Wetlands of International Importance (Ramsar). The three IBAs cover a total area of 2827 km^2, but include the Grands-Jardins and Hautes-Gorges-de-la-rivière-Malbaie Quebec national parks and the Cap Tourmente National Wildlife Area. The only Ramsar site in BCR-QC 12 essentially corresponds to the Cap Tourmente National Wildlife Area (Fig. 2).

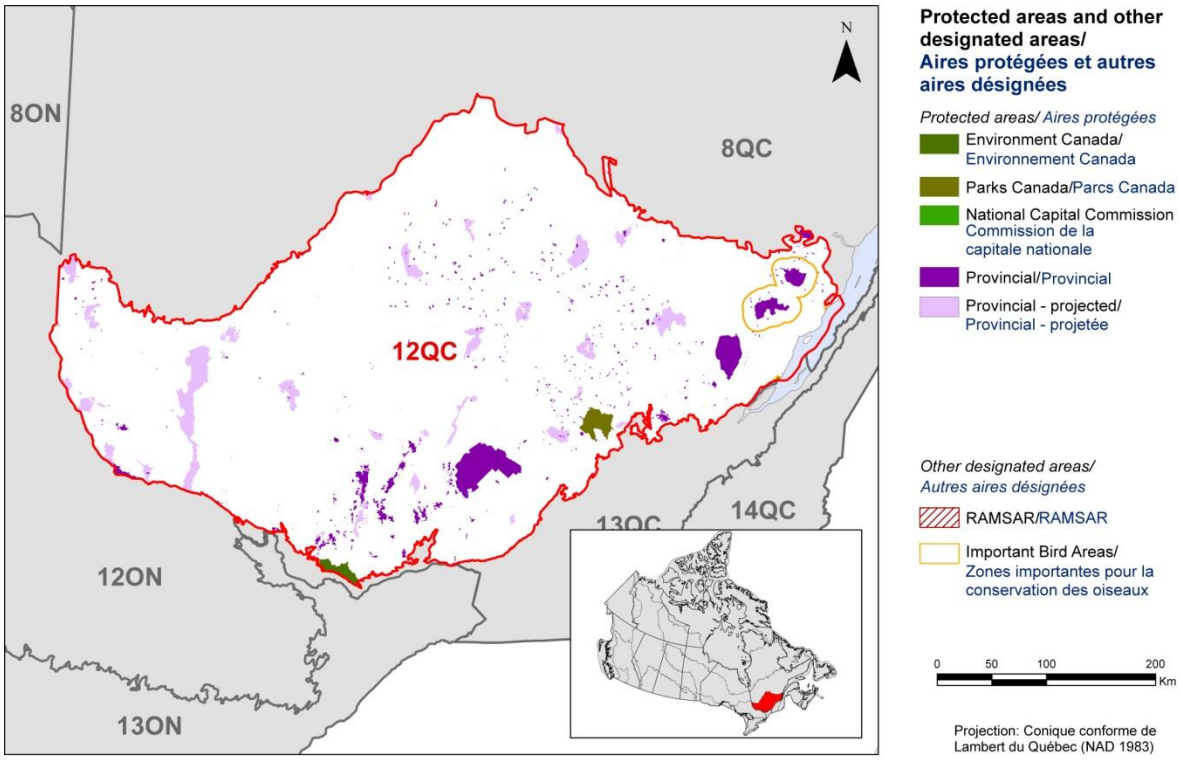

Figure 2. Map of protected and designated areas in BCR 12-QC: Boreal Hardwood Transition.

Section 1: Summary of Results – All Birds, All Habitats

Element 1: Priority Species Assessment

These Bird Conservation Strategies identify "priority species" from all regularly occurring bird species in each BCR subregion (see Appendix 2). Species that are vulnerable due to population size, distribution, population trend, abundance and threats are included because of their "conservation concern". Some widely distributed and abundant "stewardship" species are also included. Stewardship species are included because they typify the national or regional avifauna and/or because they have a large proportion of their range and/or continental population in the subregion; many of these species have some conservation concern, while others may not require specific conservation effort at this time. Species of management concern are also included as priority species when they are at (or above) their desired population objectives but require ongoing management because of their socio-economic importance as game species or because of their impacts on other species or habitats (see Appendix 1).

The purpose of the prioritization exercise is to focus implementation efforts on the issues of greatest significance for Canadian avifauna. Table 1 provides a full list of all priority species and their reason for inclusion. Tables 2 and 3 summarize the number of priority species in BCR 12-QC by bird group and by the reason for priority status.

The standard method for selecting priority species was used to identify 77 priority species, subspecies or populations (called "species" hereinafter) on a preliminary basis, among the 215 species in BCR 12-QC (Appendix 1). Regional experts reviewed the preliminary list and removed 22 pre-selected species while 7 other species were added, giving a final list of 62 priority species (Table 1). The reasons for these decisions are presented in Appendix 3.

The 62 priority species are not distributed equally among the 4 bird groups. Landbirds are the most represented group with 51 species or 82% of all priority species in BCR 12-QC (Table 2). This is a representative picture of the importance of landbirds in the region. They account for 71% of all bird species (Appendix 1). The remaining priority species consist of 2 shorebirds, 4 waterbirds and 5 waterfowl species.

The vast majority of priority species (43 of 62) were identified because they are of conservation concern (Table 1, shaded cells). They include 20 species at risk, which are either listed provincially under Quebec's *Loi sur les espèces menacées ou vulnérables* [Act respecting threatened or vulnerable species], or listed nationally under the *Species at Risk Act* (SARA) or have been assessed as at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Twelve species are considered at risk provincially and nationally, 3 species are considered at risk only provincially (Golden Eagle, Bald Eagle and Sedge Wren), while 5 species are considered at risk only under national legislation (Table 1). The species assessed as at risk by COSEWIC but that are not currently listed on Schedule 1 of SARA are the Bobolink, Wood

Thrush, Barn Swallow, Eastern Wood-Pewee and Eastern Meadowlark. Apart from the conservation species, 19 other species have been identified as priority species for stewardship reasons (Table 1; unshaded cells).

Table 1. Priority species in BCR 12–QC, population objective and the reason for priority status.

Priority species[1]	Bird group	Population objective	COSEWIC[2]	SARA[3]	Provincial listing[4]	National/continental concern[5] (landbirds)	Regional concern[5] (landbirds)	Continental stewardship[5] (landbirds)	Regional stewardship[5] (landbirds)	Conservation category and rule[6] (shorebirds)	National priority level[7] (waterbirds)	NAWMP rank[8] (waterfowl)	Expert review[9] (changes to priority list)
American Three-toed Woodpecker	Landbird	Assess/Maintain											Y
Black-backed Woodpecker	Landbird	Assess/Maintain						Y					
Bald Eagle	Landbird	Recovery objective			V			Y					
Bank Swallow	Landbird	Increase 100%					Y						
Barn Swallow	Landbird	Increase 100%	T				Y						
Bay-breasted Warbler	Landbird	Increase 50%				Y	Y						
Belted Kingfisher	Landbird	Maintain							Y				

[1] Conservation species are in shaded cells. Stewardship species are in unshaded cells.
[2] COSEWIC (Committee on the Status of Endangered Wildlife in Canada) assessment: E = Endangered; T = Threatened; SC = Special Concern.
[3] Species listed on Schedule 1 of the *Species at Risk Act* (SARA): E = Endangered; T = Threatened; SC = Special Concern. (Species at Risk Public Registry, 2012).
[4] Status under the *Loi sur les espèces menacées ou vulnérables* (Quebec)*:* T = Threatened, V = Vulnerable, L = Likely to be designated threatened or vulnerable.
[5] Taken from the online database from www.partnersinflight.org. Consult Panjabi et al. (2002) for the analytical method.
[6] Conservation concern at the level of the U.S. and Canada as identified in the Canadian Shorebird Conservation Plan (Donaldson et al. 2000). Score 5 is "Highly imperilled" and a score of 1 is "Not at risk". Refer to Donaldson et al. (2000) for the complete description of each category of conservation concern.
[7] Priority tiers at the country level as identified in “Wings Over Water”, Canada's waterbird conservation plan (Milko et al. 2003). Tier 1 is highest priority.
[8] NAWMP: North American Waterfowl Management Plan (North American Waterfowl Management Plan, Plan Committee, 2004).
[9] Expert review indicates species that were added to the priority list as a result of expert opinion, justifications for addition are presented in Appendix 3. The species that were removed, along with their conservation features and the justification for removal, are also presented in Appendix 3.
[10] The species is listed under SARA, but its recovery documents have not yet been finalized.
[11] Under the *Loi sur les espèces menacées ou vulnérables* (Québec), the subspecies *anatum* is designated *I* whereas the subspecies *tundrius* is listed as Likely to be designated as threatened or vulnerable.

Table 1 continued

Priority species[1]	Bird group	Population objective	COSEWIC[2]	SARA[3]	Provincial listing[4]	National/continental concern[5] (landbirds)	Regional concern[5] (landbirds)	Continental stewardship[5] (landbirds)	Regional stewardship[5] (landbirds)	Conservation category and rule[6] (shorebirds)	National priority level[7] (waterbirds)	NAWMP rank[8] (waterfowl)	Expert review[9] (changes to priority list)
Bicknell's Thrush[10]	Landbird	Recovery objective	T	T	V	Y	Y		Y				
Black-billed Cuckoo	Landbird	Maintain							Y				
Blackburnian Warbler	Landbird	Maintain				Y		Y	Y				
Black-throated Blue Warbler	Landbird	Maintain							Y				
Black-throated Green Warbler	Landbird	Maintain				Y		Y	Y				
Bobolink	Landbird	Increase 50%	T			Y	Y						
Boreal Owl	Landbird	Assess/Maintain											Y
Broad-winged Hawk	Landbird	Maintain							Y				
Brown Creeper	Landbird	Assess/Maintain											Y
Brown Thrasher	Landbird	Increase 100%					Y	Y					
Canada Warbler[10]	Landbird	Recovery objective	T	T	L	Y	Y		Y				
Cerulean Warbler	Landbird	Recovery objective	E	E	T	Y							
Chestnut-sided Warbler	Landbird	Maintain				Y		Y	Y				
Chimney Swift[10]	Landbird	Recovery objective	T	T	L	Y	Y						
Common Nighthawk[10]	Landbird	Recovery objective	T	T	L	Y							
Common Yellowthroat	Landbird	Maintain							Y				
Connecticut Warbler	Landbird	Increase 50%				Y	Y	Y					
Eastern Meadowlark	Landbird	Increase 100%	T										
Eastern whip-poor-will[10]	Landbird	Recovery objective	T	T	L	Y	Y						
Eastern Wood-Pewee	Landbird	Increase 50%	SC										
Field Sparrow	Landbird	Increase 100%					Y						
Golden Eagle	Landbird	Recovery objective			V								
Golden-winged Warbler[10]	Landbird	Recovery objective	T	T	L	Y			Y				

Table 1 continued

Priority species[1]	Bird group	Population objective	COSEWIC[2]	SARA[3]	Provincial listing[4]	National/continental concern[5] (landbirds)	Regional concern[5] (landbirds)	Continental stewardship[5] (landbirds)	Regional stewardship[5] (landbirds)	Conservation category and rule[6] (shorebirds)	National priority level[7] (waterbirds)	NAWMP rank[8] (waterfowl)	Expert review[9] (changes to priority list)
Least Flycatcher	Landbird	Maintain							Y				
Mourning Warbler	Landbird	Maintain				Y		Y	Y				
Nashville Warbler	Landbird	Maintain						Y					
Northern Flicker	Landbird	Increase 50%					Y						
Northern Rough-winged Swallow	Landbird	Increase 100%					Y						
Northern Saw-whet Owl (*acadicus*)	Landbird	Assess/Maintain											Y
Olive-sided Flycatcher[10]	Landbird	Recovery objective	T	T	L	Y	Y						
Ovenbird	Landbird	Maintain											Y
Peregrine Falcon (*anatum/tundrius*) [10]	Landbird	Recovery objective	SC	SC	V[11]	Y							
Pine Grosbeak	Landbird	Assess/Maintain						Y					
Purple Finch	Landbird	Maintain					Y						
Rose-breasted Grosbeak	Landbird	Maintain							Y				
Ruffed Grouse	Landbird	Maintain							Y				
Rusty Blackbird[10]	Landbird	Recovery objective	SC	SC	L	Y	Y						
Sedge Wren	Landbird	Increase			L				Y				
Short-eared Owl[10]	Landbird	Recovery objective	SC	SC	L	Y							
Swamp Sparrow	Landbird	Maintain				Y		Y					
Veery	Landbird	Increase 50%					Y		Y				
White-throated Sparrow	Landbird	Maintain				Y		Y					
Wood Thrush	Landbird	Increase 50%	T			Y	Y						
Yellow-bellied Sapsucker	Landbird	Maintain						Y	Y				
Killdeer	Shorebird	Increase 50%								3a			

Table 1 continued

Priority species[1]	Bird group	Population objective	COSEWIC[2]	SARA[3]	Provincial listing[4]	National/continental concern[5] (landbirds)	Regional concern[5] (landbirds)	Continental stewardship[5] (landbirds)	Regional stewardship[5] (landbirds)	Conservation category and rule[6] (shorebirds)	National priority level[7] (waterbirds)	NAWMP rank[8] (waterfowl)	Expert review[9] (changes to priority list)
Solitary Sandpiper	Shorebird	Assess/Maintain								3b			Y
American Bittern	Waterbird	Increase 50%									Tier 1		
Common Loon	Waterbird	Maintain									Tier 1		
Sora	Waterbird	Assess/Maintain									Tier 2		
Virginia Rail	Waterbird	Assess/Maintain									Tier 2		
American Black Duck	Waterfowl	Increase										High	
Barrow's Goldeneye (Eastern population)	Waterfowl	Recovery objective	SC	SC	V							N/A	
Common Goldeneye	Waterfowl	Maintain										Moderately high	
Hooded Merganser	Waterfowl	Maintain										High	
Wood Duck	Waterfowl	Maintain										Moderately low	Y

Table 2. Summary of priority species, by bird group, in BCR 12-QC.

Bird group	Total number of species	Total number of priority species	Percentage listed as priority	Percentage of priority list
Landbirds	154	51	33%	82%
Shorebirds	15	2	13%	3%
Waterbirds	13	4	31%	7%
Waterfowl	33	5	15%	8%
Total	**215**	**62**	**29%**	**100%**

Table 3. Number of priority species in BCR 12-QC, by reason for priority status.

Reason for priority listing[1]	Landbirds	Shorebirds	Waterbirds	Waterfowl
COSEWIC[2]	16	0	0	1
Federal SARA listed[3]	11	0	0	1
Provincially listed[4]	14	0	0	0
National/continental concern[5]	21	-	-	-
Regional concern[5]	18	-	-	-
Continental stewardship[5]	13	-	-	-
Regional stewardship[5]	18	-	-	-
Conservation category[6]	-	1	-	-
Priority level[7]	-	-	4	-
NAWMP[8]	-	-	-	3
Expert review[9]	5	1	0	1

[1] A single species can be on the priority list for more than one reason. Note that not all reasons for inclusion apply to every bird group (indicated by "-").

[2] COSEWIC indicates species assessed by the Committee on the Status of Endangered Wildlife in Canada as Endangered, Threatened, or Special Concern.

[3] Species listed on Schedule 1 of the *Species at Risk Act* as Endangered, Threatened, or Special Concern.

[4] Provincially Listed indicates species listed as Threatened, Vulnerable or Likely to be designated as threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).

[5] See Table 1.

[6] Conservation category indicates a species ranked in Canada's Shorebird Conservation Plan (Donaldson et al., 2000) as having a 5, 4a, 4b or 3a conservation category in the United States of America and Canada.

[7] Priority level indicate a species ranked in Canada's Waterbird Conservation Plan (Milko et al., 2003) as belonging to Tier 1 or Tier 2.

[8] NAWMP indicates a species ranked in the North American Waterfowl Management Plan (Plan Committee, 2004) as having Moderately High, High or Highest breeding or non-breeding conservation and/or monitoring needs in the BCR.

[9] Species that did not meet the standard criteria but that were added by experts.

Element 2: Habitats Important to Priority Species

Identifying the broad habitat requirements for each priority species within the BCR allowed species to be grouped by shared habitat-based conservation issues and actions (see Appendix 2 for details on how species were assigned to standard habitat categories). If many priority species associated with the same habitat face similar conservation issues, then conservation action in that habitat may support populations of several priority species. BCR strategies use a modified version of the standard land cover classes developed by the United Nations (Food and Agriculture Organization 2000) to categorize habitats and species were often assigned to more than one habitat class.

Priority species use 11 habitat types in BCR-12 QC (Fig. 3). Mixed wood forest is the habitat class used by the greatest number of priority species (22), all landbird species, representing 35% of all priority species in the BCR.

Although they represent only 2% of the BCR 12-QC land area, wetlands are the second type of habitat most used by priority species (20 species or 32% of priority species). This habitat class is used by all 4 bird groups, with landbirds dominating (14 species).

The prominence of landbirds in BCR 12-QC continues in the other most favoured habitat classes. Coniferous forest (27% of priority species), deciduous forest (27%) and riparian areas (21%) are among the habitats most used by priority species. Coniferous and deciduous forests are used by landbirds, and riparian areas are mostly used by landbirds, waterfowl and one species of shorebird (Solitary Sandpiper).

See Section 2 for additional details on priority species, threats and conservation actions for each habitat type in the BCR 12-QC.

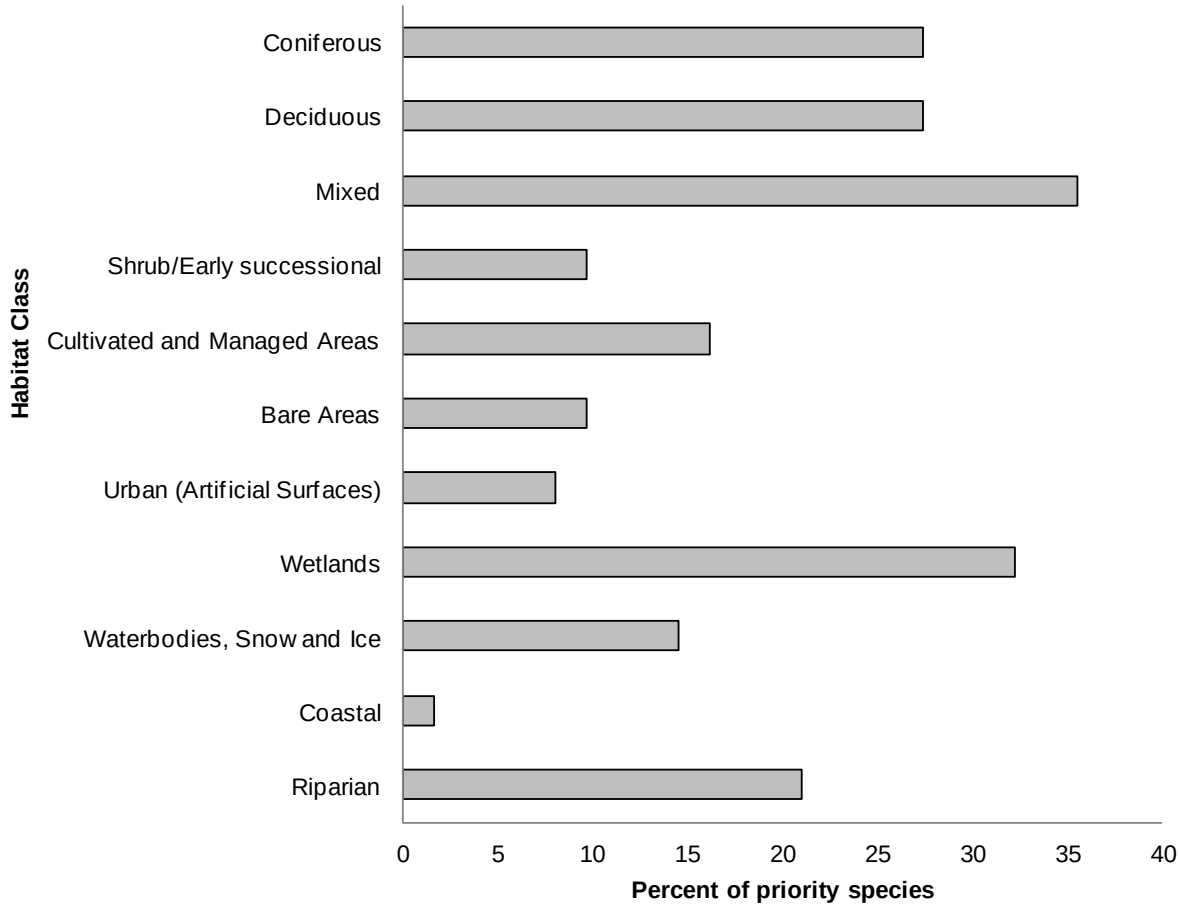

Figure 3. Percent of priority species that use each habitat type in BCR 12–QC.
Note: The total exceeds 100% because each species may be assigned to more than one habitat.

Element 3: Population Objectives

Population objectives allow us to measure and evaluate conservation success. The objectives in this strategy are assigned to categories and are based on a quantitative or qualitative assessment of species' population trends. If the population trend of a species is unknown, the objective is set as "assess and maintain", and a monitoring objective is given (see Appendix 2). For any species listed under the *Species at Risk Act* (SARA) or under provincial/territorial endangered species legislation, Bird Conservation Strategies defer to population objectives in available Recovery Strategies and Management Plans. The ultimate measure of conservation success will be the extent to which population objectives have been reached over the next 40 years. Population objectives do not currently factor in feasibility of achievement but are held as a standard against which to measure progress.

Maintaining populations at current levels was the objective assigned to the greatest number of priority species in BCR 12-QC (35% of priority species; Fig. 4). With the exception of one species, better population trend data must be acquired for decision-making for all species that have been assigned this objective. This also applies to species whose population objective is "Assess/Maintain" (15% of priority species).

Due to the significant presence of species at risk in BCR 12-QC, population objectives relating to species recovery rank second at 23% of all objectives for the region. In addition to these recovery objectives, which all seek to increase populations of species at risk, population increase objectives were also assigned to 27% of priority species under the categories "Increase," "Increase 50%" and "Increase 100%." Overall, 50% of priority species identified in BCR-12 QC were assigned a population increase objective. This reflects the magnitude of the threats affecting bird populations in this BCR.

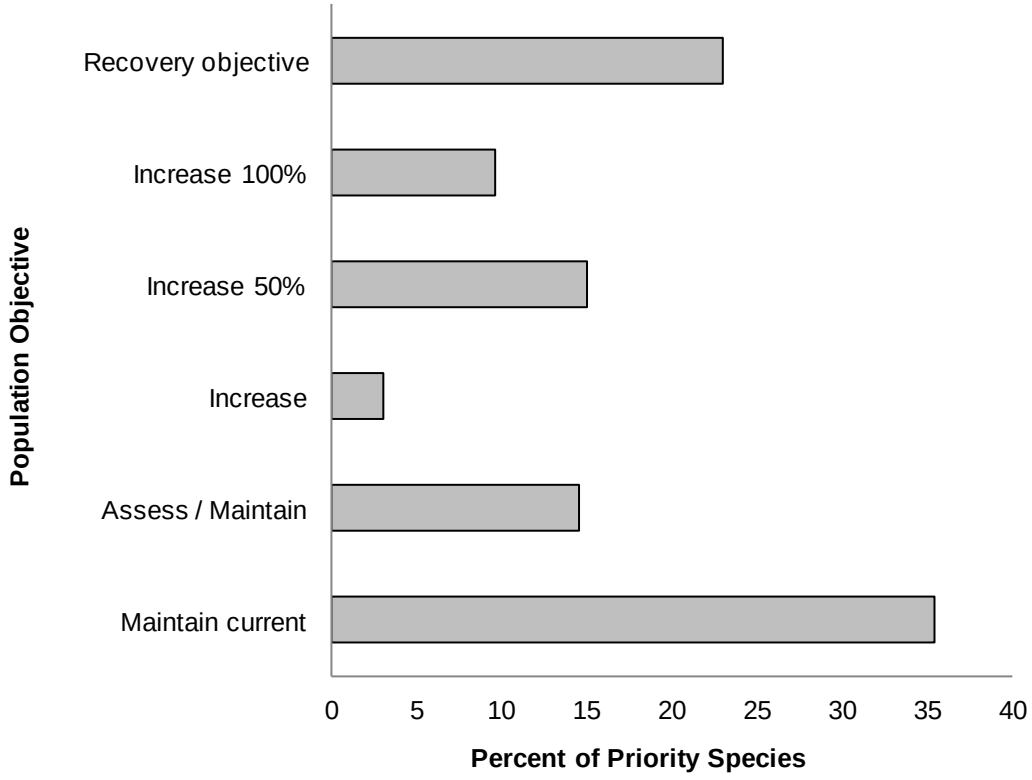

Figure 4. Percent of priority species associated with each population objective category in BCR 12–QC.

Element 4: Threat Assessment for Priority Species

The threats assessment process (see Appendix 2) identifies threats believed to have a population-level effect on individual priority species. These threats are assigned a relative magnitude (Low, Medium, High, Very High), based on their scope (the proportion of the species' range within the subregion that is impacted) and severity (the relative impact on the priority species' population). This allows us to target conservation actions towards threats with the greatest effects on suites of species or in broad habitat classes. Some well-known conservation issues (such as predation by domestic cats or climate change) may not be identified in the literature as significant threats to populations of an individual priority species and therefore may not be captured in the threat assessment. However, they merit attention in conservation strategies because of the large numbers of individual birds affected in many regions of Canada. We have incorporated them in a separate section on Widespread Issues, but, unlike other threats, they are not ranked.

Bird populations found in BCR 12-QC face many threats from different sources. No less than 342 threats classified into 11 categories and 23 sub-categories have been identified and are summarized in Figure 5. Category "12. Other direct threats," represented by sub-category "12.1 Information lacking" is the category most frequently associated with priority species in BCR 12-QC because it includes 36% of all identified threats (Fig. 5). This category, with a "Low" rolled-up overall magnitude, is composed of elements relating to the lack of biological or demographic information required for appropriate population management. Its magnitude is also attributable to the presence of species at risk for which there are no recovery strategies or management plans (Table 4). Only 5 of the 20 species at risk in BCR 12-QC had a recovery strategy or management plan published when this strategy was written. The need for more information was raised for 47 of the 62 priority species (76%) in BCR 12-QC.

Category "5. Biological resource use" has a "High" rolled-up overall magnitude (Table 4) and ranks second in the percentage of threats affecting priority species in BCR 12-QC, with 15% of all threats. Sub-category "5.3 Logging & wood harvesting," which alone is responsible for 13% of threats, includes forest habitat fragmentation, and the growing scarcity forest stands of dead trees, large diameter trees and snags with cavities.

Category "2. Agriculture & aquaculture" also has a "High" rolled-up overall magnitude (Table 4) and includes 12% of identified threats, most of which are in sub-category "2.1 Annual & perennial non-timber crops" (Fig. 5). This sub-category includes elements such as the conversion of forested farmland to arable land, habitat loss and degradation due to the transition from perennial to annual crops, intensification of agriculture, and drainage and filling of wetlands for agriculture. This sub-category is the only one in BCR 12-QC with a "Very High" rolled-up magnitude.

Sub-categories "1.1 Housing & urban areas" and "1.2 Commercial & industrial areas" of category "1. Residential & commercial development" are the other most common threats at 9% and 7% respectively (Fig. 5). These sub-categories include threats such as habitat loss and/or

degradation due to drainage and filling of wetlands for residential, commercial or industrial development, loss of woodlands for development, and a decrease in the abundance of prey insects caused by the destruction of wetlands. Overall, category 1 has a “Medium” relative magnitude (Table 4).

Category “7. Natural system modifications” is represented by sub-categories “7.2 Dams & water management/use” and “7.3 Other ecosystem modifications” in BCR 12-QC. Although it describes only a little over 5% of all existing threats, this category’s rolled-up overall magnitude remains “High” (Table 4). The only threat in sub-category 7.2 is the danger of nest flooding arising from fluctuations in river and reservoir water levels. Sub-category 7.3 includes threats such as the abandonment of agricultural land, which then becomes unsuitable for some species of farmland birds, fish stocking in historically fishless lakes, closure or disruption of sandpits used for nesting and the transition of shrub habitats to forest habitats.

Category “11. Climate change & severe weather” includes only 5% of identified threats, but its rolled-up overall magnitude is “High” (Table 4). This category includes sub-categories “11.1 Habitat shifting & alteration” and “11.5 Other impacts.” The only threat in sub-category 11.1 is wetland loss and degradation, and the only threat in sub-category 11.5 is the higher frequency of adverse weather events that may affect migration, reproductive success, nesting phenology and prey availability. The threat of reduced prey availability affects aerial insectivores such as various species of swallows, the Common Nighthawk, the Chimney Swift and the Olive-sided Flycatcher.

Other types of threats such as “3. Energy production & mining,” “4. Transportation & service corridors,” “6. Human intrusions & disturbance,” “8. Invasive & other problematic species & genes” and “9. Pollution” each include less than 5% of all identified threats and have a rolled-up overall magnitude of “Low” or “Medium” (Fig. 5, Table 4).

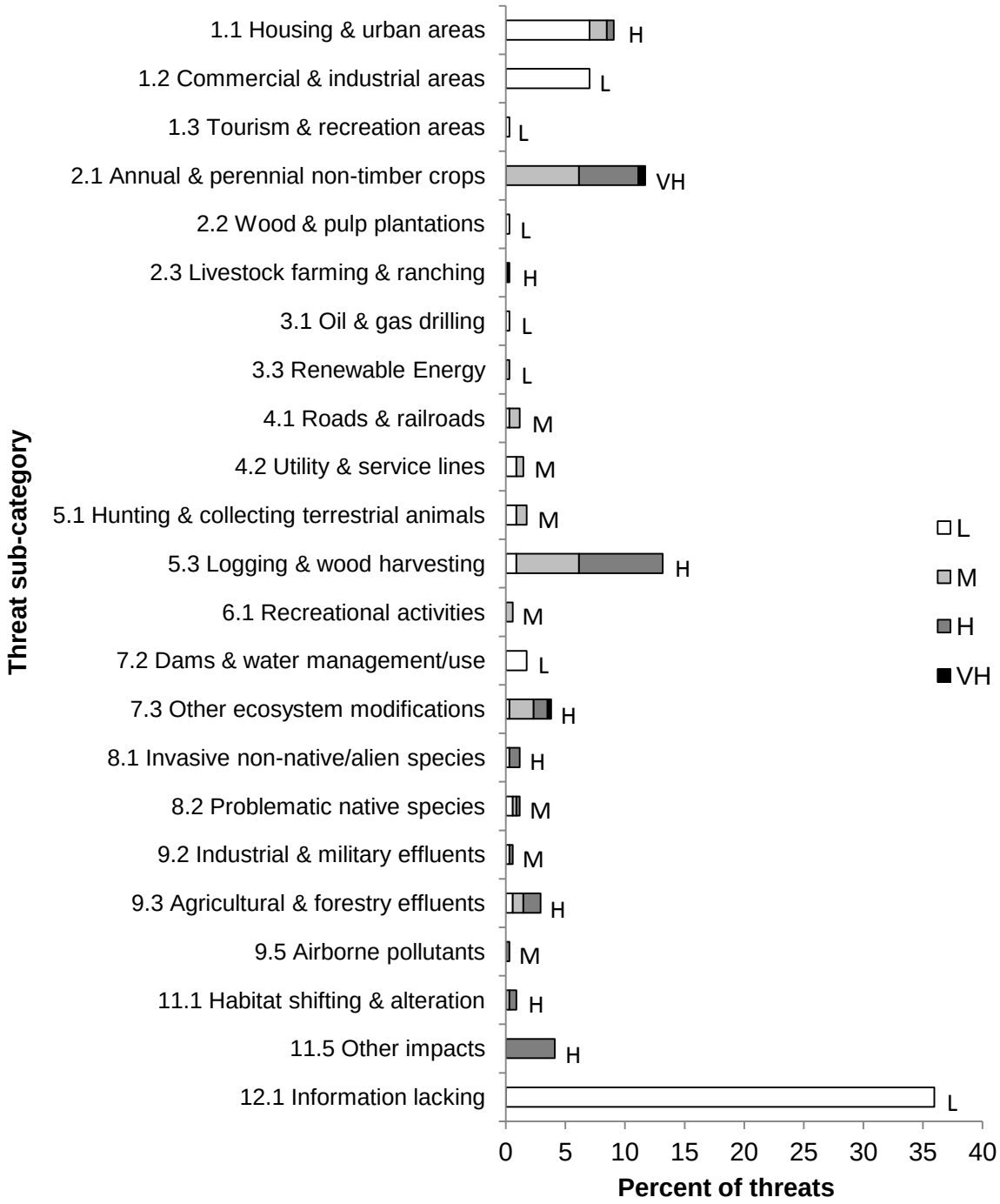

Figure 5. Percent of identified threats to priority species within BCR 12-QC by threat sub-category.
Each bar represents the percent of the total number of threats identified in each threat sub-category in BCR 12-QC (for example, if 100 threats were identified in total for all priority species in BCR 12-QC, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. The overall magnitude of the sub-threat in the BCR is shown at the end of each bar. (See Appendix 2 for details on how magnitude was assessed.)

The rolled-up overall magnitude of threats is “High” in 4 of the 11 habitat classes in the BCR 12-QC: deciduous, cultivated and managed areas, urban, and wetlands (Table 4). The last 3 are particularly affected by “High” relative magnitude threats from climate change and severe weather (category 11), while deciduous forests face threats of similar magnitude resulting from biological resource use (category 5) and agriculture (category 2). Cultivated and managed areas are also affected by agricultural threats (“Very High” relative magnitude) and pollution (category 9). Birds found in wetlands are affected by “High” relative magnitude impacts in categories “5. Biological resource use” and “8. Invasive & other problematic species & genes,” while birds utilizing urban areas are particularly affected by residential and commercial development (category 1).

Section 2 provides more details on the threats associated with the various habitat classes. Threats to priority species while they are outside Canada during the non-breeding season were also assessed and are presented in the section entitled Threats Outside Canada.

Table 4. Relative magnitude of identified threats to priority species within BCR 12-QC by threat category and broad habitat class.

Overall ranks were generated through a roll-up procedure described in Kennedy et al. (2012). L represents Low Magnitude threats; M = Medium; H = High; VH = Very High. Blank cells indicate that no priority species had threats identified in the threat category/habitat combination.

Threat category	Habitat class											
	Coniferous	Deciduous	Mixed Wood	Shrub/Early Successional	Cultivated and Managed Areas	Bare Areas	Urban	Wetlands	Waterbodies	Coastal	Riparian	**Overall**
Overall	**M**	**H**	**M**	**M**	**H**	**M**	**H**	**H**	**M**	**L**	**M**	
1. Residential & commercial development	L	L	L	.	.	.	H	M	L	.	M	**M**
2. Agriculture & aquaculture	M	H	.	M	VH	.	.	M	.	.	.	**H**
3. Energy production & mining	L	.	.	.	.	.	.	.	.	L	.	**L**
4. Transportation & service corridors	L	M	.	L	L	.	L	.	.	.	L	**L**
5. Biological resource use	H	H	H	L	.	L	L	H	M	L	H	**H**
6. Human intrusions & disturbance	.	.	.	.	.	M	.	.	.	.	.	**L**
7. Natural system modifications	.	.	.	H	M	H	.	L	M	.	M	**H**
8. Invasive & other problematic species & genes	.	L	.	M	.	.	.	H	.	.	.	**M**
9. Pollution	.	.	.	L	H	.	.	M	L	M	.	**M**
11. Climate change & severe weather	.	.	.	.	H	.	H	H	.	.	M	**H**
12. Other direct threats	L	L	L	L	L	L	L	L	L	.	L	**L**

Element 5: Conservation Objectives

Conservation objectives were designed to address threats and information gaps that were identified for priority species. They describe the environmental conditions and research and monitoring that are thought to be necessary for progress towards population objectives and to understand underlying conservation issues for priority bird species. As conservation objectives are reached, they will collectively contribute to achieving population objectives. Whenever possible, conservation objectives were developed to benefit multiple species, and/or respond to more than one threat (see Appendix 2).

Conservation objectives have been divided into the seven categories presented in Figure 6. In BCR-12 QC, 43% of suggested conservation objectives are in category "1. Ensure adequate habitat" and include nearly all habitats in BCR 12-QC, with the exception of bare areas and coastal areas. This objective category includes four sub-categories in this BCR: "1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat," "1.2 Maintain the size, shape and configuration of habitat within the natural range of variation," "1.3. Ensure the continuation of natural processes that maintain bird habitat" and "1.4 Maintain important bird features on the landscape."

Objective "7. Improve understanding (of population status, limiting factors, and mitigation)" ranks second with 27% of all suggested conservation objectives. All objectives in this category are from sub-category "7.1 Improve population/demographic monitoring" and demonstrate a need for increased monitoring in this BCR for many priority species in the four bird groups.

Seventeen percent of the conservation objectives involve managing individual species (category 3). Three quarters of the objectives in this category are from sub-category "3.4 Implement recovery plans for species at risk" because there are 20 species at risk in BCR 12-QC. Sub-categories "3.3 Reduce parasitism/predation" and "3.5 Prevent and control the spread of invasive and exotic species" complete this category's objectives.

Objective "2. Reduce mortality/increase productivity" represents 5% of the conservation objectives in BCR 12–QC . Nearly half of this category's objectives are in sub-category "2.1 Reduce mortality and/or sub-lethal effects from pesticide use," while nearly one quarter are from sub-category "2.7. Reduce incidental mortality from collisions." The other objectives in this category are part of sub-categories "2.2. Reduce mortality and/or sub-lethal effects from exposure to contaminants," "2.4 Reduce incidental mortality" and "2.8. Reduce mortality from legal or illegal hunting, and persecution."

Categories "6. Manage for climate change" and "4. Reduce disturbance" accounted for 5% and 2% of all the objectives raised for BCR 12-QC. Sub-category "6.2 Manage for habitat resilience as climate changes," which primarily involves aerial insectivores, is the only sub-category included in category 6. All category 4 conservation objectives are from sub-category "4.1. Reduce disturbance from human recreation" and are mostly related to priority species that are

nesting or gathering near the lakes. No objectives have been assigned to sub-category "5. 5. Ensure adequate food supplies" in BCR 12-QC.

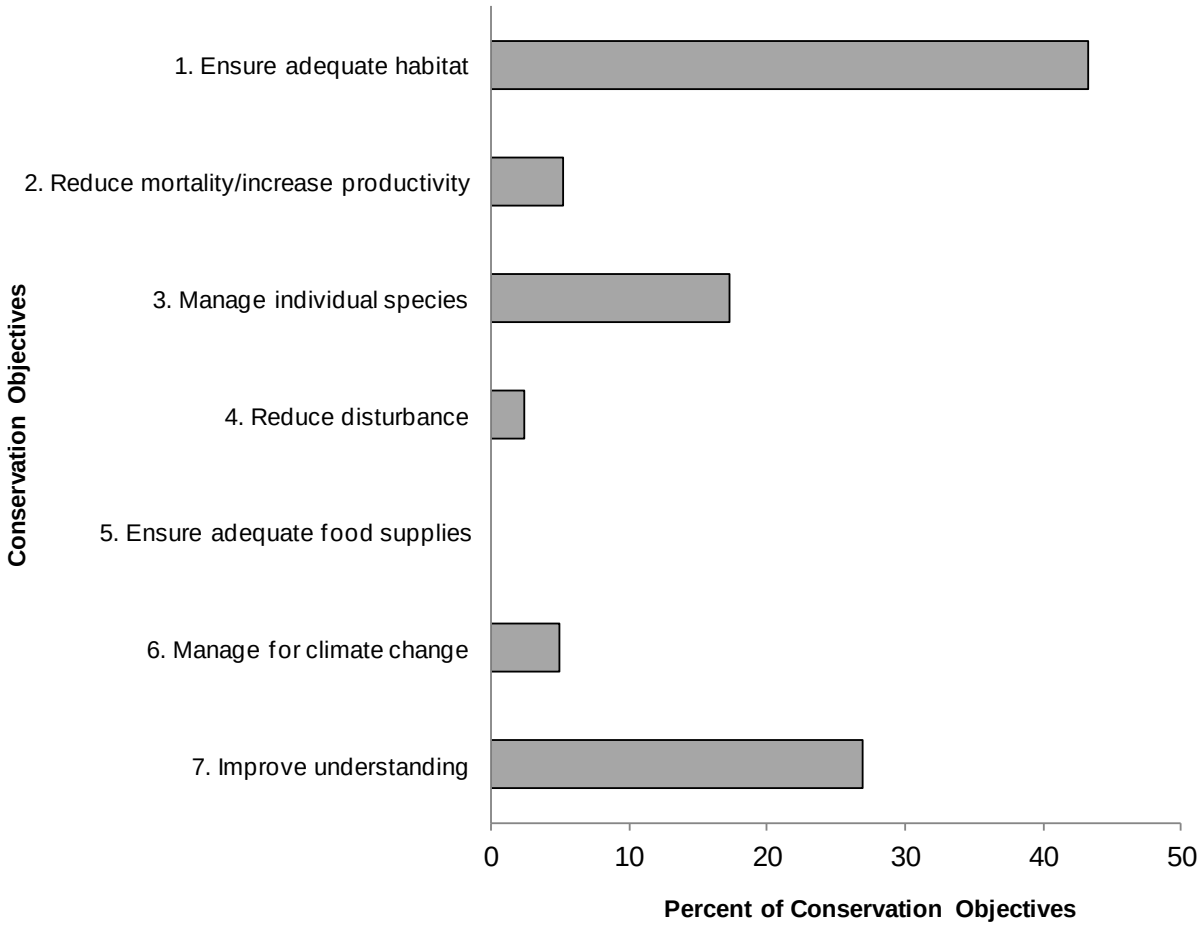

Figure 6. Percent of all conservation objectives assigned to each conservation objective category in BCR 12-QC.

Note: Objective "7. Improve understanding" in this case indicates improving our understanding of population status, limiting factors and mitigation.

Element 6: Recommended Actions

Recommended actions indicate on-the-ground activities that will help to achieve the conservation objectives (Fig. 7). Actions are strategic rather than highly detailed and prescriptive (see Appendix 2). Whenever possible, recommended actions benefit multiple species and/or respond to more than one threat. Recommended actions defer to or support those provided in recovery documents for species at risk at the federal, provincial or territorial level, but will usually be more general than those developed for individual species.

Figure 7 shows that 32% of the actions recommended in BCR 12-QC are in sub-category "8.2 Monitoring." The high frequency of this recommendation is primarily due to the lack of biological or demographic information on the priority species in the BCR. The actions suggested in this category include increasing the coverage of the Breeding Bird Survey (BBS), conducting specific surveys (for example, surveys involving high altitude birds, birds nesting in boreal forests or nocturnal birds), expanding the current migration monitoring program, and maintaining waterfowl banding and survey programs.

Sub-category "1.1 Site/area protection" is the second largest, representing 25% of all recommended actions. The actions recommended in this category particularly target wetlands and include protecting a variety of wetlands through various mechanisms such as stewardship or the legal designation of wetlands as conservation areas, the adoption of municipal urban plans that protect wetlands and woodlands, and the protection of large tracts of mature forest. These actions are designed to minimize the impact of threats relating to residential and commercial development, as well as agriculture.

The adoption of standards and beneficial practices, mainly in agriculture and forestry (5.3), is the third most frequently mentioned action sub-category (11%). More specifically, developing beneficial practices to reduce accidental bird mortality in agricultural areas, implementing silvicultural treatments that maintain natural habitat structure and supporting sustainable agriculture in Quebec are some actions suggested for overcoming several threats relating to annual and perennial crops, and logging and wood harvesting.

Sub-category "3.2 Species recovery" represents 10% of the recommended actions and includes continued implementation of recovery strategies or management plans for species at risk. Sub-category "5.2 Policies and regulations" includes 8% of the recommended actions and refers primarily to improving the protection of wetlands through available policies, regulations and stewardship tools.

More details on recommended actions for the various habitat classes are presented in Section 2.

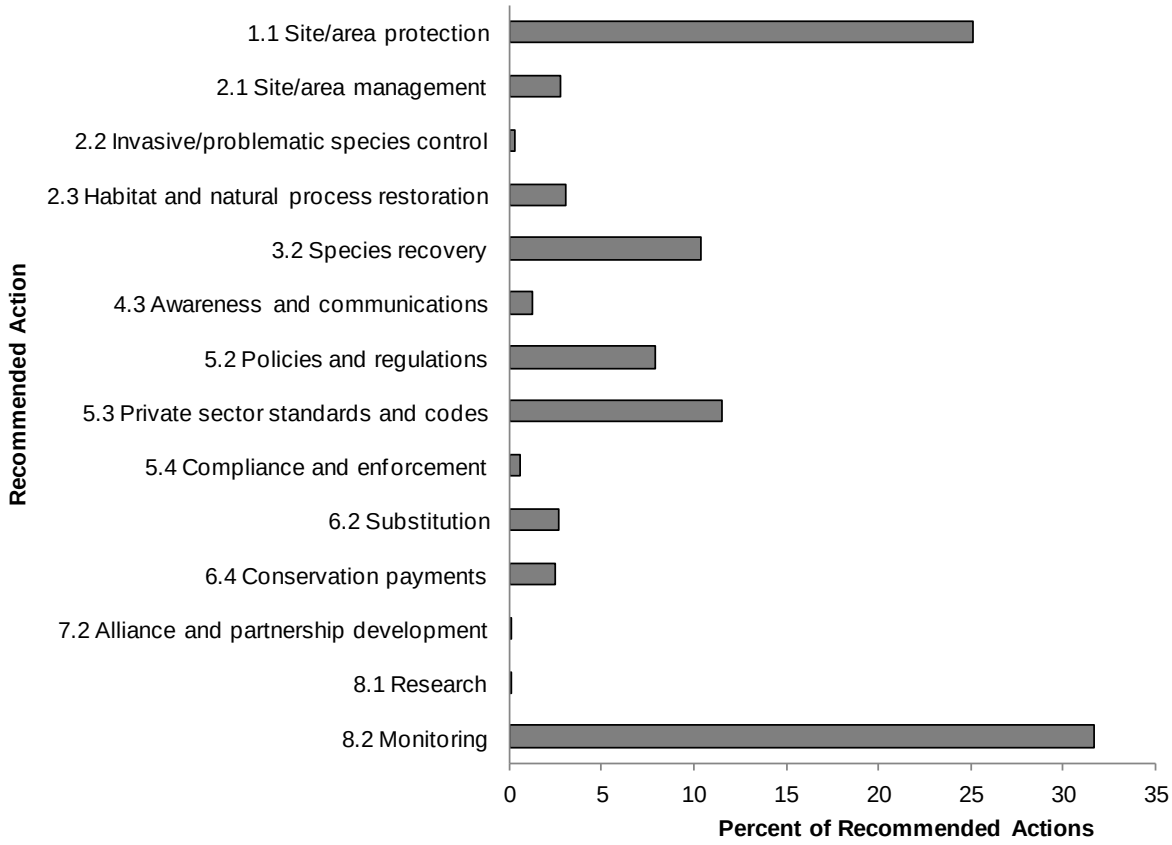

Figure 7. Percent of recommended actions assigned to each sub-category in BCR 12–QC.
Sub-categories "8.1 Research" and "8.2 Monitoring" refer to specific species where more information is required before conservation actions can be formulated. See section Research and Population Monitoring Needs for information on broad-scale research and monitoring requirements.

Section 2: Conservation Needs by Habitat

The following sections provide more detailed information on priority species, their threats and objectives within each of the broad habitat classes that occur in BCR 12-QC. Where appropriate, habitat information is provided at a finer scale than the broad habitat categories in order to coincide with other land management exercises in the region. Some species do not appear in the threats table because their low level threats have not been assigned objectives or actions and/or identified threats are addressed in the Widespread Issues section of the strategy.

Coniferous

According to the United Nations Food and Agriculture Organization's (UN-FAO) Land Cover Classification System, coniferous habitats are defined as forest or woodland dominated by evergreen trees whose foliage is typically needle-shaped. In BCR 12-QC, coniferous habitats occupy 21% of the land, making this habitat class the second largest in the BCR in terms of area (Fig. 8). Coniferous habitats are mainly represented by the balsam fir-white birch and the spruce-moss bioclimatic domains, and include species such as balsam fir, white spruce, black spruce, jack pine, larch, white birch and trembling aspen.

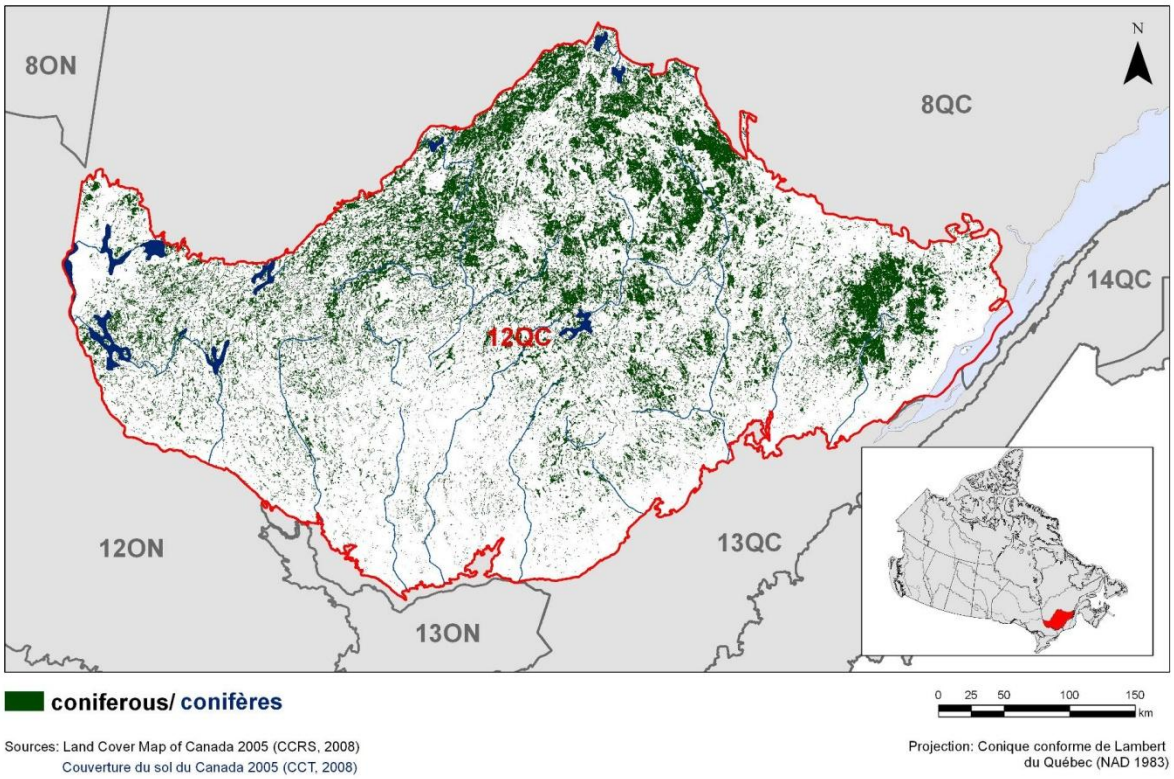

Figure 8. Map of coniferous habitat in BCR 12-QC: Boreal Hardwood Transition.

Seventeen priority species, all landbirds, use coniferous habitats in BCR 12-QC (Table 5). Thirteen of these species were included in the priority list for conservation reasons, while 4

were included for stewardship purposes. Four priority species found in this habitat type are species at risk and have been listed on Schedule 1 of SARA as “Threatened”: the Whip-poor-will, Bicknell’s Thrush, Olive-sided Flycatcher and Canada Warbler. There are however, no published recovery strategies for these 4 species at the time of writing this strategy.

The threats most frequently identified in coniferous habitat involve logging and wood harvesting (Fig. 9). This threat category has a “High” rolled-up overall magnitude and accounts for 64% of this habitat’s conservation issues. The main threats reported include: forest habitat fragmentation and loss, loss of mature forest, the growing scarcity of stands of dead trees, large diameter trees and snags with cavities, and loss of disturbed habitat.

The full list of threats to priority species in the coniferous habitat of BCR 12-QC as well as the objectives, and recommended conservation actions are presented in Table 6. Conservation objectives are mainly to conserve, protect and restore coniferous habitats and the features that make them important for birds. Conservation actions primarily seek to have forestry stakeholders establish standards and beneficial practices to preserve the characteristics of coniferous habitats that are important for priority birds.

Table 5. Priority species that use coniferous habitat, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
American Three-toed Woodpecker	Disturbed forests (burnt out areas / windfall)	Assess/Maintain	-	X	-
Black-backed Woodpecker	Disturbed forests (burnt out areas / windfall); Dense mature coniferous forest	Assess/Maintain	-	X	-
Bay-breasted Warbler	Mature coniferous forest	Increase 50%	-	X	-
Bicknell's Thrush[4]	Dense coniferous forest, shrubland, arboreal succession, stunted trees	Recovery objective	X	X	-
Blackburnian Warbler	Stands of mature conifers	Maintain	-	-	X
Black-throated Green Warbler	Stands of conifers with a closed canopy and complex vertical layers	Maintain	-	-	X
Boreal Owl	Dense mature coniferous forest	Assess/Maintain	-	X	-
Brown Creeper	Mature coniferous forest	Assess/Maintain	-	X	-
Canada Warbler[4]	Relatively open stands of conifers	Recovery objective	X	X	-
Connecticut Warbler	Open coniferous forest	Increase 50%	-	X	-
Eastern whip-poor-will[4]	Many types of dry forest habitats with clearings and stands of young pine	Recovery objective	X	X	-
Northern Flicker	Open stands of conifers	Increase 50%	-	X	-
Olive-sided Flycatcher[4]	Stands of conifers	Recovery objective	X	X	-

[1] "At risk" includes species considered Endangered, Threatened or Special Concern pursuant to an assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); listed on Schedule 1 of the *Species at Risk Act* (SARA) as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).

[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.

[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.

[4] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objectives for these species are: Eastern whip-poor-will: Assess/Increase 100%; Bicknell's Thrush: Assess/Increase 100%; Olive-sided Flycatcher: Assess/Increase 100%; Canada Warbler: Assess/Increase 100%.

Table 5 continued

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Ovenbird	Dense mature forest	Maintain	-	-	X
Pine Grosbeak	Coniferous forest	Assess/Maintain	-	X	-
Purple Finch	Stands of conifers (open)	Maintain	-	X	-
White-throated Sparrow	Stands of conifers	Maintain	-	-	X

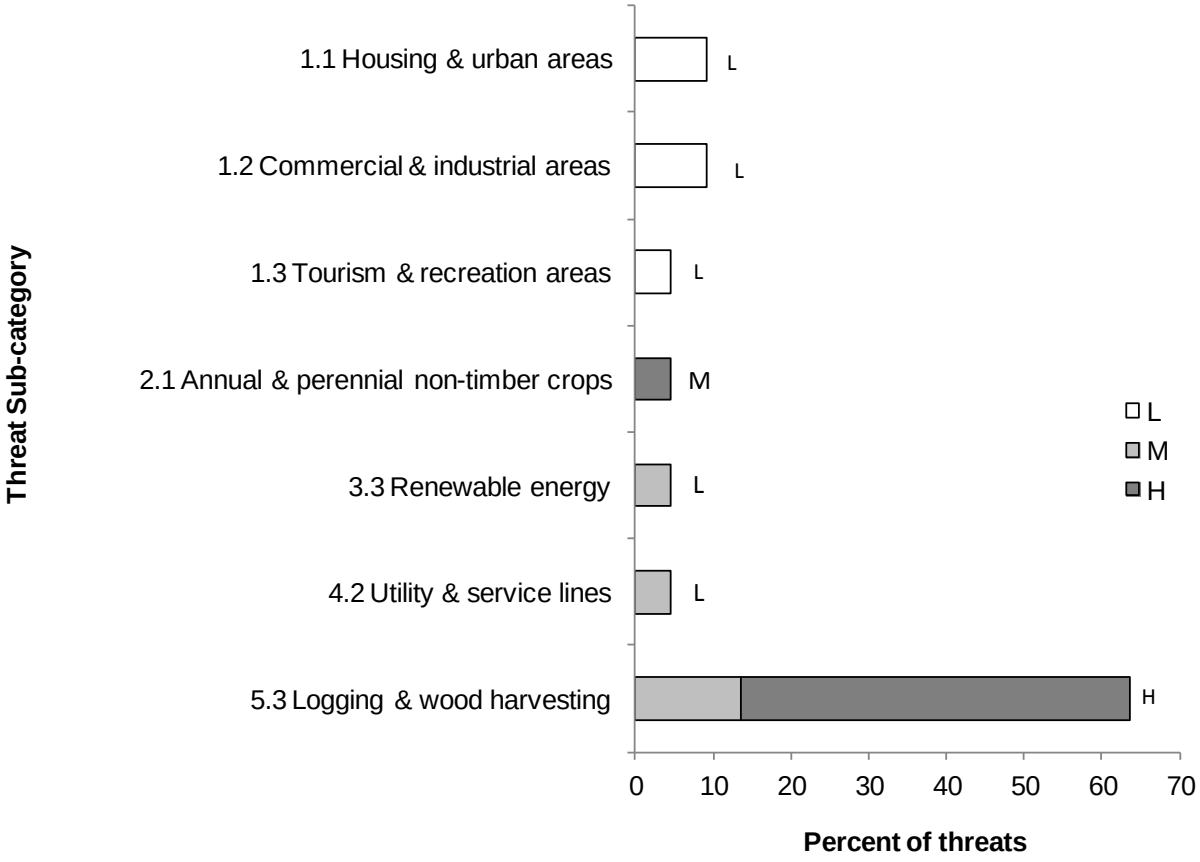

Figure 9. Percent of identified threats to priority species in coniferous habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in coniferous habitat (for example, if 100 threats were identified in total for all priority species in coniferous habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in coniferous habitat is shown at the end of each bar.

Table 6. Threats addressed, conservation objectives, recommended actions and priority species affected in the coniferous habitat of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Loss of mature forest (conversion of woodlands into residential, commercial or industrial land).	1.1 Housing & urban areas 1.2 Commercial & industrial areas	Conserve mature coniferous forests and the features that make them important for birds.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	In municipalities, adopt urban plans that protect important woodlands. Protect large tracts of mature forest through stewardship or by legally designating them as conservation areas.	1.1 Site/area protection	Pine Grosbeak, Brown Creeper
Habitat loss through development of tourism and recreational activities (ski resorts and hiking), renewable energy (wind turbines and transmission lines) and telecommunication towers.	1.3 Tourism & recreation areas 3.3 Renewable energy 4.2 Utility & service lines	Conserve and restore the quality and quantity of coniferous habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Implement the mitigation and prevention actions identified in project environmental assessments.	5.3 Private sector standards and codes	Bicknell's Thrush
Conversion of Jack Pine stands to blueberry fields.	2.1 Annual & perennial non-timber crops	Conserve mature coniferous forests and the features that make them important for birds.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Protect important nesting sites through stewardship or by legally designating them as conservation areas.	1.1 Site/area protection	Connecticut Warbler

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Table 6 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Gradual disappearance of mature forests due to shorter turnaround time in forestry.	5.3 Logging & wood harvesting	Increase the quantity of mature conifer forest on the landscape	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Extend the period between logging operations. Promote forest management that maintains the landscape structure (stand composition and age) within the natural range of variation.	2.3 Habitat and natural process restoration 5.3 Private sector standards and codes	Bay-breasted Warbler, Pine Grosbeak, Brown Creeper, Black-backed Woodpecker, American Three-toed Woodpecker
Habitat loss and fragmentation due to the reduced average size of forest habitats and their increasing isolation.	5.3 Logging & wood harvesting	Maintain connectivity between coniferous forests.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Adopt practices that maximize habitat connectivity (better spatial configuration).	5.3 Private sector standards and codes	Bicknell's Thrush
Simplification of forest structure through the regeneration of forest cover orby the use of intermediate silvicultural treatments (precommercial thinning).	5.3 Logging & wood harvesting	Conserve the diversity of types of coniferous forest on the landscape	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Reduce use of intermediate silvicultural treatments (precommercial thinning). Promote forest management that maintains the landscape structure (stand composition and age) within the natural range of variation.	5.3 Private sector standards and codes	Bicknell's Thrush
Habitat loss (scarcity of large diameter trees).	5.3 Logging & wood harvesting	Restore features in coniferous forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	5.3 Private sector standards and codes	Brown Creeper, Northern Flicker

Table 6 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Habitat loss (scarcity of snags for cavity nesting birds).	5.3 Logging & wood harvesting	Restore features in coniferous forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Install artifical nesting structures. Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	3.2 Species recovery 5.3 Private sector standards and codes	Boreal Owl
Habitat loss (scarcity of stands of dead trees).	5.3 Logging & wood harvesting	Restore features in coniferous forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	5.3 Private sector standards and codes	Black-backed Woodpecker, American Three-toed Woodpecker
Loss of (recently and severely) disturbed habitats due to fire suppression, control of insect infestations and increased salvage harvesting.	5.3 Logging & wood harvesting	Conserve an appropriate percentage of dead trees in recently disturbed forests.	1.4. Maintain important habitat features on the landscape	Limit salvage harvesting.	5.3 Private sector standards and codes	Black-backed Woodpecker, American Three-toed Woodpecker

Deciduous

According to the United Nations Food and Agriculture Organization's (UN-FAO) Land Cover Classification System, deciduous habitats are defined as forest or woodlands dominated by trees that lose their leaves for part of the year. In BCR 12-QC, deciduous habitats occupy 16% of the land, making this habitat class the third largest in the BCR in terms of area (Fig. 10). They are chiefly represented by the sugar maple-basswood and sugar maple-yellow birch bioclimatic domains and include representative species such as sugar maple, basswood, yellow birch, American white ash and American beech.

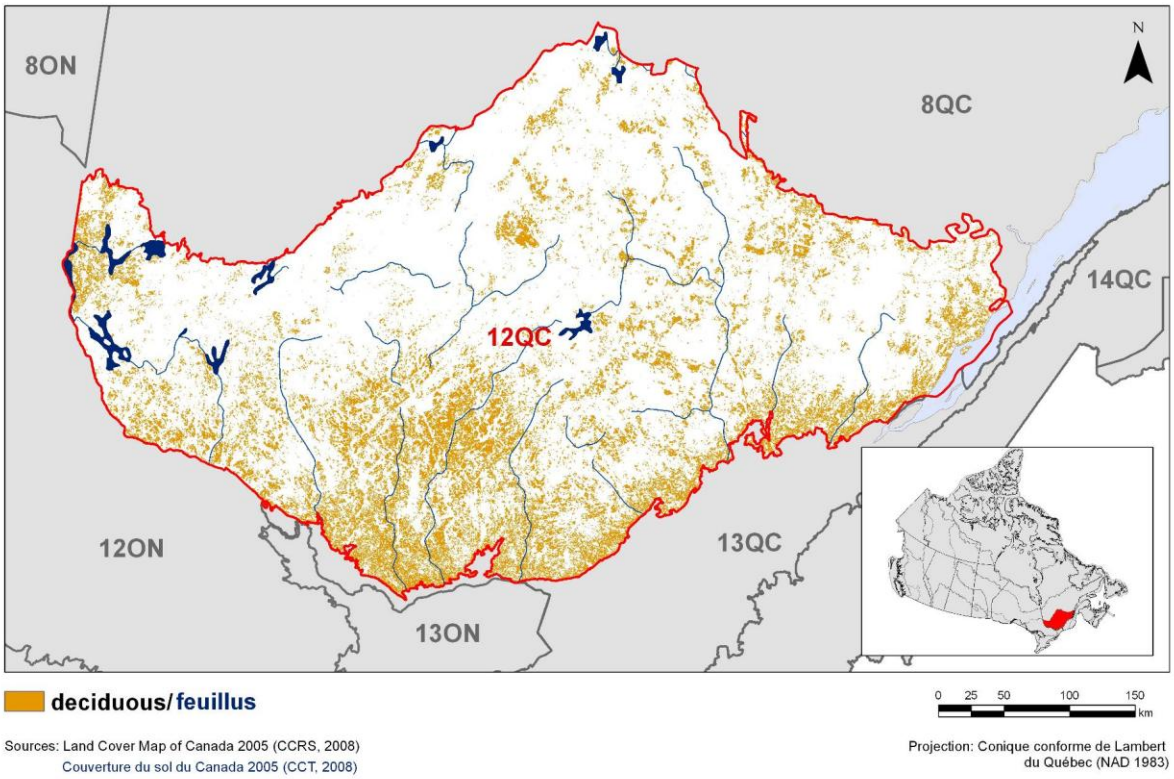

Figure 10. Map of deciduous habitat in BCR 12-QC: Boreal Hardwood Transition.

Seventeen priority species, all landbirds, use the deciduous habitats in BCR 12-QC (Table 7). Eight of these species were selected for conservation reasons, while 9 were chosen for stewardship reasons. Two priority species found in this habitat type are species at risk and are listed on Schedule 1 of SARA: the Whip-poor-will (Threatened) and the Cerulean Warbler (Special Concern). COSEWIC has assessed the Wood Thrush as Threatened and the Eastern Wood-Pewee as a species of Special Concern.

The threats most frequently identified in the deciduous habitat involve logging and wood harvesting (Fig. 11). This threat sub-category has a "High" rolled-up overall magnitude and accounts for 32% of this habitat's conservation issues. The main threats relating to the forest sector are essentially the same as those in coniferous habitats. They include forest habitat

fragmentation and loss, loss of mature forest, the growing scarcity of large diameter trees and snags.

Threat sub-categories “1.1 Housing & urban areas”, “1.2 Commercial & industrial areas” and “2.1 Annual & perennial non-timber crops” each account for 14% of reported deciduous habitat threats, but only 2.1 has a “High” rolled-up overall magnitude (Fig. 11). The conservation issue associated with these three threat categories is the conversion of woodlands to residential, commercial or agricultural land.

The full list of threats in the deciduous habitat of BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 8. Conservation objectives are mainly to conserve, protect and restore deciduous habitats and the features that make them important for birds. Conservation actions include various suggestions such as the use of silvicultural treatments that preserve some characteristics that are important for birds, and the preservation of woodlands in agricultural and suburban areas.

Table 7. Priority species that use deciduous habitat, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Black-billed Cuckoo	Stands of intermediate age deciduous trees	Maintain	-	-	X
Black-throated Blue Warbler	Deciduous stands with a layered structure	Maintain	-	-	X
Brown Creeper	Mature deciduous forest	Assess/Maintain	-	X	-
Cerulean Warbler	Dense mature deciduous forest	Recovery objective[4]	X	X	-
Eastern whip-poor-will[5]	Many types of dry forest habitats with clearings, and edges of cultivated fields interspersed with bushes and especially young stands of oak and beech.	Recovery objective	X	X	-
Eastern Wood-Pewee	Deciduous stands of any age, clearings or strips	Increase 50%	X	X	-
Least Flycatcher	Deciduous stands	Maintain	-	-	X
Mourning Warbler	Primarily early successional stands with a dense layer of deciduous trees	Maintain	-	-	X
Nashville Warbler	Young conifer stands with a dense shrub layer dominated by deciduous trees	Maintain	-	-	X
Northern Flicker	Open deciduous stands	Increase 50%	-	X	-

[1] "At risk" includes species considered Endangered, Threatened or Special Concern pursuant to an assessment by the COSEWIC; listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).
[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.
[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.
[4] Consult Environment Canada (2011).
[5] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objectives for these species are: Eastern whip-poor-will: Assess/Increase 100%.

Table 7 continued

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Northern Saw-whet Owl (*acadicus*)	Dense mature deciduous forest	Assess/Maintain	-	X	-
Ovenbird	Dense mature forest	Maintain	-	-	X
Rose-breasted Grosbeak	Open stands of early successional deciduous trees	Maintain	-	-	X
Ruffed Grouse	Deciduous stands	Maintain	-	-	X
Veery	Stands of intermediate age deciduous trees	Increase 50%	-	X	-
Wood Thrush	Dense mature deciduous forest	Increase 50%	X	X	-
Yellow-bellied Sapsucker	Mainly mature deciduous stands	Maintain	-	-	X

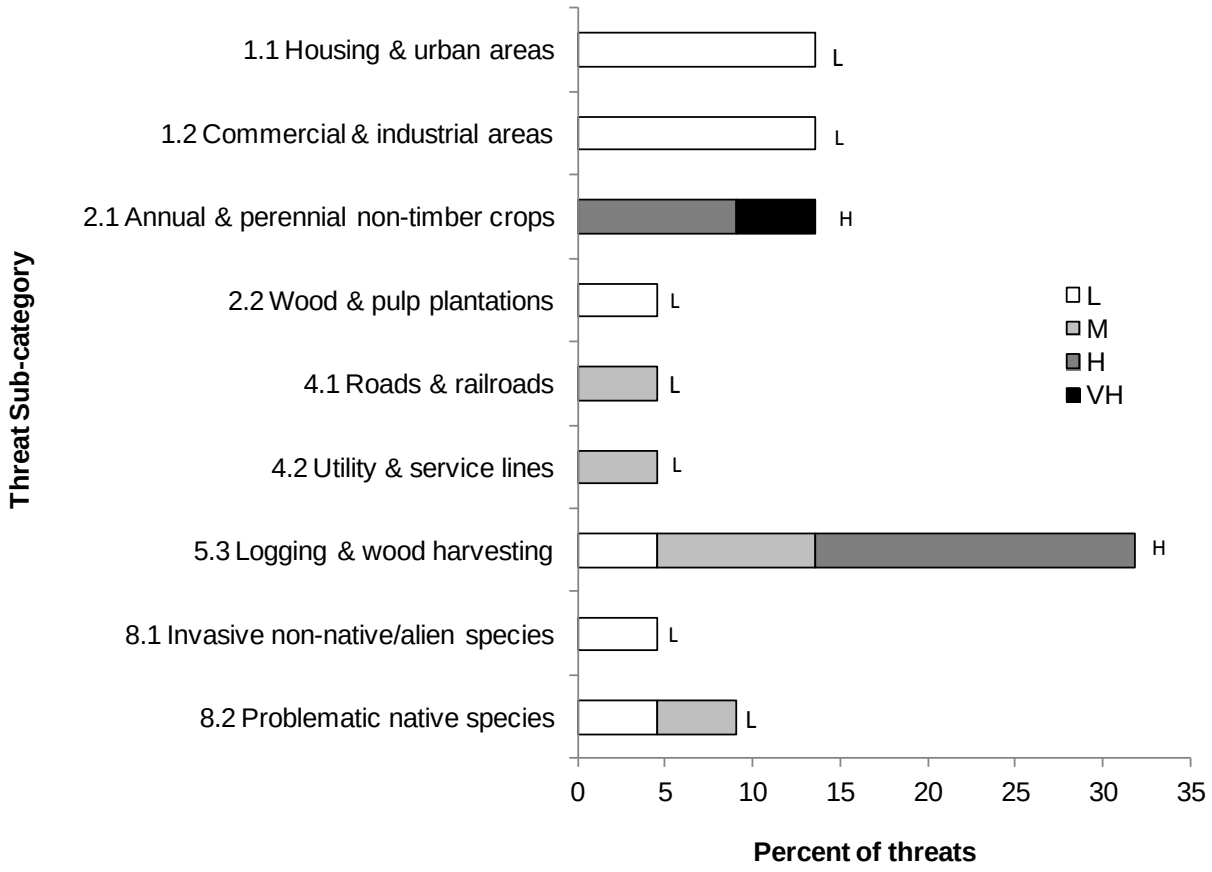

Figure 11. Percent of identified threats to priority species in deciduous habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in deciduous habitat (for example, if 100 threats were identified in total for all priority species in deciduous habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in deciduous habitat is shown at the end of each bar.

Table 8. Threats addressed, conservation objectives, recommended actions and priority species affected in the deciduous habitat of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Loss of mature forest (conversion of woodlands into residential, commercial or industrial land).	1.1 Housing & urban areas 1.2 Commercial & industrial areas	Conserve mature deciduous forests and the features that make them important for birds.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	In municipalities, adopt urban plans that protect important woodlands. Protect large tracts of mature forest through stewardship or by legally designating them as conservation areas.	1.1 Site/area protection	Brown Creeper, Wood Thrush, Cerulean Warbler
Loss of mature forest (conversion of forested farmland into agricultural land).	2.1 Annual & perennial non-timber crops	Conserve and restore the quality and quantity of deciduous forests on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Develop incentives to maintain woodlands in agricultural areas.	6.4 Conservation incentives	Brown Creeper, Wood Thrush, Cerulean Warbler
Sugarbush management.	2.2 Wood & pulp plantations	Restore features in deciduous forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Promote silvicultural treatments in sugarbushes that maintain key habitat features (snags, irregular structure, etc.).	5.3 Private sector standards and codes	Eastern Wood-Pewee
Habitat loss and fragmentation due to expansion of energy transportation corridors and the road system.	4.1 Roads and railroads 4.2 Utilities & service lines	Maintain connectivity between dense mature deciduous forests.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Avoid constructing new roads and transportation corridors in large tracts of mature forest.	2.1 Site/area management	Wood Thrush

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Table 8 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Habitat loss and fragmentation due to the reduced average size of forest habitats and their increasing isolation.	5.3 Logging & wood harvesting	Maintain connectivity between deciduous forests.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Adopt forestry practices that maximize habitat connectivity (better spatial configuration).	5.3 Private sector standards and codes	Wood Thrush, Cerulean Warbler
Simplification of forest structure through the regeneration of forest cover or by the use of intermediate silvicultural treatments (precommercial thinning).	5.3 Logging & wood harvesting	Conserve the diversity of types of deciduous forest on the landscape.	1.2. Maintain the size, shape and configuration of habitat within the natural range of variation.	Promote forest management that maintains the landscape structure (stand composition and age) within the natural range of variation.	5.3 Private sector standards and codes	Veery
Habitat loss (scarcity of snags for cavity nesting birds).	5.3 Logging & wood harvesting	Restore features in deciduous forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Install artificial nesting structures. Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	3.2 Species recovery 5.3 Private sector standards and codes	Northern Saw-whet Owl (*acadicus*)
Habitat loss (scarcity of large diameter trees).	5.3 Logging & wood harvesting	Restore features in deciduous forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	5.3 Private sector standards and codes	Brown Creeper, Northern Flicker

Table 8 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Disappearance of mature forests due to shorter turnaround time in forestry.	5.3 Logging & wood harvesting	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Cerulean Warbler management plan (Environment Canada, 2011).	3.2 Species recovery	Cerulean Warbler
Habitat loss and degradation (loss of important tree species due to disease or infestation);	8.1 Invasive non-native/alien species 8.2 Problematic native species	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Cerulean Warbler management plan (Environment Canada, 2011).	3.2 Species recovery	Cerulean Warbler
Nest predation by the Brown-headed Cowbird	8.2 Problematic native species	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Cerulean Warbler management plan (Environment Canada, 2011).	3.2 Species recovery	Cerulean Warbler

Mixed Wood

Mixed wood forests are defined as forests or woodlands characterized by a mixture of coniferous and deciduous species. In BCR 12-QC, mixed wood forests occupy 48% of the land, making it the dominant habitat class in the BCR (Fig. 12). Mixed wood forests are composed of a blend of various tree species found in deciduous and coniferous habitats, such as yellow birch, balsam fir, white spruce and cedar.

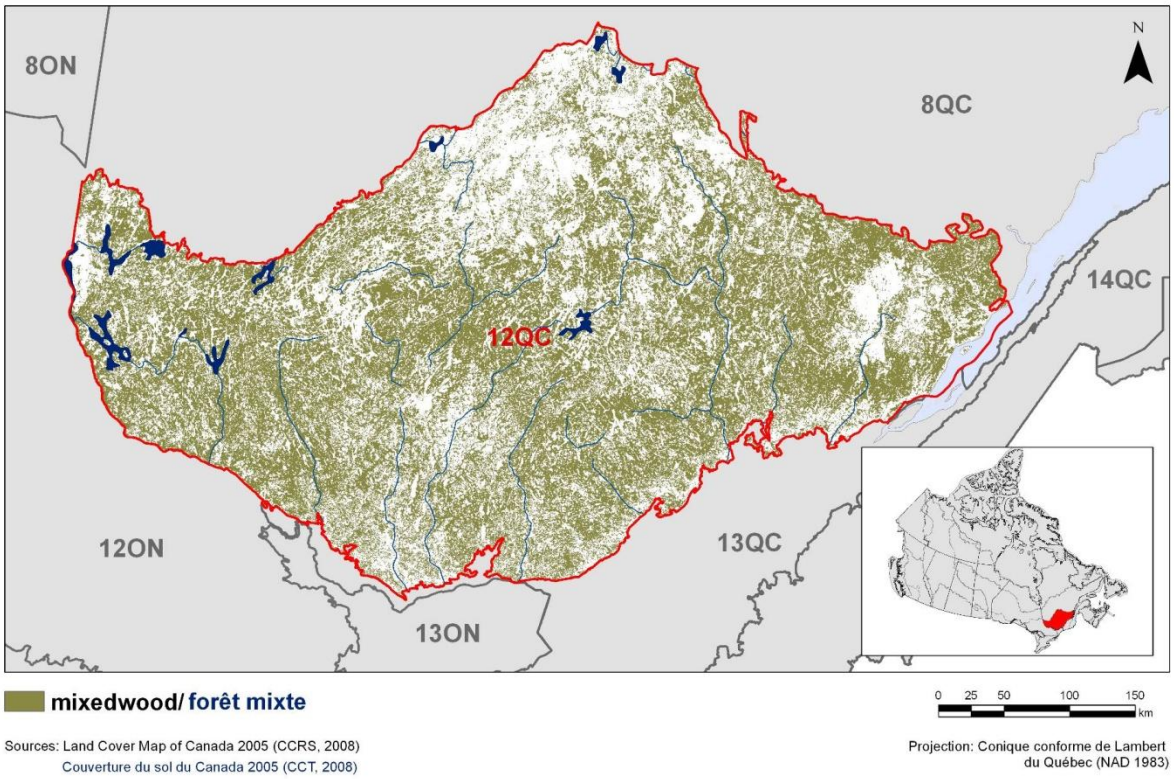

Figure 12. Map of mixed wood habitat in BCR 12-QC: Boreal Hardwood Transition.

Mixed wood forests in BCR 12-QC are inhabited by 22 priority species (all landbirds, Table 9), more species than in any other habitat category in the BCR (Fig. 3). Ten of these species were selected for conservation reasons, while 12 were chosen for stewardship purposes. Three species found in this habitat type are species at risk listed as Threatened on Schedule 1 of SARA: Whip-poor-will, Olive-sided Flycatcher and Canada Warbler. There are currently no recovery strategies published for any of these 3 species. COSEWIC has assessed the Eastern Wood-Pewee as a species of Special Concern.

Only three sub-categories of threats affect species in mixed wood habitats in BCR 12-QC (Fig. 13). Sub-category “5.3 Logging & wood harvesting” has a “High” rolled-up overall magnitude and accounts for 80% of threats reported in this habitat. The main threats relating to the sub-category are essentially the same as those in coniferous and deciduous forests. They

include loss of mature forest, the growing scarcity of stands of dead trees, large diameter trees and snags with cavities, and loss of disturbed habitat.

The full list of threats in mixed wood habitats of BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 10. Conservation objectives are mainly to conserve, protect and restore mixed wood forests and the features that make them important for birds. Conservation actions primarily seek to have forestry stakeholders establish standards and beneficial practices to preserve the characteristics of mixed wood habitats that are important for priority birds.

Table 9. Priority species that use mixed wood habitat, regional habitat sub-class, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
American Three-toed Woodpecker	Disturbed forests (burnt out areas / windfall)	Assess/Maintain	-	X	-
Bay-breasted Warbler	Mature mixed wood forests	Increase 50%	-	X	-
Black-billed Cuckoo	Mixed wood stands of intermediate age	Maintain	-	-	X
Blackburnian Warbler	Mature mixed wood stands	Maintain	-	-	X
Black-throated Blue Warbler	Mixed wood stands with a layered structure	Maintain	-	-	X
Black-throated Green Warbler	Mixed wood stands with a closed canopy and complex vertical layers	Maintain	-	-	X
Brown Creeper	Mature mixed wood forest	Assess/Maintain	-	X	-
Canada Warbler[4]	Relatively open mixed wood stands	Recovery objective	X	X	-
Chestnut-sided Warbler	Early successional areas around mixed wood stands	Maintain	-	-	X
Eastern whip-poor-will[4]	Many types of dry forest habitats with clearings, and edges of cultivated fields interspersed with bushes and especially young stands of oak and beech.	Recovery objective	X	X	-
Eastern Wood-Pewee	Mixed wood stands of any age, clearings or strips	Increase 50%	X	X	-

[1] "At risk" includes species: considered Endangered, Threatened or Special Concern pursuant to an assessment by COSEWIC; listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).

[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.

[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.

[4] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objectives for these species are: Canada Warbler: Assess/Increase 100%; Eastern whip-poor-will: Assess/Increase 100%; Olive-sided Flycatcher: Increase 100%.

Table 9 continued

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Least Flycatcher	Mixed wood stands	Maintain	-	-	X
Nashville Warbler	Young mixed wood stands with a dense shrub layer dominated by deciduous trees	Maintain	-	-	X
Northern Saw-whet Owl (*acadicus*)	Mature dense mixed wood forests	Assess/Maintain	-	X	-
Olive-sided Flycatcher[4]	Mixed wood stands	Recovery objective	X	X	-
Ovenbird	Mature dense forest	Maintain	-	-	X
Purple Finch	Open mixed wood stands	Maintain	-	X	-
Rose-breasted Grosbeak	Open, early successional mixed wood forest	Maintain	-	-	X
Ruffed Grouse	Mixed wood stands ,species uses mature stands in winter	Maintain	-	-	X
Veery	Mixed wood stands of intermediate age	Increase 50%	-	X	-
White-throated Sparrow	Mixed wood stands	Maintain	-	-	X
Yellow-bellied Sapsucker	Mature mixed wood stands	Maintain	-	-	X

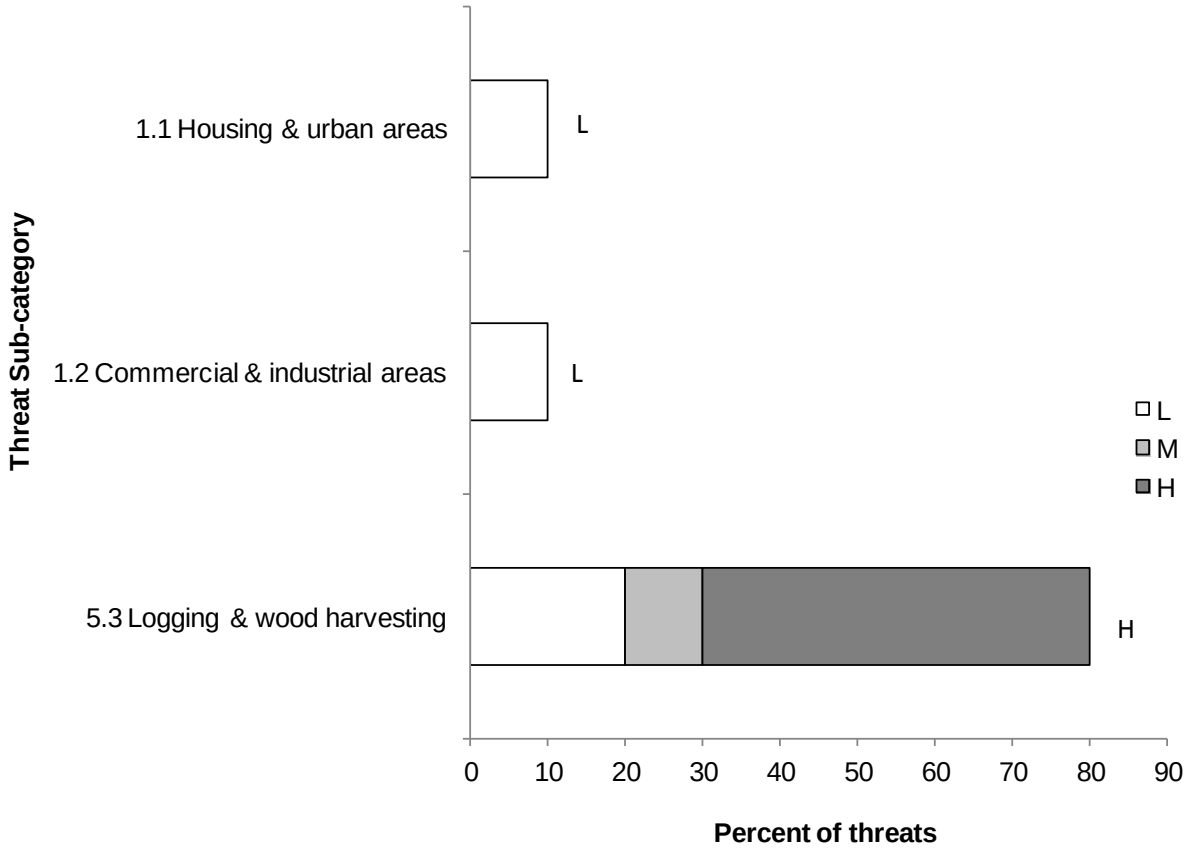

Figure 13. Percent of identified threats to priority species in mixed wood habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in mixed wood habitat (for example, if 100 threats were identified in total for all priority species in mixed wood habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in mixed wood habitat is shown at the end of each bar.

Table 10. Threats addressed, conservation objectives, recommended actions and priority species affected in the mixed wood habitat of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Loss of mature forest (conversion of woodlands into residential, commercial or industrial land).	1.1 Housing & urban areas 1.2 Commercial & industrial areas	Conserve mature mixed wood forests and the features that make them important for birds.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	In municipalities, adopt urban plans that protect important woodlands. Protect large tracts of mature forest through stewardship or by legally designating them as conservation areas.	1.1 Site/area protection	Brown Creeper
Gradual disappearance of mature forests due to shorter turnaround time in forestry.	5.3 Logging & wood harvesting	Increase the quantity of mature mixed wood forest on the landscape	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Extend the period between logging operations. Promote forest management that maintains the landscape structure (stand composition and age) within the natural range of variation.	2.3 Habitat and natural process restoration 5.3 Private sector standards and codes	Brown Creeper, Bay-breasted Warbler, American Three-toed Woodpecker
Simplification of forest structure through the regeneration of forest cover or by the use of g intermediate silvicultural treatments (precommercial thinning).	5.3 Logging & wood harvesting	Conserve and restore the quality and quantity of mixed wood forests on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Promote forest management that maintains the landscape structure (stand composition and age) within the natural range of variation.	5.3 Private sector standards and codes	Veery
Habitat loss (scarcity of stands of dead trees).	5.3 Logging & wood harvesting	Restore features in mixed wood forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	5.3 Private sector standards and codes	American Three-toed Woodpecker

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Table 10 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Habitat loss (scarcity of large diameter trees).	5.3 Logging & wood harvesting	Restore features in mixed wood forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	5.3 Private sector standards and codes	Brown Creeper
Habitat loss (scarcity of snags for cavity nesting birds).	5.3 Logging & wood harvesting	Restore features in mixed wood forests that are important for birds.	1.4. Maintain important habitat features on the landscape	Install artificial nesting structures. Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	3.2 Species recovery 5.3 Private sector standards and codes	Northern Saw-whet Owl (*acadicus*)
Loss of (recently and severely) disturbed habitat due to fire suppression, control of insect infestations and increased salvage harvesting.	5.3 Logging & wood harvesting	Conserve an appropriate percentage of dead trees in recently disturbed forests.	1.4. Maintain important habitat features on the landscape	Limit salvage harvesting.	5.3 Private sector standards and codes	American Three-toed Woodpecker

Shrub/Early Successional

According to the United Nations Food and Agriculture Organization's (UN-FAO) Land Cover Classification System, "shrub and early successional" habitats are defined as woody vegetation less than 5 metres in height. Shrub and early successional habitats occupy only 0.2% of BCR 12-QC and are mostly situated in the northern part of the BCR (Fig. 14).

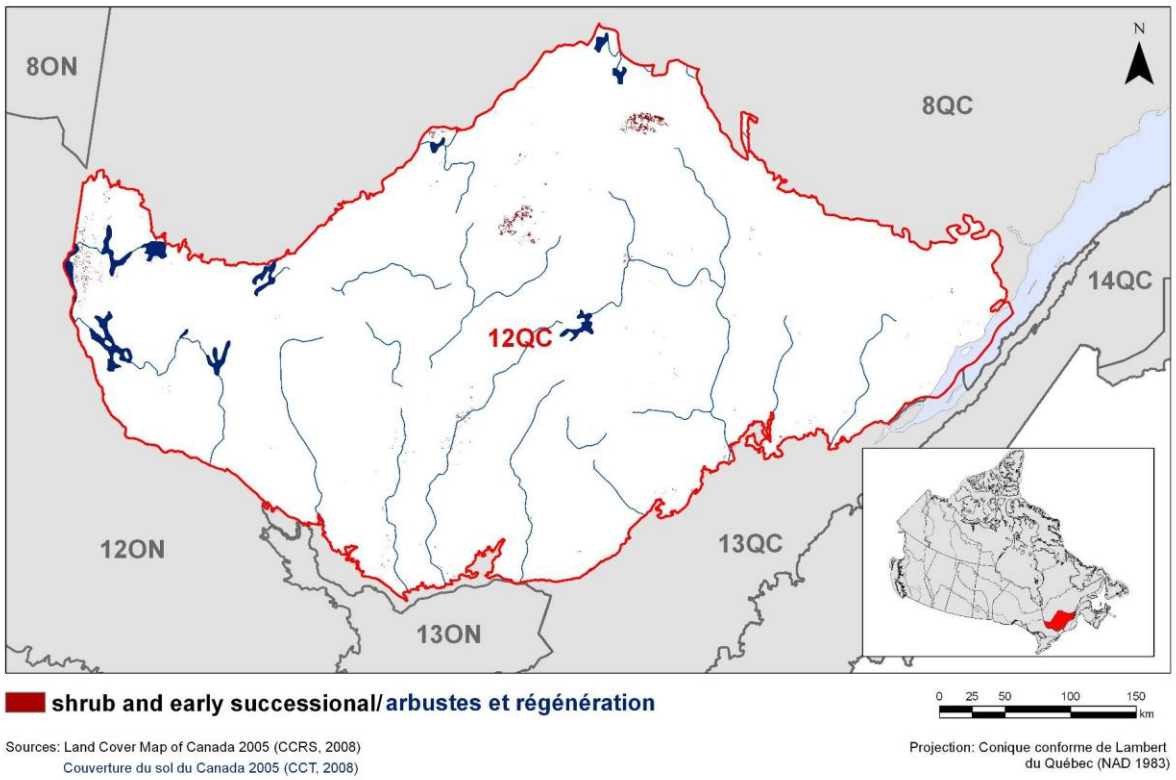

Figure 14. Map of shrub and early successional habitat in BCR 12-QC: Boreal Hardwood Transition.

In BCR 12-QC, shrub and early successional habitats are utilized by six priority species, all of which are landbirds (Table 11). Two species found in this habitat type are species at risk listed as Threatened in Schedule 1 of SARA, but for which there are currently no recovery strategies: the Olive-sided Flycatcher and Golden-winged Warbler. The Golden Eagle, another species at risk, is designated as "Vulnerable" provincially. Only one species, the Common Yellowthroat, has been selected for stewardship reasons.

Threat sub-categories "7.3 Other ecosystem modifications" and "8.2 Problematic native species" and "2.1 Annual & perennial non-timber crops" each account for 22% of reported threats in shrub and early successional habitats (Fig. 15). The first sub-category has a "High" rolled-up overall magnitude, while the other two have "Medium" rolled-up overall magnitudes. The only threat associated with ecosystem changes is the natural transition of shrub and old-field habitats into forest habitats, caused by the lack of renewal of early successional habitats. Sub-category 8.2 also includes only one threat: nest predation by the Brown-headed Cowbird.

Conservation issues related to annual and perennial non-timber crops primarily involve shrub habitat loss and degradation due to intensification of agriculture.

The full list of threats in the shrub and early successional habitat in BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 12. Conservation objectives chiefly involve conserving, protecting, and restoring shrub and early successional habitats and the habitat features that make them important for birds, as well as limiting the impacts of certain native species. Conservation actions include various suggestions such as developing incentives and management approaches for the conservation of shrub and early successional habitats.

Table 11. Priority species that use shrub and early successional habitat, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Brown Thrasher	Shrublands	Increase 100%	-	X	-
Common Yellowthroat	Shrublands	Maintain	-	-	X
Field Sparrow	Shrublands	Increase 100%	-	X	-
Golden Eagle	Logging and burnt out areas	Provincial recovery objective[4]	X	X	-
Golden-winged Warbler[5]	Shrublands	Recovery objective	X	X	-
Olive-sided Flycatcher[5]	Logging and burnt out areas	Recovery objective	X	X	-

[1] "At risk" includes species: considered Endangered, Threatened or Special Concern pursuant to an assessment by COSEWIC; listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).

[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.

[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.

[4] Consult Équipe de rétablissement de l'aigle royal au Québec (2005).

[5] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objectives for these species are: Olive-sided Flycatcher: Increase 100%; Golden-winged Warbler: Increase 100%.

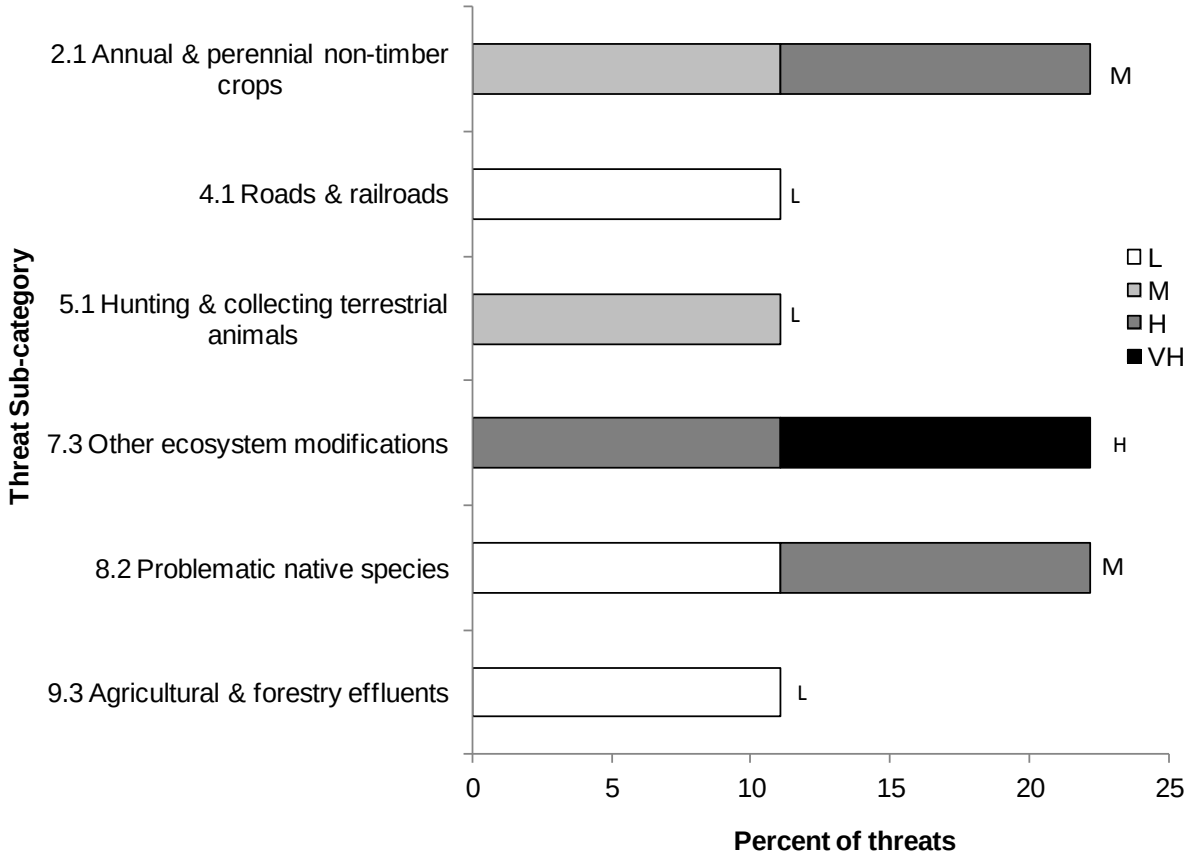

Figure 15. Percent of identified threats to priority species in shrub and early successional habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in shrub and early successional habitat (for example, if 100 threats were identified in total for all priority species in shrub and early successional habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in shrub and early successional habitat is shown at the end of each bar.

Table 12. Threats addressed, conservation objectives, recommended actions and priority species affected in the shrub and early successional habitat of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Habitat loss and degradation (intensification of agriculture).	2.1 Annual & perennial non-timber crops	Conserve and restore the quality and quantity of shrub and early successional habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Develop land management approaches that include fallow fields. Develop incentives to maintain large tracts of shrub pasture and forage land.	2.1 Site/area management 6.4 Conservation incentives	Golden-winged Warbler
Loss of natural vegetation (hedges, riparian strips, isolated trees, bush layer) on the agricultural landscape.	2.1 Annual & perennial non-timber crops	Conserve and restore the quality and quantity of shrub and early successional habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Promote the maintenance and recovery of hedges and bush habitats.	2.3 Habitat and natural process restoration	Brown Thrasher
Collisions with vehicles when birds nest along roads.	4.1 Roads and railroads	Reduce bird mortality along roads.	2.7 Reduce incidental mortality from collisions.	Construct road shoulders to limit nesting.	2.1 Site/area management	Brown Thrasher
Deliberate hunting or accident trapping.	5.1 Hunting and collecting terrestrial animals	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Golden Eagle provincial recovery strategy (Équipe de rétablissement de l'aigle royal au Quebec, 2005).	3.2 Species recovery	Golden Eagle
Natural evolution of shrubland and abandoned fields into forests, and lack of renewal of this type of habitat.	7.3 Other ecosystem modifications	Conserve and restore the quality and quantity of shrub and early successional habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Develop land management approaches that include fallow fields.	2.1 Site/area management	Field Sparrow, Golden-winged Warbler

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Table 12 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Nest predation by the Brown-headed Cowbird	8.2 Problematic native species	Reduce the Brown-headed Cowbird's impact on priority species.	3.3. Reduce parasitism/predation	Reduce habitat fragmentation to limit the strip effect. Continue to monitor the Brown-headed Cowbird to track changes in their abundance.	2.2 Invasive/problematic species control 8.2 Monitoring	Field Sparrow, Golden-winged Warbler
Overutilization of pesticides (bird poisoning, eggshell thinning, reduced prey insects, leaching to adjacent habitats, reduced prey fish).	9.3 Agricultural & forestry effluents	Reduce impact of anthropogenic contaminants on shrubs and early successional habitats.	2.1. Reduce mortality and/or sub-lethal effects from pesticide use	Reduce pesticide use and promote an integrated pest management system.	2.3 Habitat and natural process restoration	Brown Thrasher

Cultivated and Managed Areas

According to the United Nations Food and Agriculture Organization's (UN-FAO) Land Cover Classification System, cultivated and managed habitats are composed of vegetation from a specific crop or development. They include tree plantations, orchards, grass crops as well as urban vegetation such as urban parks, golf courses and lawns. This type of habitat covers only 0.6% of the land in BCR 12-QC (Fig. 16).

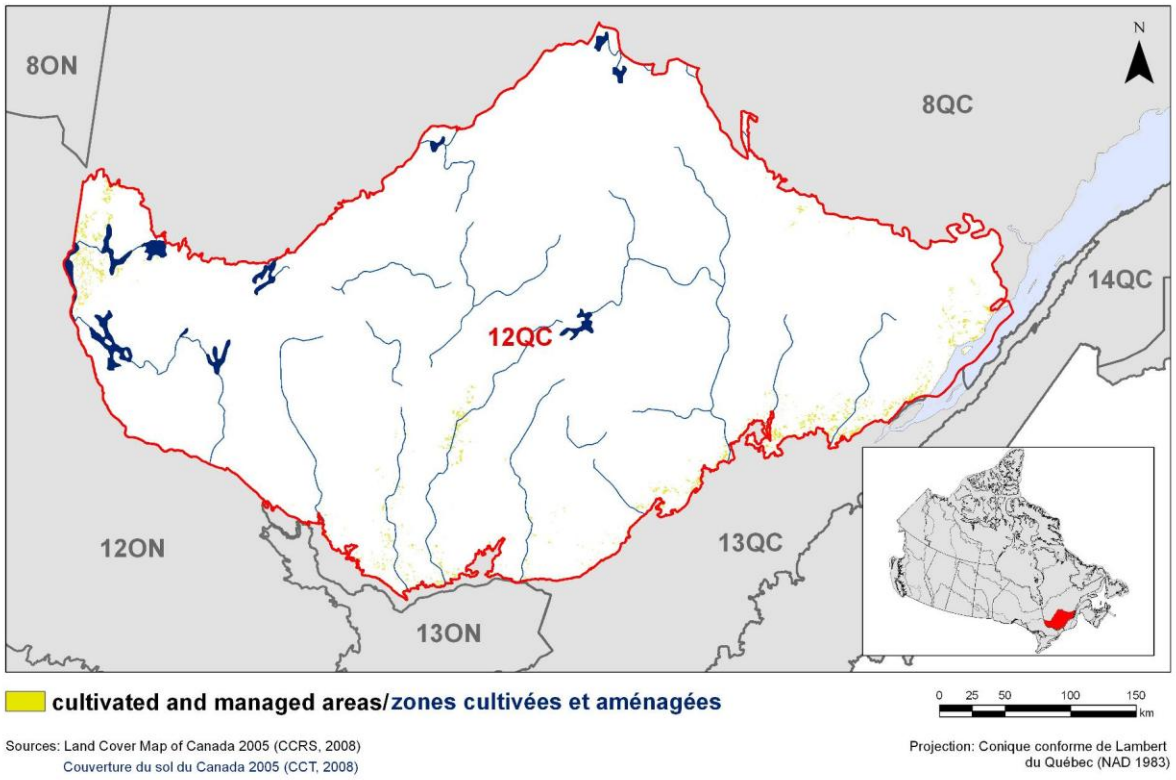

Figure 16. Map of cultivated and managed areas in BCR 12-QC: Boreal Hardwood Transition.

Cultivated and managed areas in BCR 12-QC host 10 priority species, all of which are landbirds with the exception of 1 shorebird (Killdeer, Table 13). All the species were selected for conservation reasons and 6 of them are also species at risk, 3 of which are listed on Schedule 1 of SARA (Common Nighthawk, Short-eared Owl and Chimney Swift). The Bobolink, Barn Swallow and Eastern Meadowlark have been assessed as "Threatened" by COSEWIC but are not listed on Schedule 1.

The most frequently identified threat sub-category is "2.1 Annual & perennial non-timber crops," which accounts for 49% of all reported threats in this habitat (Fig. 17). The main conservation issues in this category whose relative magnitude is considered "High" are the conversion of annual crops to perennial crops, intensification of agriculture and accidental bird mortality during harvest.

With 21% of threats, sub-category “9.3 Agricultural & forestry effluents” ranks second and has a “High” rolled-up overall magnitude. The only threat relating to this sub-category in the cultivated and managed habitat is the overuse of pesticides, which can cause poisoning, eggshell thinning and a reduction in prey insects.

Sub-category “11.5 Other impacts” accounts for 13% of threats reported in the cultivated and managed habitat and has a “High” rolled-up overall magnitude. The increased frequency of adverse weather events relating to climate change is the only threat in this sub-category and is implicitly associated with aerial insectivores and the decline of their food sources. The increased frequency of extreme weather events during the migration period could also be a major issue for many bird species.

Threat sub-category “2.3 Livestock farming & ranching” has a “High” rolled-up overall magnitude. The conservation issue associated with this threat is the increasing scarcity of nesting sites for Barn Swallows due to the reduction in the number of farm buildings. The modern construction standards for these buildings make them less attractive for building nests.

The full list of threats in the cultivated and managed habitat of BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 14. Conservation objectives are mainly to conserve, protect and restore open habitats and the features that make them important for birds, reduce the impacts of pesticide contamination and climate change, and reduce accidental bird mortality at harvest.

Conservation actions include various suggestions such as adopting beneficial agricultural practices to reduce bycatch, as well as developing and supporting sustainable agriculture in Quebec through approaches such as maintaining large tracts of shrubland, pasture and forage, and reducing pesticide use by promoting integrated pest management.

Table 13. Priority species that use cultivated and managed areas, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for Priority Status		
			At Risk[1]	CC[2]	S[3]
Bank Swallow	Hayfield and pasture	Increase 100%	-	X	-
Barn Swallow	Hayfield and pasture	Increase 100%	X	X	-
Bobolink	Hayfield and pasture	Increase 50%	X	X	-
Chimney Swift[4]	Hayfield and pasture	Recovery objective	X	X	-
Common Nighthawk[4]	Hayfield and pasture	Recovery objective	X	X	-
Eastern Meadowlark	Hayfield and pasture	Increase 100%	X	X	-
Field Sparrow	Bush pasture	Increase 100%	-	X	-
Killdeer	Cultivated fields	Increase 50%	-	X	-
Northern Rough-winged Swallow	Hayfield and pasture	Increase 100%	-	X	-
Short-eared Owl[4]	Hayfield	Recovery objective	X	X	-

[1] "At risk" includes species considered Endangered, Threatened or Special Concern pursuant to an assessment by COSEWIC; listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).

[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.

[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.

[4] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objectives for these species are: Common Nighthawk: Reverse the decline; Short-eared Owl: Increase 100%; Chimney Swift: Reverse the decline.

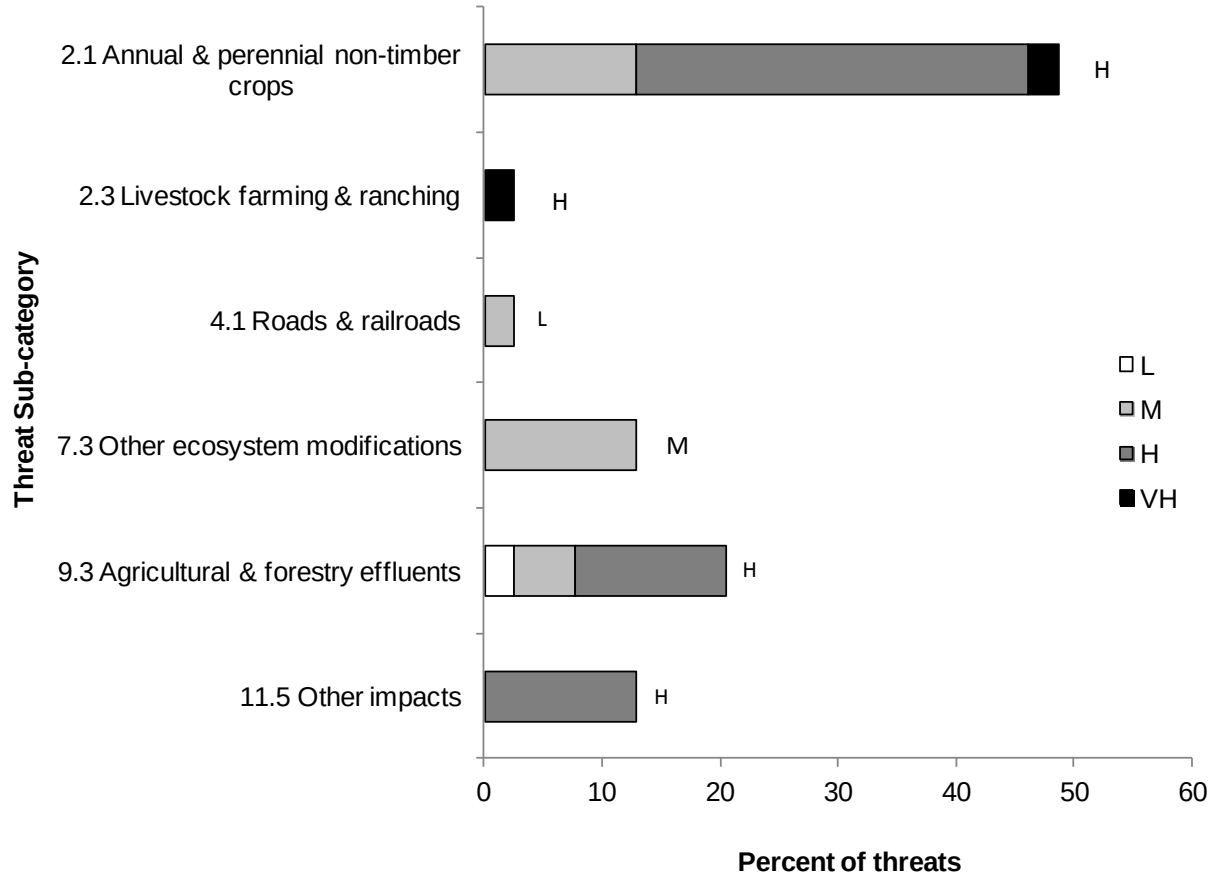

Figure 17. Percent of identified threats to priority species in cultivated and managed areas in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in cultivated and managed areas (for example, if 100 threats were identified in total for all priority species in cultivated and managed,areas and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in cultivated and managed areas is shown at the end of each bar.

Table 14. Threats addressed, conservation objectives, recommended actions and priority species affected in the cultivated and managed areas of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Habitat loss and degradation (conversion of perennial crops to annual crops).	2.1 Annual & perennial non-timber crops	Conserve and restore the diversity and quality of open habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Develop incentives to maintain large tracts of pasture and forage land.	6.4 Conservation incentives	Common Nighthawk, Bobolink, Short-eared Owl, Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Eastern Meadowlark
Habitat loss and degradation (intensification of agriculture).	2.1 Annual & perennial non-timber crops	Conserve and restore the diversity and quality of open habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Support sustainable agricultural development in Quebec.	5.3 Private sector standards and codes	Bobolink, Short-eared Owl, Rough-winged Swallow, Bank Swallow, Barn Swallow, Killdeer, Eastern Meadowlark
Accidental bird mortality at harvest.	2.1 Annual & perennial non-timber crops	Reduce bird mortality at harvest.	2.4 Reduce accidental mortality	Develop beneficial management practices for harvesting when accidental bird mortality may occur (delay harvest, raise blade height, etc.).	5.3 Private sector standards and codes	Bobolink, Short-eared Owl, Eastern Meadowlark
Reduction in the number of artificial nesting sites	2.1 Annual & perennial non-timber crops 2.3 Livestock farming & ranching	Conserve and restore the diversity and quality of open habitats on the landscape.	1.4. Maintain important habitat features on the landscape	Install artificial nesting structures.	3.2 Species recovery	Barn Swallow
Collisions with vehicles when birds nest along roads.	4.1 Roads and railroads	Reduce bird mortality along roads.	2.7 Reduce incidental mortality from collisions.	Construct road shoulders to limit nesting.	2.1 Site/area management	Killdeer

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Table 14 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Abandonment of farmland.	7.3 Other ecosystem modifications	Conserve and restore the diversity and quality of open habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Develop incentives to maintain abandoned agricultural shrubland.	6.4 Conservation incentives	Bobolink, Short-eared Owl, Bank Swallow, Barn Swallow, Eastern Meadowlark
Overutilization of pesticides (bird poisoning, eggshell thinning, reduced prey insects, leaching to adjacent habitats, reduced prey fish).	9.3 Agricultural & forestry effluents	Reduce impact of anthropogenic contaminants on cultivated and managed habitats.	2.1. Reduce mortality and/or sub-lethal effects from pesticide use	Reduce pesticide use and promote an integrated pest management system.	2.3 Habitat and natural process restoration	Common Nighthawk, Bobolink, Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Killdeer, Eastern Meadowlark
Higher frequency of adverse climate events due to climate change that may affect migration, reproductive success, availability of prey or nesting phenology.	11.5 Other impacts	Reduce potential impact of climate change on cultivated and managed habitats.	6.2. Manage for habitat resilience as climate changes	Promote the reduction of greenhouse gas emissions.	6.2 Substitution	Common Nighthawk, Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift

Bare Areas

According to the United Nations Food and Agriculture Organization's (UN-FAO) Land Cover Classification System adapted for developing BCR strategies, bare areas are habitats with less than 4% plant cover whose cover is not artificial and the result of anthropogenic activities. They include bare rocks, sandy areas and cliffs. However, they do not include coastal habitats, which will be addressed separately. This type of habitat covers only 0.1% of the land in BCR 12-QC and is mainly located in the north of the region (Fig. 18).

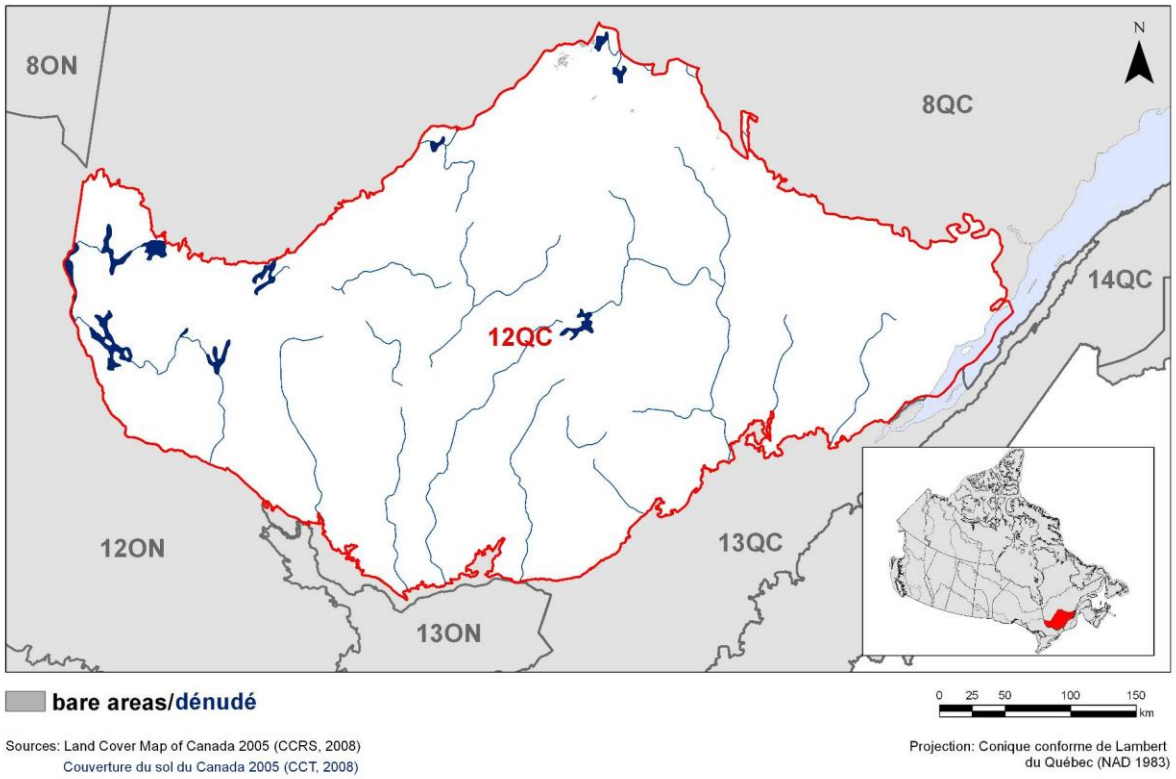

Figure 18. Map of bare areas in BCR 12-QC: Boreal Hardwood Transition.

Six priority landbird species are found in the bare areas of BCR 12-QC (Table 15). There are three species at risk: the Common Nighthawk, Peregrine Falcon (both listed on Schedule 1 of SARA) and the Golden Eagle (vulnerable at the provincial level). Only one species, the Belted Kingfisher, has been selected for stewardship purposes.

A small number of threats have been reported in bare areas. Threat sub-category "7.3 Other ecosystem modifications" accounts for 40% of threats reported in this habitat and has a "High" rolled-up overall magnitude (Fig. 19). The conservation issue for this threat is closing or disturbing sandpits that are used as nesting sites by two species of swallows.

Threat sub-category “6.1 Recreational activities” accounts for 40% of threats reported in this habitat and has a “Medium” rolled-up overall magnitude. The only threat in this sub-category is the disturbance of nesting sites by hikers or cliff climbers and affects the Golden Eagle and the Peregrine Falcon.

The last threat sub-category affecting birds in bare areas is “5.1 Hunting & collecting terrestrial animals.” This sub-category has a “Low” rolled-up overall magnitude and it involves the killing or accidental trapping of Golden Eagles.

The full list of threats in the bare areas of BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 16. Conservation objectives and recommended actions seek to minimize disturbance around nesting sites during the breeding season and raise awareness among trappers, hunters and the general public through outreach campaigns.

Table 15. Priority species that use bare areas, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At Risk[1]	CC[2]	S[3]
Bank Swallow	Riverbanks, sand, gravel or clay cliffs	Increase 100%	-	X	-
Belted Kingfisher	Riverbanks, sandpits, rocky escarpments	Maintain	-	-	X
Common Nighthawk[4]	Outcrops, gravel or sand beaches	Recovery objective	X	X	-
Golden Eagle	Cliffs	Provincial recovery objective[5]	X	X	-
Northern Rough-winged Swallow	Riverbanks, sand, gravel or clay embankments	Increase 100%	-	X	-
Peregrine Falcon (*anatum/tundrius*)[4]	Rock walls, cliffs	Recovery objective	X	X	-

[1] "At risk" includes species considered Endangered, Threatened or Special Concern pursuant to an assessment by COSEWIC; listed on Schedule 1 of the SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Québec).
[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.
[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.
[4] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objectives for these species are: Common Nighthawk: Reverse the decline; Peregrine Falcon (anatum/tundrius): Maintain.
[5] Consult Équipe de rétablissement de l'aigle royal au Québec (2005).

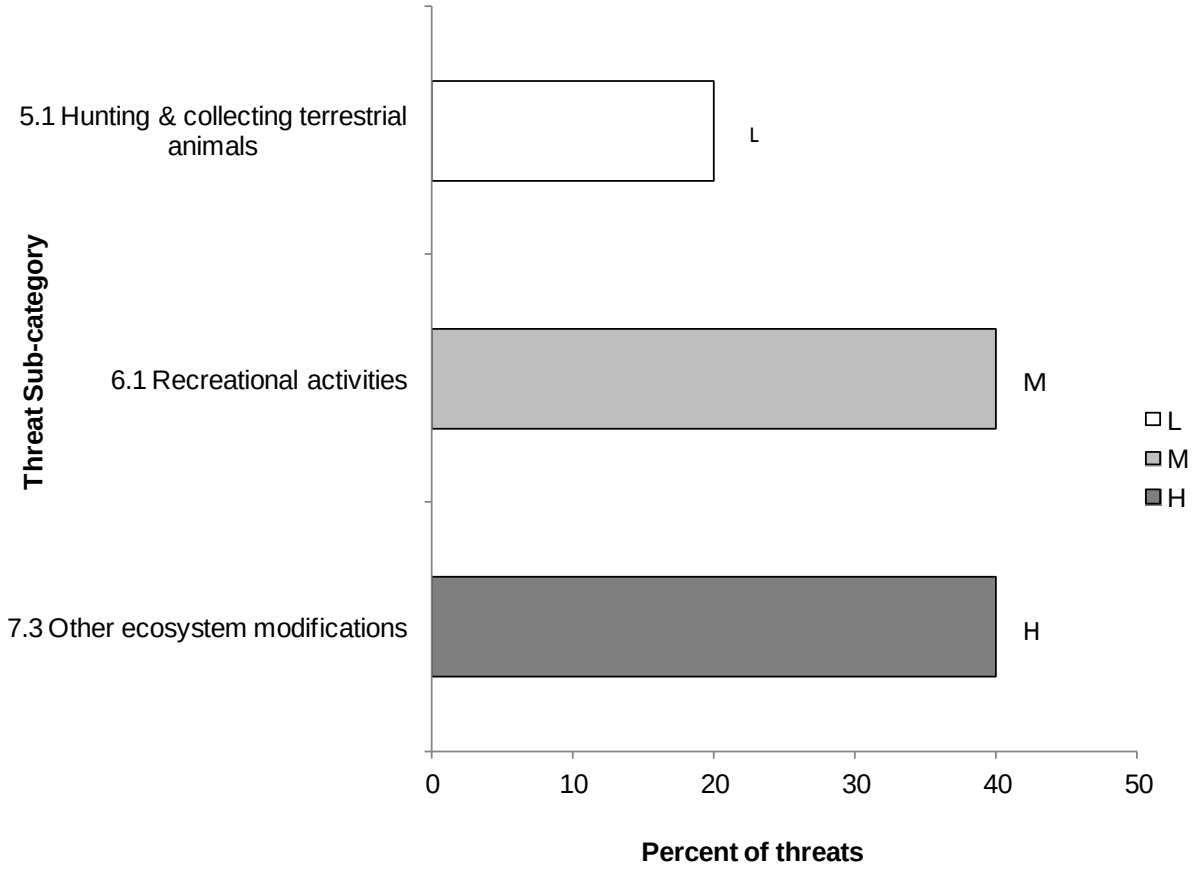

Figure 19. Percent of identified threats to priority species in bare areas in each threat sub-category. Each bar represents the percent of the total number of threats identified in each threat sub-category in bare areas (for example, if 100 threats were identified in total for all priority species in bare areas, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in bare areas is shown at the end of eachbar.

Table 16. Threats addressed, conservation objectives, recommended actions and priority species affected in the bare areas of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Deliberate hunting or accident trapping.	5.1 Hunting and collecting terrestrial animals	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Golden Eagle provincial recovery strategy (Équipe de rétablissement de l'aigle royal au Quebec, 2005).	3.2 Species recovery	Golden Eagle
Disturbance of nesting sites.	6.1 Recreational activities	Minimize disturbance near nesting sites. Recovery of species at risk.	4.1. Reduce disturbance from human recreation 3.4. Implement recovery strategies for species at risk	Limit activities near nesting sites during the breeding season. Establish buffer zones around known nesting sites. Raise public awareness through outreach campaigns on the vulnerability of certain species to disturbance. Continue to implement the Golden Eagle provincial recovery strategy (Équipe de rétablissement de l'aigle royal au Quebec, 2005).	2.1 Site/area management 3.2 Species recovery 4.3 Awareness and communications	Golden Eagle, Peregrine Falcon (*anatum/tundrius*)
Closure or disturbance of sandpits used for nesting.	7.3 Other ecosystem modifications	Minimize disturbance during nesting period.	4.1. Reduce disturbance from human recreation	Limit activities in sandpits during breeding period.	2.1 Site/area management	Northern Rough-winged Swallow, Bank Swallow

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Urban

The urban habitat primarily consists of human-made surfaces and artificial structures. It includes structures associated with cities, towns and transport routes as well as landfill sites. This type of habitat covers only 0.3% of the land in BCR 12-QC and is mainly located in the southern portion of the region (Fig. 20).

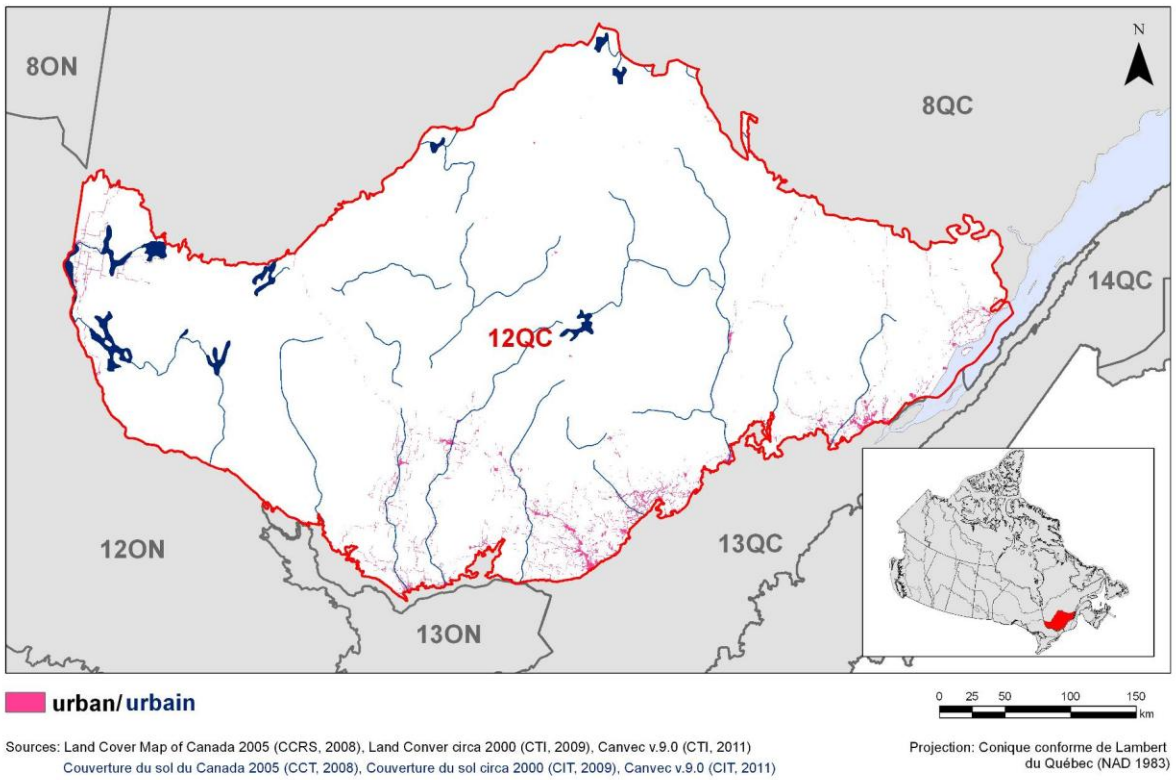

Figure 20. Map of urban habitats in BCR 12-QC: Boreal Hardwood Transition.

Five priority landbird species, selected for conservation reasons, are found in the urban habitats of BCR 12-QC (Table 17). Three are species at risk listed on Schedule 1 of SARA (Common Nighthawk, Peregrine Falcon (*anatum/tundrius*) and Chimney Swift) and a fourth is a provincially listed species at risk (Golden Eagle).

Threat sub-categories “1.1 Housing & urban areas,” “1.1 Other impacts” and “4.2 Utility & service lines” each include 25% of reported threats in urban habitats (Fig. 21). The first two have a “High” rolled-up overall magnitude, and the conservation issues associated with these threats are respectively fewer artificial nesting sites for Chimney Swifts and Common Nighthawks and the higher frequency of violent weather events. Threats relating to utility and service lines have a “Low” rolled-up overall magnitude and involve the risk of raptors colliding with power transmission structures.

The two other threat sub-categories affecting priority species in urban habitats are “4.1 Roads & railroads” and “5.1 Hunting & collecting terrestrial animals.” Each account for 13% of reported threats, and both have a “Low” rolled-up overall magnitude. The first concerns the Killdeer, which is susceptible to collisions with vehicles when it nests along roads, while the second involves the deliberate killing or accidental trapping of Peregrine Falcons.

The full list of threats in the urban habitat of BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 18. Conservation objectives are mainly to conserve, protect and restore open habitats and the features that make them important for birds, reduce the impacts of climate change and reduce accidental mortality. Conservation actions include various suggestions such as installing artificial nesting structures, reducing greenhouse gas emissions, as well as introducing measures to reduce collisions with vehicles and power transmission structures.

Table 17. Priority species that use urban habitats, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Chimney Swift[4]	Chimneys suitable for nesting.	Recovery objective	X	X	-
Common Nighthawk[4]	Gravel roofs	Recovery objective	X	X	-
Golden Eagle	Transmission lines and other artificial urban structures (bridges, buildings, etc.)	Provincial recovery objective[5]	X	X	-
Killdeer	Gravel or broken asphalt road shoulders and parking lots	Increase 50%	-	X	-
Peregrine Falcon (*anatum/tundrius*)[4]	Artificial urban structures (bridges, buildings, etc.)	Recovery objective	X	X	-

[1] "At risk" includes species: considered Endangered, Threatened or Special Concern pursuant to an assessment by COSEWIC; listed on Schedule 1 of the SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).
[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.
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[4] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objectives for these species are: Common Nighthawk: Reverse the decline; Peregrine Falcon (*anatum/tundrius*): Maintain; Chimney Swift: Reverse the Decline.
[5] Consult Équipe de rétablissement de l'aigle royal au Québec (2005).

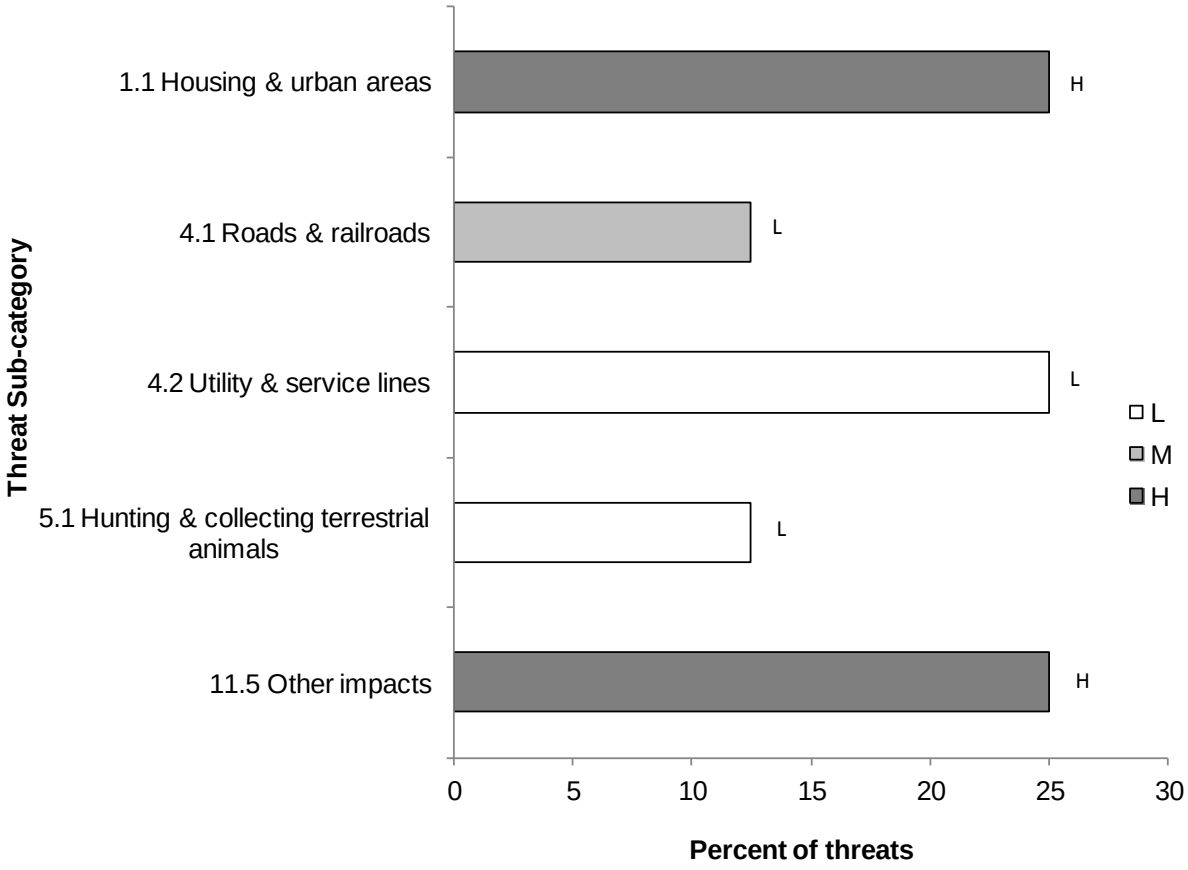

Figure 21. Percent of identified threats to priority species in the urban habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in urban habitat (for example, if 100 threats were identified in total for all priority species in urban habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in urban habitat is shown at the end of each bar.

Table 18. Threats addressed, conservation objectives, recommended actions and priority species affected for urban habitats in BCR 12–QC Region.

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Reduction in the number of artificial nesting sites.	1.1 Housing & urban areas	Restore features in urban habitats that are important for birds.	1.4. Maintain important habitat features on the landscape	Install nesting structures.	3.2 Species recovery	Common Nighthawk, Chimney Swift
Collisions with vehicles when birds nest along roads.	4.1 Roads & railroads	Reduce bird mortality along roads.	2.7 Reduce incidental mortality from collisions.	Construct road shoulders to limit nesting.	2.1 Site/area management	Killdeer
Collisions with power lines and other man-made structures	4.2 Utilitiy & service lines	Reduce collisions with man-made structures. Recovery of species at risk.	2.7 Reduce incidental mortality from collisions. 3.4. Implement recovery strategies for species at risk	Promote actions to reduce collisions with man-made structures. Continue to implement the Golden Eagle provincial recovery strategy (Équipe de rétablissement de l'aigle royal au Quebec, 2005).	2.1 Site/area management 3.2 Species recovery	Golden Eagle, Peregrine Falcon (*anatum/tundrius*)
Deliberate hunting or accidental trapping.	5.1 Hunting & collecting terrestrial animals	Reduce bird mortality caused by killing and trapping.	2.8 Reduce mortality from legal or illegal hunting, and persecution	Increase awareness among trappers and the public through outreach campaigns.	4.3 Awareness and communications	Peregrine Falcon (*anatum/tundrius*)

Table 18 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Priority species affected
Higher frequency of adverse weather events due to climate change that may affect migration, reproductive success, availability of prey or nesting phenology.	11.5 Other impacts	Reduce potential impact of climate change on urban habitats.	6.2. Manage for habitat resilience as climate changes	Promote the reduction of greenhouse gas emissions.	6.2 Substitution	Common Nighthawk, Chimney Swift

Wetlands

In the context of the BCR strategies, the habitat class defined as “wetlands” is any terrestrial habitat that is either temporarily saturated with water or permanently flooded. A wetland can be a bog, swamp or freshwater, brackish or saltwater marsh. Wetlands cover 2% of BCR 12-QC and are scattered across the entire region, with higher concentrations in the northern region (Fig. 22).

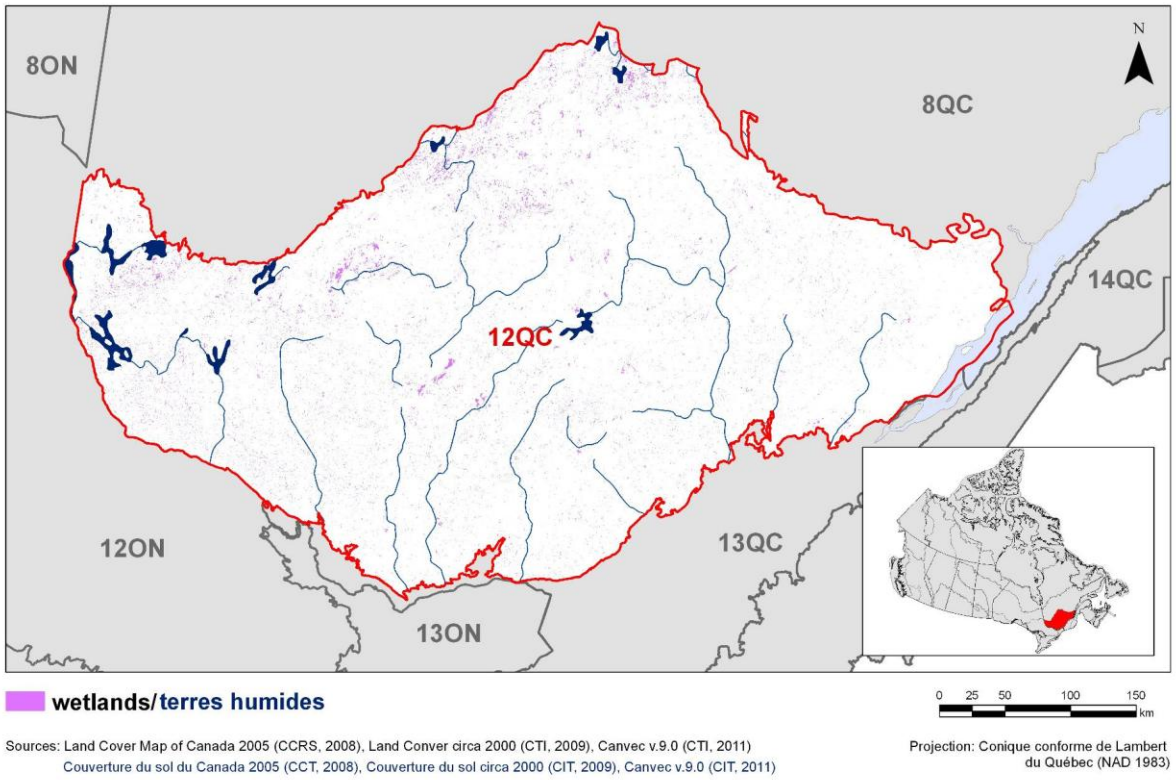

Figure 22. Map of wetlands in BCR 12-QC: Boreal Hardwood Transition.

Although they only cover a small portion of BCR 12-QC, wetlands are the second most utilized habitat type (Fig. 3). There are a total of 20 priority species from the 4 bird groups, including 14 landbirds, 3 waterbirds and 2 waterfowl species (Table 19). There is also one priority shorebird species found there, the Solitary Sandpiper. Half of the priority species found in this habitat type are species at risk, and 7 of them are listed on Schedule 1 of SARA. Seventeen species were selected for conservation reasons, while the Swamp Sparrow, Black Duck and Common Yellowthroat were chosen for stewardship reasons.

Eleven threat sub-categories affect priority species in wetlands, which makes wetlands the habitat class with the greatest variety of threats in BCR 12-QC (Fig. 23). The most frequently reported sub-category is “Housing & urban areas,” which accounts for 24% of all threats. This threat sub-category has a “Medium” rolled-up overall magnitude, and its main conservation

issues are habitat loss and degradation caused by increased human presence around the lakes, as well as draining and filling of wetlands for residential development. The decrease in the number of insect prey resulting from the loss of wetlands is another threat, which specifically affects aerial insectivores.

Threat sub-categories “1.2 Commercial & industrial areas” and “2.1 Annual & perennial non-timber crops” each account for 21% of reported threats. They are ranked second and have “Low” and “Medium” rolled-up overall magnitudes, respectively. The threats associated with these two sub-categories are habitat loss caused by drainage and filling of wetlands for agricultural and commercial development, and reduced numbers of prey insects.

Although they individually represent a smaller percentage of reported threats, four threat sub-categories have a “High” rolled-up overall magnitude: Logging & wood harvesting (5.3), Dams & water management/use (7.2), Invasive non-native/alien species (8.1) and the higher frequency of adverse weather events (11.5). Overall, these threats account for 26% of wetland conservation issues in BCR 12-QC.

The full list of threats in the wetlands of BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 20. Conservation objectives are mainly to conserve, protect and restore wetlands on the landscape, and limit the impacts of climate change and colonization by certain invasive plant species.

Conservation actions include various suggestions such as protecting priority wetlands through stewardship or by legally designating them as conservation areas, adopting urban land use plans that protect wetlands, developing beneficial agricultural practices and promoting silvicultural treatments that maintain natural habitat structure.

Table 19. Priority species that use wetlands, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
American Bittern	Freshwater marshes, swamps	Increase 50%	-	X	-
American Black Duck	Freshwater marshes, swamps, bogs	Increase	-	-	X
Bank Swallow	Freshwater marshes, bogs	Increase 100%	-	X	-
Barn Swallow	Marsh	Increase 100%	X	X	-
Canada Warbler[4]	Treed swamps, bogs	Recovery objective	X	X	-
Chimney Swift[4]	Marsh	Recovery objective	X	X	-
Common Nighthawk[4]	Marsh	Recovery objective	X	X	-
Common Yellowthroat	Freshwater marshes	Maintain	-	-	X
Golden Eagle	Bogs	Provincial recovery objective[5]	X	X	-
Northern Rough-winged Swallow	Freshwater marshes	Increase 100%	-	X	-
Olive-sided Flycatcher[4]	Treed swamps	Recovery objective	X	X	-
Peregrine Falcon (*anatum/tundrius*)[4]	Freshwater marshes	Recovery objective	X	X	-

[1] "At risk" includes species: considered Endangered, Threatened or Special Concern pursuant to an assessment by the COSEWIC; listed on Schedule 1 of the SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).

[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.

[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.

[4] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objectives for these species are: Common Nighthawk: Reverse the decline; Peregrine Falcon (*anatum/tundrius*): Maintain; Short-eared Owl: Increase 100%; Chimney Swift: Reverse the decline; Olive-sided Flycatcher: Increase 100%; Canada Warbler: Assess/Increase 100%; Rusty Blackbird: Increase 100%.

[5] Consult Équipe de rétablissement de l'aigle royal au Québec (2005).

Table 19 continued

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Rusty Blackbird[4]	Swamps, bogs	Recovery objective	X	X	
Sedge Wren	Freshwater marshes	Increase	X	X	-
Short-eared Owl[4]	Freshwater marshes	Recovery objective	X	X	-
Solitary Sandpiper	Boreal forest swamps	Assess/Maintain	-	X	-
Sora	Areas of emergent vegetation associated with rivers and lakes	Assess/Maintain	-	X	-
Swamp Sparrow	Freshwater marshes	Maintain	-	-	X
Virginia Rail	Areas of emergent vegetation associated with rivers and lakes	Assess/Maintain	-	X	-
Wood Duck	Treed swamps	Maintain	-	X	-

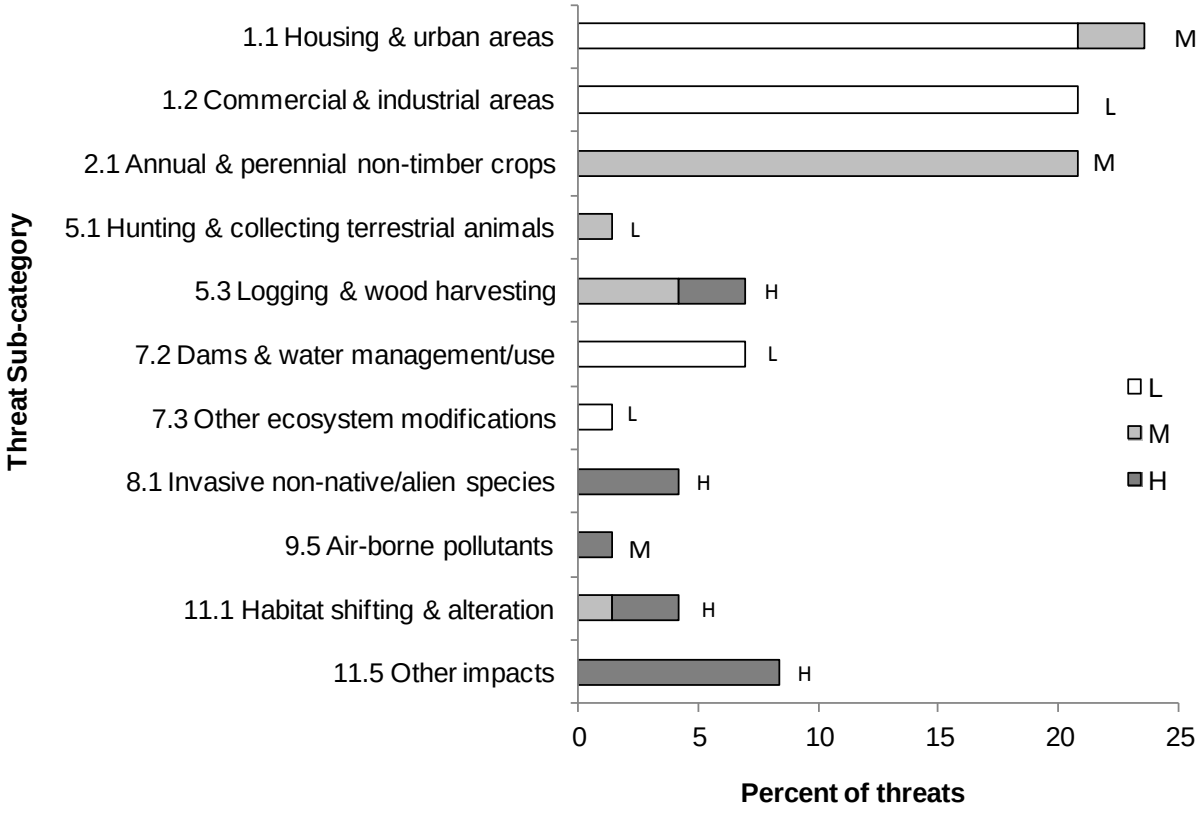

Figure 23. Percent of identified threats to priority species in wetlands in each threat sub-category.
Each bar represents the percent of the total number of threats identified in each threat sub-category in wetlands (for example, if 100 threats were identified in total for all priority species in wetlands, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in wetlands is shown at the end of each bar.

Table 20. Threats addressed, conservation objectives, recommended actions and priority species affected in wetland habitats in BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Increased human presence around lakes resulting in disturbance to birds, loss of wetlands and shoreline development.	1.1 Housing & urban areas	Minimize disturbance near nesting and feeding sites in wetlands.	4.1. Reduce disturbance from human recreation	Establish buffer zones around nesting and feeding habitats in recreational areas. Increase public awareness through outreach campaigns on the vulnerability of certain species to disturbance.	2.1 Site/area management 4.3 Awareness and communications	Sora, Virginia Rail
Habitat loss (drainage and filling of wetlands for residential or commercial development).	1.1 Housing & urban areas 1.2 Commercial & industrial areas	Conserve and restore the diversity and quality of wetlands on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Protect wetlands for priority species through stewardship or by legally designating them as conservation areas. Protect wetlands of various sizes, configurations and habitat conditions to ensure the diversity of habitats and species on the landscape. In municipalities, adopt urban plans that protect wetlands. Improve the protection of wetlands by enforcing existing policies and regulations.	1.1 Site/area protection 5.2 Policies and regulations	American Bittern, Wood Duck, Peregrine Falcon (*anatum/tundrius*), Short-eared Owl, Sora, Olive-sided Flycatcher, Canada Warbler, Rusty Blackbird, Virginia Rail, Sedge Wren

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Table 20 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Decrease in the number of prey insects due to the loss of wetlands.	1.1 Housing & urban areas 1.2 Commercial & industrial areas 2.1 Annual & perennial non-timber crops	Conserve and restore the diversity and quality of wetlands on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Protect wetlands for priority species through stewardship or by legally designating them as conservation areas. Protect wetlands of various sizes, configurations and habitat conditions to ensure the diversity of habitats and species on the landscape. Improve the protection of wetlands by enforcing existing policies and regulations. Support sustainable agricultural development in Quebec.	1.1 Site/area protection 5.2 Policies and regulations 5.3 Private sector standards and codes	Common Nighthawk, Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift
Habitat loss (drainage and filling of wetlands for agricultural development).	2.1 Annual & perennial non-timber crops	Conserve and restore the diversity and quality of wetlands on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Protect wetlands for priority species through stewardship or by legally designating them as conservation areas. Protect wetlands of	1.1 Site/area protection	American Bittern, Wood Duck, Solitary Sandpiper, Peregrine Falcon (*anatum/tundrius*), Short-eared Owl, Sora, Olive-sided Flycatcher, Canada Warbler, Rusty Blackbird,

Table 20 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
				various sizes, configurations and habitat conditions to ensure the diversity of habitats and species on the landscape. Improve the protection of wetlands by enforcing existing policies and regulations. Support sustainable agricultural development in Quebec.	5.2 Policies and regulations 5.3 Private sector standards and codes	Sedge Wren
Deliberate hunting or accident trapping.	5.1 Hunting and collecting terrestrial animals	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Golden Eagle provincial recovery strategy (Équipe de rétablissement de l'aigle royal au Quebec, 2005).	3.2 Species recovery	Golden Eagle
Habitat loss and degradation (logging in forest wetlands).	5.3 Logging & wood harvesting	Conserve and restore the diversity and quality of wetlands on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Promote compliance with provincial legislation relating to logging in forest wetlands.	5.4 Compliance and enforcement	American Bittern, Wood Duck, Solitary Sandpiper, Olive-sided Flycatcher
Habitat loss (scarcity of snags for cavity nesting birds).	5.3 Logging & wood harvesting	Restore features in wetlands that are important for birds.	1.4. Maintain important habitat features on the landscape	Install artificial nesting structures. Promote silvicultural treatments that maintain key habitat	3.2 Species recovery 5.3 Private sector standards and codes	Wood Duck

Table 20 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
				features (large diameter trees, snags with cavities, dead trees and structure).		
Habitat loss and degradation (nest flooding during major fluctuations in reservoir and river water levels).	7.2 Dams & water management/use	Conserve and restore the diversity and quality of wetlands on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Manage water levels to avoid flooding nests during the nesting period.	5.3 Private sector standards and codes	American Bittern, Solitary Sandpiper, Sora, Virginia Rail, Sedge Wren
Habitat loss and degradation (restriction of the number of beaver ponds as a result of beaver trapping).	7.3 Other ecosystem modifications	Maintain a good beaver population in the BCR.	1.3. Ensure the continuation of natural processes that maintain bird habitat	Increase awareness among trappers and the public through outreach campaigns.	4.3 Awareness and communications	Solitary Sandpiper
Habitat loss and degradation (invasive species).	8.1 Invasive non-native/alien species	Limit the impact of invasive plants on landscape structure and composition.	3.5 Prevent and control the spread of invasive and exotic species	Track invasive species and assess the possibility of developing a control program	8.2 Monitoring	American Bittern, Sora, Virginia Rail
Habitat loss and degradation (acidification of wetlands may affect food availability and increase mercury poisoning).	9.5 Air-borne pollutants	Conserve and restore the diversity and quality of wetlands on the landscape.	2.2. Reduce mortality and/or sub-lethal effects from exposure to contaminants	Encourage the reduction of gas emissions that cause acid rain. Develop research projects to fill gaps in knowledge about the acidification of lakes and ecotoxicology.	5.3 Private sector standards and codes 8.1 Research	American Bittern

Table 20 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Habitat loss and degradation (climate change could cause a loss of productivity in habitats used as staging areas).	11.1 Habitat shifting & alteration	Reduce potential impact of climate change on wetlands.	6.2. Manage for habitat resilience as climate changes	Promote the reduction of greenhouse gas emissions.	6.2 Substitution	Solitary Sandpiper
Habitat loss and degradation (climate change could alter the number, size and location of wetlands).	11.1 Habitat shifting & alteration	Reduce potential impact of climate change on wetlands.	6.2. Manage for habitat resilience as climate changes	Promote the reduction of greenhouse gas emissions.	6.2 Substitution	Sora, Virginia Rail
Higher frequency of adverse weather events due to climate change that may affect migration, reproductive success, availability of prey or nesting phenology.	11.5 Other impacts	Reduce potential impact of climate change on wetlands.	6.2. Manage for habitat resilience as climate changes	Promote the reduction of greenhouse gas emissions.	6.2 Substitution	Common Nighthawk, Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Olive-sided Flycatcher

Waterbodies, Snow and Ice

According to the United Nations Food and Agriculture Organization's (UN-FAO) Land Cover Classification System adapted for developing BCR strategies, "waterbodies, snow and ice" are primarily areas covered with water such as lakes, reservoirs, rivers and ponds. Expanses of snow and ice (permanent, seasonal, moving or stable) are also included in this class, but no priority species utilize this habitat type in BCR 12-QC. The "waterbodies, snow and ice" habitat class covers a little over 9% of the land in the BCR 12-QC and includes numerous rivers, many lakes, and a few large lakes and reservoirs (Fig. 24).

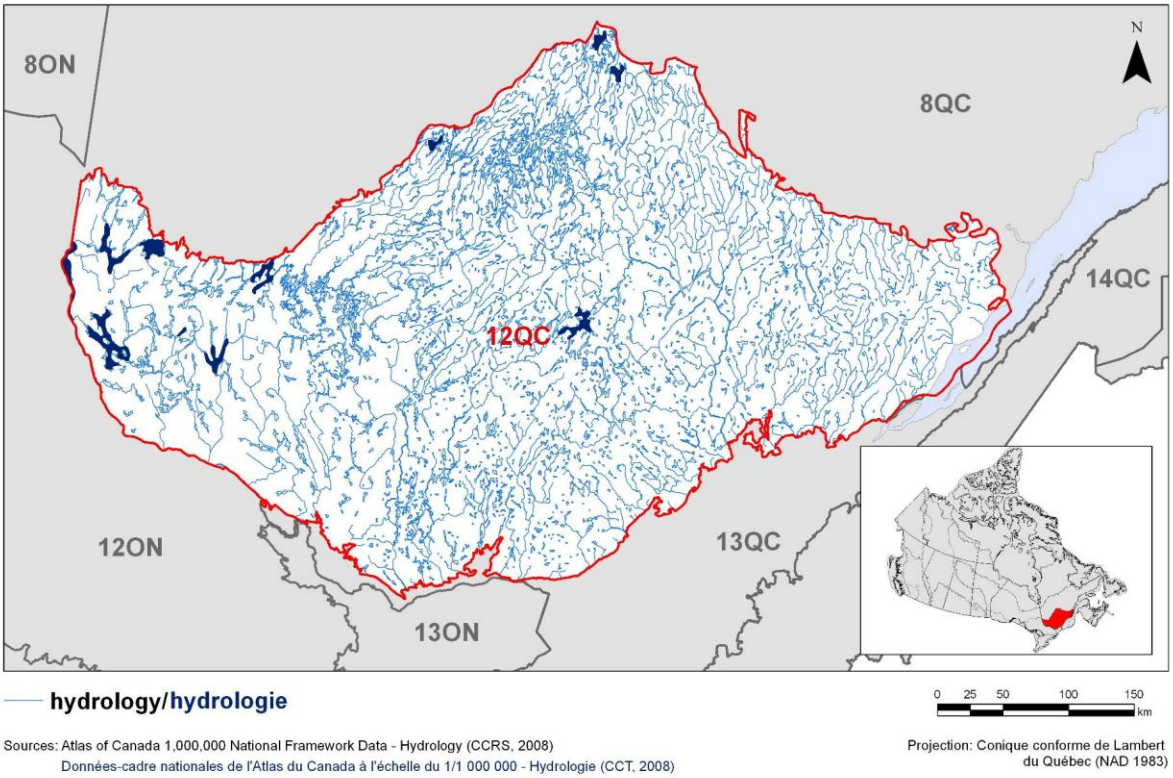

Figure 24. Hydrology map of BCR 12-QC: Boreal Hardwood Transition.

Nine priority species from the four bird groups are found in the waterbodies of BCR 12-QC (Table 15). The priority species using the waterbodies include the Bald Eagle, which is at risk provincially (Vulnerable), and Barrow's Goldeneye (Eastern population) which is listed as Special Concern on Schedule 1 of SARA and Vulnerable at the provincial level. Six species were included as priorities for conservation reasons while nine were chosen for stewardship purposes.

Threat sub-categories "5.3 Logging & wood harvesting," "1.2 Commercial & industrial areas" and "1.1 Housing & urban areas" each include 27% of reported threats for waterbodies (Fig. 25). The first sub-category has a "Medium" rolled-up overall magnitude and involves the

increasing scarcity of snags for cavity nesting birds. The two other two sub-categories have a "Low" rolled-up overall magnitude and deal with the drainage and filling of wetlands near waterbodies for commercial or residential development. Wetlands near lakes and rivers are essential components to the quality of these habitats. For this reason, some threats affecting this type of wetlands are also considered for waterbodies.

Sub-categories "9.3 Agricultural & forestry effluents" and "7.3 Other ecosystem modifications" respectively have "Low" and "Medium" rolled-up overall magnitudes, and each accounts for a little less than 10% of reported threats. Sub-category 9.3 is related to the problem of degradation of aquatic environments in agricultural areas and focuses more specifically on the overuse of pesticides and runoff that cause adverse effects on water quality and the food chain. The fish stocking in historically fishless lakes is the threat relating to sub-category 7.3 for this habitat.

The full list of threats to priority birds found in the waterbodies of BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 22. Conservation objectives are mainly to conserve and restore the quality and quantity of freshwater habitats on the landscape. Conservation actions include various suggestions such as protecting wetlands next to waterbodies, using silvicultural treatments that maintain natural habitat structure and installing artificial nesting structures.

Table 21. Priority species that use waterbodies, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
American Black Duck	Lakes, beaver ponds, agricultural watercourses	Increase	-	-	X
Bald Eagle	Large lakes and rivers	Provincial recovery objective[4]	X	X	-
Barrow's Goldeneye (Eastern population)	Small fishless lakes (<15 ha) located at higher elevations (>500 m)	Recovery objective[5]	X	X	-
Belted Kingfisher	Lakes, rivers	Maintain	-	-	X
Common Goldeneye	Lakes, beaver ponds	Maintain	-	X	-
Common Loon	Lakes with fish at least 5 ha in area with a preference for large alkaline lakes (> 50 ha) at low elevations	Maintain	-	-	X
Hooded Merganser	Lakes, beaver ponds	Maintain	-	X	-
Solitary Sandpiper	Beaver ponds in the boreal forest	Assess/Maintain	-	X	-
Wood Duck	Lakes, beaver ponds	Maintain	-	X	-

[1] "At risk" includes species considered Endangered, Threatened or Special Concern pursuant to an assessment by the COSEWIC; listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).
[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.
[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.
[4] Consult the Comité de rétablissement du pygargue à tête blanche au Québec (2002).
[5] Consult Environment Canada (2013).

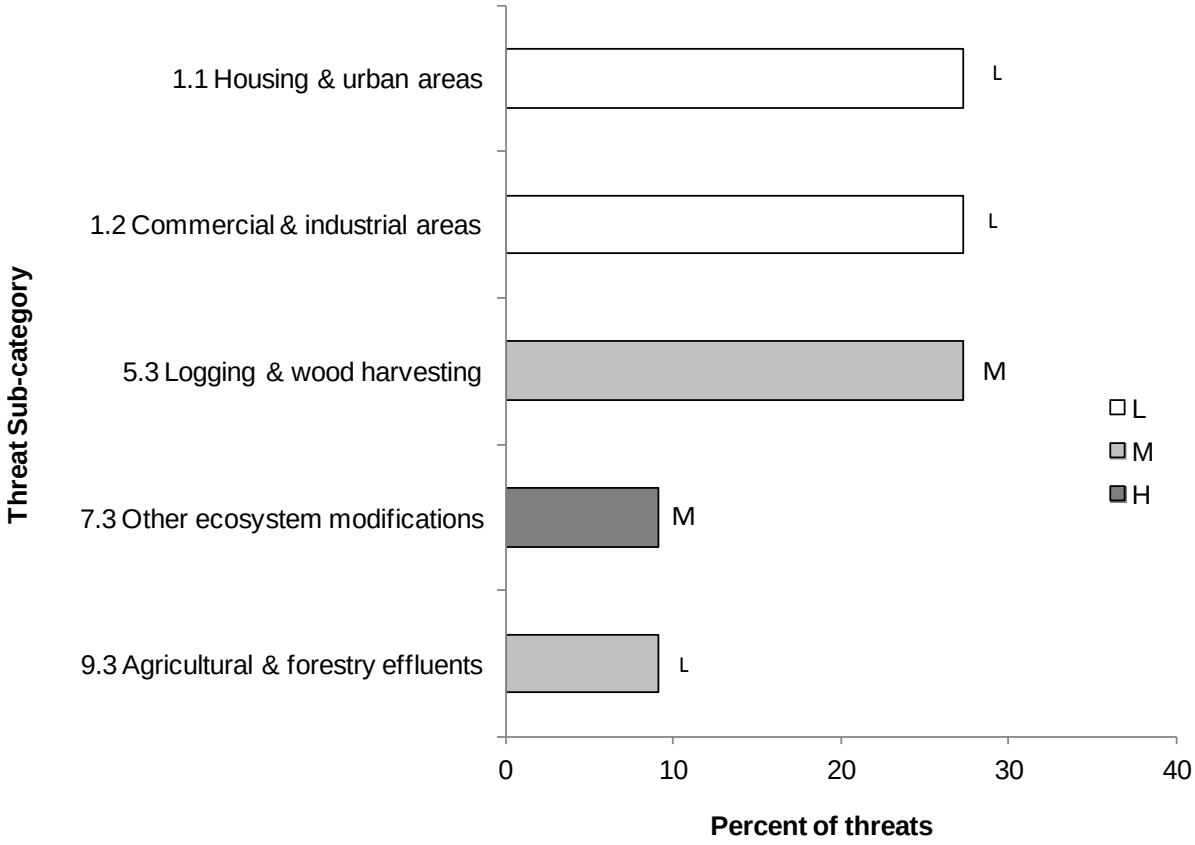

Figure 25. Percent of identified threats to priority species in waterbodies in each threat sub-category. Each bar represents the percent of the total number of threats identified in each threat sub-category in waterbodies (for example, if 100 threats were identified in total for all priority species in waterbodies, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in waterbodies is shown at the end of each bar.

Table 22. Threats addressed, conservation objectives, recommended actions and priority species affected in the waterbodies of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Habitat loss (drainage and filling of wetlands for residential or commercial development).	1.1 Housing & urban areas 1.2 Commercial & industrial areas	Conserve and restore the diversity and quality of waterbodies on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Protect wetlands for priority species through stewardship or by legally designating them as conservation areas. Protect wetlands of various sizes, configurations and habitat conditions to ensure the diversity of habitats and species on the landscape. In municipalities, adopt urban plans that protect wetlands. Improve the protection of wetlands by enforcing existing policies and regulations.	1.1 Site/area protection 5.2 Policies and regulations	Wood Duck, Common Goldeneye, Hooded Merganser
Habitat loss (scarcity of snags for cavity nesting birds).	5.3 Logging & wood harvesting	Restore features in freshwater habitats that are important for birds.	1.4. Maintain important habitat features on the landscape	Install artificial nesting structures. Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	3.2 Species recovery 5.3 Private sector standards and codes	Wood Duck, Common Goldeneye, Hooded Merganser
Fish stocking in historically fishless lakes.	7.3 Other ecosystem modifications	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Barrow's Goldeneye [Eastern population] management plan (Environment Canada, 2013).	3.2 Species recovery	Barrow's Goldeneye (Eastern population)

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Table 22 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Overutilization of pesticides (bird poisoning, eggshell thinning, reduced prey insects, reaching to adjacent habitats, reduced prey fish).	9.3 Agricultural & forestry effluents	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Bald Eagle provincial recovery strategy ("Comité de rétablissement du pygargue à tête blanche au Quebec" [Recovery Committee for the Bald Eagle in Quebec], 2002).	3.2 Species recovery	Bald Eagle

Coastal

Coastal habitats consist of terrestrial and aquatic habitats along the marine coasts. They consist mainly of estuary areas, mudflats, sandbars, rocky shores and islands. The area of this habitat type is difficult to calculate, but it is estimated that the BCR 12-QC marine coast stretches 135 km along the St. Lawrence River (Fig. 26).

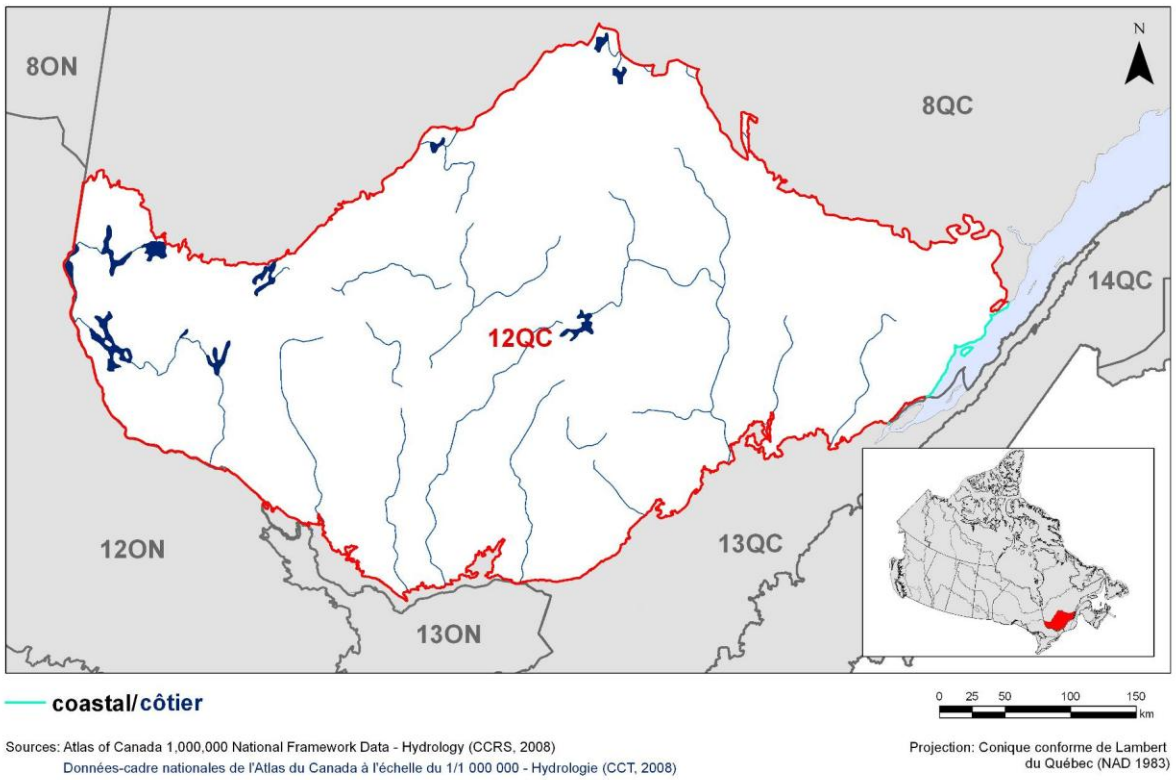

Figure 26. Map of coastal habitats in BCR 12-QC: Boreal Hardwood Transition.

Only one priority species is found in the coastal habitat of the BCR 12-QC, the Barrow's Goldeneye (Eastern population), which is a species at risk listed on Schedule 1 of SARA (Special Concern; Table 23).

Threat sub-category "9.2 Industrial & military effluents" accounts for 50% of reported threats to the Barrow's Goldeneye (Eastern population), and it has a "Medium" rolled-up overall magnitude (Fig. 27). This threat involves oil spills, as well as sediment contamination in the St. Lawrence River in areas where the Barrow's Goldeneye is found during the wintering period (Table 24).

Threat sub-categories "3.1 Oil & gas drilling" and "5.1 Hunting & collecting terrestrial animals" each account for 25% of threats to the Barrow's Goldeneye in coastal habitats, and both have a "Low" rolled-up overall magnitude. Conservation issues associated with these categories are

respectively potential offshore oil exploration and exploitation, as well as hunting, which may be unintentional because of the great similarity between the Barrow's Goldeneye and the Common Goldeneye.

The conservation objective for the Barrow's Goldeneye (Eastern population) in BCR 12-QC is the recovery of this species at risk by continuing to implement the management plan developed for the species (Environment Canada, 2013). The plan contains courses of action for all threats identified here for coastal habitats.

Table 23. Priority species that use the coastal habitat, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Barrow's Goldeneye (Eastern population)	Large foreshores of the upper estuary	Recovery objective[4]	X	X	-

[1] "At risk" includes species considered Endangered, Threatened or Special Concern pursuant to an assessment by the Committee on the Status of Endangered Wildlife in Canada; listed on Schedule 1 of the *Species at Risk Act* as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the "*Loi sur les espèces menacées ou vulnérables* (Quebec).
[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.
[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.
[4] Consult Environment Canada (2013).

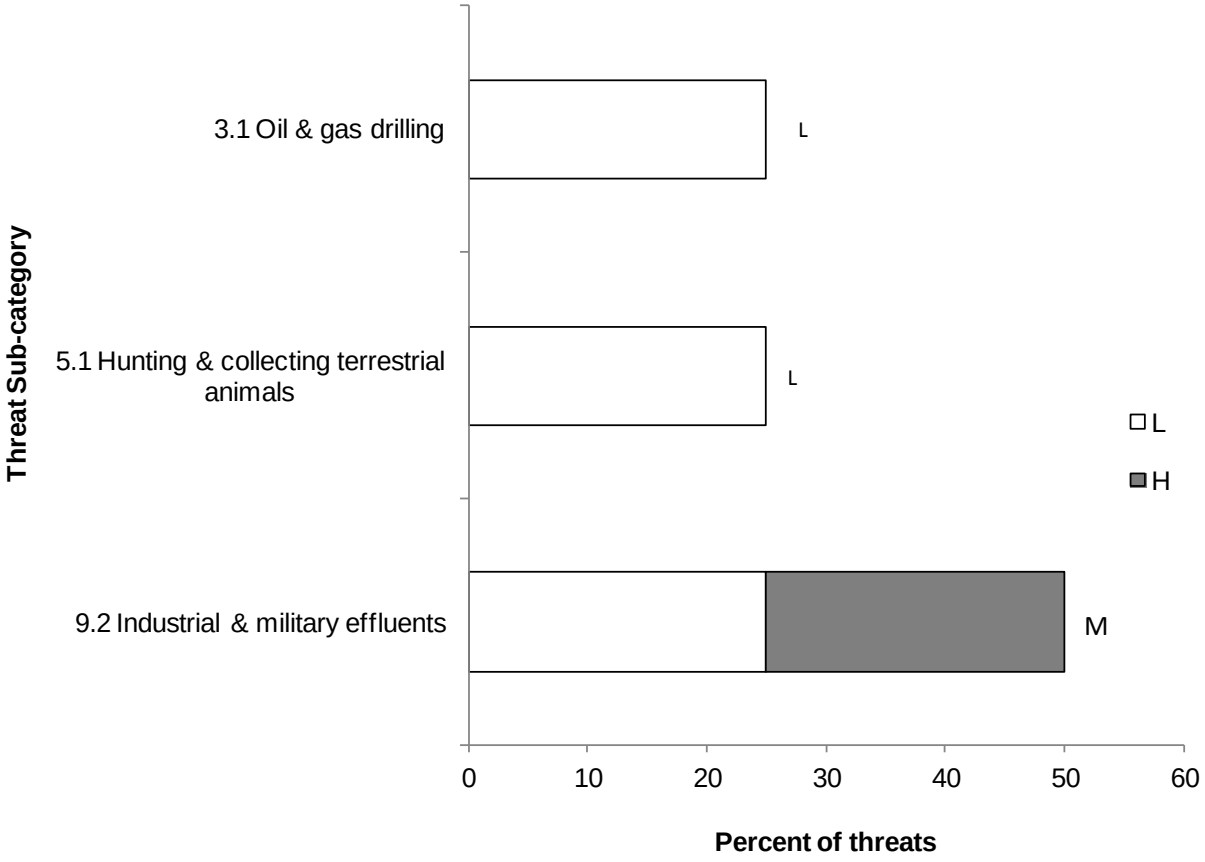

Figure 27. Percent of identified threats to priority species in coastal habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in coastal habitat (for example, if 100 threats were identified in total for all priority species in coastal habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in coastal habitat is shown at the end of each bar.

Table 24. Threats addressed, conservation objectives, recommended actions and priority species affected in the coastal habitats of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected
Potential offshore oil exploration and exploitation.	3.1 Oil & gas drilling	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Barrow's Goldeneye [Eastern population] management plan (Environment Canada, 2013).	3.2 Species recovery	Barrow's Goldeneye (Eastern population)
Hunting (confusion with the Common Goldeneye)	5.1 Hunting and collecting terrestrial animals	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Barrow's Goldeneye [Eastern population] management plan (Environment Canada, 2013).	3.2 Species recovery	Barrow's Goldeneye (Eastern population)
Oil spills.	9.2 Industrial & military effluents	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Barrow's Goldeneye [Eastern population] management plan (Environment Canada, 2013).	3.2 Species recovery	Barrow's Goldeneye (Eastern population)
Sediment contamination (polychlorinated biphenyls, polycyclic aromatic hydrocarbons, lead and mercury).	9.2 Industrial & military effluents	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Barrow's Goldeneye [Eastern population] management plan (Environment Canada, 2013).	3.2 Species recovery	Barrow's Goldeneye (Eastern population)

Riparian

Riparian habitats are defined as any habitat located within 15 metres of a freshwater body. Based on BCR 12-QC's hydrographic system (see Fig. 24), it is estimated that this habitat accounts for only 0.8% of the land, but it is found almost everywhere in the area.

Thirteen priority species, including 7 landbirds, 5 species of waterfowl and 1 shorebird, are found in the raparian habitats of BCR 12-QC (Table 25). Ten of these species were selected for conservation reasons, while 3 were chosen for stewardship purposes. Three are species at risk listed on Schedule 1 of SARA (Barrow's Goldeneye, (Eastern population), Olive-sided Flycatcher and Rusty Blackbird) and one is a species provincially designated at risk (Bald Eagle).

The most frequently reported threat sub-category in the riparian habitats of BCR 12-QC is "5.3 Logging & wood harvesting," which accounts for 47% of all reported threats in this habitat (Fig. 28). This sub-category has a "High" rolled-up overall magnitude, and the conservation issues associated with it are the loss of wooded riparian strips and the loss of important bird features (snags and large diameter trees).

Sub-categories "1.1 Housing & urban areas" and "7.3 Other ecosystem modifications" both have a "Medium" rolled-up overall magnitude and respectively account for 18% and 12% of reported threats. The first involves increased human presence around the lakes resulting in habitat loss and degradation and disturbance to birds. The second includes the erosion of riparian strips used for nesting. The other threat sub-categories affecting riparian habitats each account for 6% of reported threats and have a "Low" or "Medium" rolled-up overall magnitude (Fig. 28).

The full list of threats in the riparian habitats of BCR 12-QC as well as the objectives, conservation actions and species that could benefit are presented in Table 26. Conservation objectives are mainly to conserve and restore riparian habitats on the landscape, and restore the features that make them important for birds. Conservation actions include various suggestions such as promoting the use of silvicultural treatments that maintain wooded riparian strips and other characteristics that are important for birds, and preserving and restoring riparian habitats.

Table 25. Priority species that use riparian habitat, details on habitat used, population objectives and reason for priority status.

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
American Black Duck	Edges of lakes, rivers and streams	Increase	-	-	X
Bald Eagle	Power lines in coastal areas, forest areas near or along coasts or major rivers	Provincial recovery objective[4]	X	X	-
Bank Swallow	Riparian slopes	Increase 100%	-	X	-
Barrow's Goldeneye (Eastern population)	Presence of tree cavities (snags and live mature trees) in the spruce-moss forest near small fishless lakes (<15 ha) located at higher elevations (>500 m)	Recovery objective[5]	X	X	-
Broad-winged Hawk	Large deciduous or mixed wood stands next to wetlands or a watercourse	Maintain	-	-	X
Common Goldeneye	Edges of lakes, rivers and streams (in mature coniferous, deciduous or mixed wood forests)	Maintain	-	X	-
Hooded Merganser	Edges of lakes, rivers and streams (in mature coniferous, deciduous or mixed wood forests)	Maintain	-	X	-
Northern Rough-winged Swallow	Riversides	Increase 100%	-	X	-
Olive-sided Flycatcher[6]	Riparian stands of mixed wood or conifers	Recovery objective	X	X	-
Rusty Blackbird[6]	Riparian forests	Recovery objective	X	X	-

[1] "At risk" includes species considered Endangered, Threatened or Special Concern pursuant to an assessment by the COSEWIC; listed on Schedule 1 of the SARA as Endangered, Threatened or Special Concern, and listed as Endangered, Vulnerable or Likely to be designated threatened or vulnerable under the *Loi sur les espèces menacées ou vulnérables* (Quebec).

[2] "Conservation concern" includes species considered of concern in the Partners in Flight database downloaded from www.partnersinflight.org, the Canadian Shorebird Conservation Plan (Donaldson et al., 2000), Canadian Shorebird Conservation Plan (Milko et al., 2003), the North American Waterfowl Management Plan (Plan Committee, 2004) or by regional experts.

[3] "Stewardship" includes abundant species with a wide range with a large percentage of their range or their continental population located in the conservation unit or sub-unit. These species include landbirds considered by Partners in Flight but also species from other bird groups added by experts.

[4] Consult the Comité de rétablissement du pygargue à tête blanche au Québec (2002).

[5] Consult Environment Canada (2013).

[6] Species listed on Schedule 1 of SARA, but for which there are no recovery documents. Official documents related to SARA will prevail as soon as they are published; however, the interim population objective for these species are: Olive-sided Flycatcher: Increase 100%; Rusty Blackbird: Increase 100%.

Table 25 continued

Priority species	Details on habitat used	Population objective	Reason for priority status		
			At risk[1]	CC[2]	S[3]
Solitary Sandpiper	Beaver ponds in the boreal forest	Assess/Maintain	-	X	-
Swamp Sparrow	Riparian bush land	Maintain	-	-	X
Wood Duck	Mature forests (coniferous, deciduous or mixed wood) near lakes, ponds and watercourses	Maintain	-	X	-

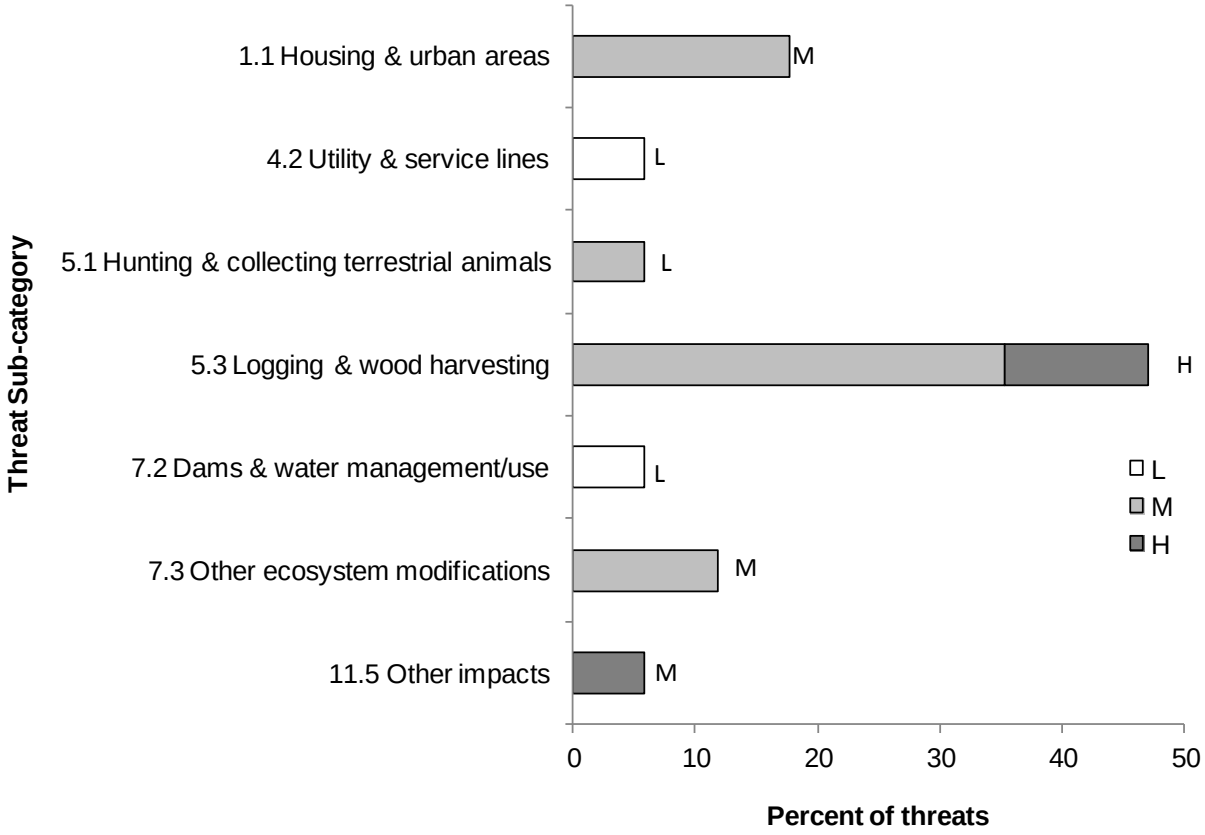

Figure 28. Percent of identified threats to priority species in riparian habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in riparian habitat (for example, if 100 threats were identified in total for all priority species in riparian habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). The bars are divided to show the distribution of Low (L), Medium (M), High (H) and Very High (VH) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, H and VH rankings in the sub-category). The overall magnitude of the sub-threat in riparian habitat is shown at the end of each bar.

Table 26. Threats addressed, conservation objectives, recommended actions and priority species affected in the riparian habitat of BCR 12-QC.

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Increased human presence around lakes resulting in disturbance to birds, loss of wetlands and shoreline development.	1.1 Housing & urban areas	Minimize disturbance near nesting and feeding sites in wetlands.	4.1. Reduce disturbance from human recreation	Establish buffer zones around known nesting and feeding habitats in recreational areas. Increase public awareness through outreach campaigns on the vulnerability of certain species to disturbance.	2.1 Site/area management 4.3 Awareness and communications	Wood Duck, Common Goldeneye, Hooded Merganser
Collisions with power lines and other man-made structures	4.2 Utilities & service lines	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Bald Eagle provincial recovery strategy (Comité de rétablissement du pygargue à tête blanche au Quebec, 2002).	3.2 Species recovery	Bald Eagle
Deliberate hunting or accident trapping.	5.1 Hunting and collecting terrestrial animals	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Bald Eagle provincial recovery strategy (Comité de rétablissement du pygargue à tête blanche au Quebec, 2002).	3.2 Species recovery	Bald Eagle
Loss of wooded riparian strips.	5.3 Logging & wood harvesting	Conserve and restore the quality and quantity of riparian habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Promote the maintenance of large wooded riparian strips as part of forest management.	5.3 Private sector standards and codes	Common Goldeneye, Hooded Merganser, Rusty Blackbird

[1] Priority species for which the only identified threat is in category "12.1 Information lacking" are not included in this table.

Table 26 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Habitat loss (scarcity of snags for cavity nesting birds).	5.3 Logging & wood harvesting	Restore features in riparian habitats that are important for birds.	1.4. Maintain important habitat features on the landscape	Install artificial nesting structures. Promote silvicultural treatments that maintain key habitat features (large diameter trees, snags with cavities, dead trees and irregular structure).	3.2 Species recovery 5.3 Private sector standards and codes	Wood Duck, Common Goldeneye, Barrow's Goldeneye (Eastern population), Hooded Merganser
Habitat loss (scarcity of large diameter trees).	5.3 Logging & wood harvesting	Recovery of species at risk.	3.4. Implement recovery strategies for species at risk	Continue to implement the Bald Eagle provincial recovery strategy (Comité de rétablissement du pygargue à tête blanche au Quebec, 2002).	3.2 Species recovery	Bald Eagle
Habitat loss and degradation (nest flooding during major fluctuations in reservoir and river water levels);	7.2 Dams & water management/use	Conserve and restore the diversity and quality of waterbodies on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Manage water levels to avoid flooding nests during the nesting period.	5.3 Private sector standards and codes	Solitary Sandpiper
Erosion of riparian strips used for nesting.	7.3 Other ecosystem modifications	Conserve and restore the quality and quantity of riparian habitats on the landscape.	1.1. Ensure land and resource-use policies and practices maintain or improve bird habitat.	Use erosion prevention methods that help maintain / restore sufficiently wide natural riparian strips. Conserve and restore riparian habitats.	2.3 Habitat and natural process restoration	Northern Rough-winged Swallow, Bank Swallow

Table 26 continued

Threats addressed	Threat category	Objectives	Objective category	Recommended actions	Action category	Priority species affected[1]
Higher frequency of adverse weather events due to climate change that may affect migration, reproductive success, availability of prey or nesting phenology.	11.5 Other impacts	Reduce potential impact of climate change on wetlands.	6.2. Manage for habitat resilience as climate changes	Promote the reduction of greenhouse gas emissions.	6.2 Substitution	Olive-sided Flycatcher

Section 3: Additional Issues

Widespread Issues

Some well-known conservation issues may not be identified in the literature as significant threats to populations of an individual priority species and therefore may not be captured in the threat assessment. However, these issues, while they may or may not be limiting factors for any individual species or population, contribute to avian mortality or decreases in reproductive success across many species and thus warrant conservation attention. Usually these issues transcend habitat types and are considered "widespread". Examples of these issues include:

- Collisions with human-made structures (buildings, cars, utility/telecommunications towers and lines, etc.)
- Predation by domestic cats
- Pollution/pesticides/oil spills
- Climate change

Because the widespread issues do not fit into the standard presentation format used in the BCR strategies, they are presented separately here. The mortality estimates included here are largely based on draft reports that were available within Environment Canada when this strategy was produced; the numbers may change as the final scientific papers are peer-reviewed and published. Human-related avian mortality across all sectors was standardized and compared in Calvert *et al*. 2013.

Collisions

Buildings

Collisions with glass windows or reflective panels on buildings is believed to be a significant source of bird mortality in Canada. Estimates of mortality from collisions with houses in Canada (including birds using feeders) range from approximately 15.8–30.5 million birds per year (Machtans et al. 2013). Mortality from collisions with buildings of fewer than 12 storeys is estimated at approximately 0.3–11.4 million birds/year, and for all cities in Canada with tall buildings in an urban core the estimate is 13 000–256 000 birds/year (Machtans et al. 2013). The total estimated mortality from collisions with buildings in Canada is therefore between 16.1 and 42.2 million birds/year (Machtans et al. 2013).

Data from Canada and the northeastern United States reveal that 163 species of birds of 32 families are known to have been killed by buildings. Some families and species of birds are disproportionately affected by collisions with buildings. *Parulidae* (warblers), *Fringillidae* (sparrows and allies), and *Regulidae* (kinglets) account for 70% of all bird deaths; the species most frequently killed are White-throated Sparrows (13.5% of all reported deaths), Golden-crowned Kinglets (10.2%), Dark-eyed Juncos (6.1%), Ovenbirds (5.3%) and Ruby-crowned Kinglets (5.3%). The population-level effects of bird mortality from building strikes are unknown. See Table 27 for conservation objectives and actions.

Wind Turbines

The 2955 wind turbines in Canada in 2011 have drawn considerable attention for their potential to cause mortality to birds and other species (notably bats). Two sources of mortality are typically associated with wind turbines: collisions with the turbines themselves, and the destruction of nests by turbine construction activities during the breeding season. On average, 5.9 birds are killed per turbine per year. Scaling up to a national level, an estimated 16 700 birds (range 13 300–21 600) die from collisions with wind turbines each year (Table 27; Zimmerling et al. 2013).

Some species are particularly vulnerable to collisions with wind turbines, for example, raptors flying along a land/water interface. For smaller, more common passerine species (warblers, thrushes, kinglets, etc.), the relatively small number of birds affected does not appear to pose a population-level threat. However, the anticipated proliferation of wind turbines means we should continue to ensure that turbines are sited to avoid important bird habitats and migration corridors.

In addition to collision mortality, wind turbines construction and installation can result in the loss of habitat for birds. At the 43 terrestrial wind farms in Canada for which data are available, on average, total habitat loss per turbine is approximately 1.23 ha on average. Based on this average, the predicted total habitat loss for wind farms nationwide is 3635 ha. Using published estimates of nest densities, the total number of affected nests, not accounting for construction that might occur outside the breeding season, is approximately 5700 (Zimmerling et al. 2013). See Table 27 for conservation objectives and actions.

Communication Towers

There are currently almost 8000 communication towers in Canada >60 m high (Longcore et al. 2012), each of which can pose a hazard to birds during migration. Birds are attracted to the lights of communication towers and are killed when they collide with the structures and guy wires. Mortality increases exponentially with tower height, in part because the use of guy wires also increases with tower height. Poor weather also plays a significant role in increasing migrant fatality; foggy and cloudy conditions increase the lit area around towers and block celestial clues used by migrating birds. The result is that birds circle to exhaustion in the halo of artificial light, or collide with each other, the tower or its guy wires (American Bird Conservancy 2012).

Avian mortality at towers is unequally distributed among species and regions, but estimates suggest that over 220 000 birds are killed in Canada each year (Table 27; Longcore et al. 2012).

Neotropical migrants in the families *Parulidae* (wood-warblers) and *Vireonidae* (vireos) are the species most commonly killed by communication towers. These families include threatened species and many that are of conservation concern in Canada and/or the United States. When considered in concert with mortality at towers in the United States (which is 20 times higher due to the larger number and greater height of towers in the United States), and the mortality from other stationary structures, mortality from collisions with Canadian communications

towers may negatively affect the population trends of some birds. See Table 27 for conservation objectives and actions.

Power Lines

Birds may be killed by colliding with power lines, or they may be electrocuted. Species with high wing-loading and thus low maneuverability, such as waterfowl, appear particularly at risk for collisions (Bevanger 1998). Electrocutions are most likely for large birds such as raptors and herons, whose bodies are large enough to span the distances between wires and create a short circuit. Raptors' habit of using power poles as perches further increases their risk. However, estimates of total mortality due to collisions and electrocutions can vary widely (Manville 2005) and population-level impacts are difficult to determine. Canadian estimates are that 161 000–802 000 birds are killed annually by electrocution and another 5.3–20.6 million birds are killed each year by colliding with electrical transmission lines (Calvert et al. 2013). See Table 27 for conservation objectives and actions.

Vehicles

There are over 1.4 million km of roads and hundreds of airports in Canada (World Bank Indicators 2012) that are often bordered by fences and vegetation providing convenient places for birds to perch, forage and nest. The paved surfaces can attract birds through the heat they emit, the puddles that form beside roads, and the salt and grit used for de-icing. Current estimates for one- and two-lane paved roads outside of major urban centres in Canada are that between 4.65 and 13.8 million birds are killed annually (Bishop and Brogan 2013).

Bird collisions with cars are influenced by the location of the road, proximity of vegetation and vehicle speed. Raptors and owls that hunt and forage near roads are particularly vulnerable, but many species that forage for grit and road salt or are otherwise attracted to roads have a high likelihood of being hit by vehicles. The population level effects of this source of mortality are not known. See Table 27 for conservation objectives and actions.

Predation by Domestic Cats

Based on the number of pet cats in Canada and published kill rates by cats elsewhere, roughly 204 million birds (range 105–348 million) are killed by domestic and feral cats in Canada each year (Blancher 2013). The broad range on this estimate reflects imprecise information on the average number of bird kills per cat, especially for rural and feral cats, and a lack of information on the number of feral cats (versus owned or pet cats) in Canada.

The birds most susceptible to cat predation are those that nest or forage on or near the ground or spend substantial time in human-dominated landscapes (both rural and urban) where cats are abundant. The proportion of Canada's birds killed by cats would be higher if additional cat predation when migrating through, or wintering in, the U.S. were factored in.

Without detailed study of the individual species affected, it is difficult to assess whether mortality caused by cat predation impacts population trends of birds in Canada. Nevertheless, it

is likely that many species of birds are potentially vulnerable to population effects at the local scale in southern Canada. See Table 27 for conservation objectives and actions.

Pollution

Pollution caused by industrial chemicals, pesticides and heavy metals can have both direct and indirect effects on survival and reproduction in birds. Sometimes the effects of exposure to pollutants are unexpected and do not result in immediate, measurable impacts on bird populations (Eeva and Lehikoinen 2000, Franceschini et al. 2008, North American Bird Conservation Initiative, U.S. Committee 2009, Mineau 2010). However, persistent exposure can result in sharp declines in bird populations as happened with Peregrine Falcons in eastern Canada prior to the ban of DDT. See Table 27 for conservation objectives and actions.

Pesticides

The most recent estimate suggests that 0.96–4.4 million birds are killed by pesticides annually in Canada (Mineau 2010). Provinces such as Saskatchewan, which have a large agricultural land base, account for the majority of the estimated kill, and pesticides are thought to be an important contributor to the decline in grassland bird species in Canada (Mineau 2010). Pesticides can kill birds rapidly following contact or may have sub-lethal impacts such as suppressed immune function and reduced stress response. There may also be indirect effects of pesticides such as reduction in prey and changes in vegetation that reduce habitat quality. While the use of the many toxic pesticides has been eliminated in Canada, migratory birds are still exposed while on wintering grounds in countries where their use is still permitted (Mineau 2010). See Table 27 for conservation objectives and actions.

Toxic Chemicals and Heavy Metals

Toxic organic chemicals and heavy metals released into the environment can also negatively impact bird populations. While some industrial chemicals such as PCBs are regulated, there is concern about new chemicals such as flame retardants (PBDE) that are used in computers, car parts and upholstery and whose effects on wildlife are largely unknown (Environment Canada 2003). Scavengers experience toxic effects when they ingest lead shotgun pellets or bullet fragments embedded in carcasses of game animals, and loons and other waterbirds are exposed to lead from shotgun pellets, sinkers and jigs that they ingest either while collecting grit for their gizzards or by eating bait fish with line and sinker still attached (Scheuhammer and Norris 1996, Scheuhammer et al. 2003). In some areas, lead poisoning from sinkers and jigs can account for approximately half of the mortality of adult Common Loons on their breeding grounds (Scheuhammer and Norris 1996). Birds are also susceptible to bioaccumulation of other toxic metals such as methylmercury, selenium and others when they consume prey that has been exposed to these substances. See Table 27 for conservation objectives and actions.

Oil Pollution

Oil may enter the environment either accidentally, through deliberate dumping, or in contained tailings ponds. It may be a single large event, as occurred in the Gulf of Mexico in 2010, or numerous smaller events. Annual estimates are that between 217 800 and 458 600 birds are

killed by ship-source oil spills annually (Calvert et al. 2013). Typically, diving birds are most at risk of oiling; however, any birds that come into contact with oil are vulnerable. Oil can impact birds through direct effects such as hypothermia (resulting from lost water-proofing of feathers following oil contamination), toxicity (from ingesting oil as they preen or by inhaling volatile organic compounds), and indirect effects, such as reduced prey availability and decreased quality of habitat. While techniques exist to clean and rehabilitate oiled birds, many birds die before, during and after rescue attempts (Brown and Lock 2003). See Table 27 for conservation objectives and actions.

Table 27. Conservation objectives and actions associated with bird mortality from collisions, cats and contaminants.

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
Collision mortality						
Collisions with buildings cause bird mortality.	1.1 Housing and urban areas 1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with windows/buildings	2.7 Reduce incidental mortality from collisions	Follow beneficial management practices for bird-friendly buildings including using bird-friendly glass, reducing reflection from windows, providing visual markers to enable birds to perceive windows, and reducing light pollution.	2.1 Site/area management 5.3 Private sector standards and codes	All species
Collisions with wind turbines cause bird mortality.	3.3 Renewable energy	Reduce incidental mortality from collisions with wind turbines	2.7 Reduce incidental mortality from collisions.	Follow beneficial management practices for reducing bird mortality when designing and locating wind turbines. Ensure that offshore wind energy developments will not present significant migration barriers. Locate offshore wind energy developments away from seabird breeding colonies and important waterbird foraging areas. Utilize techniques such as radar monitoring to determine pre-construction flight paths and assess the degree to which wind farms present migration barriers, and infrared camera systems to quantify strike rates.	2.1 Site/area management 5.3 Private sector standards and codes 1.2 Resource and habitat protection 8.2 Monitoring	All species
Collisions with communications towers cause bird mortality, particularly during migration.	1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with man-made structures	2.7 Reduce incidental mortality from collisions.	Follow beneficial management practices for reducing mortality to birds when constructing new communications towers.	2.1 Site/area management 5.3 Private sector standards and codes	All species

Table 27 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
				Switch off solid lights on existing towers and ensure that remaining lights have a synchronized, complete dark phase. Take steps to ensure that new towers avoid guy wires and minimize height, and avoid topographic locations where migrating birds are likely to be found in abundance. Retrofit existing towers to adhere to as many guidelines as possible.		
Collisions with power lines and accidental electrocution cause bird mortality.	4.2 Utility and service lines	Reduce mortality from collisions with utility lines / transmission towers	2.7 Reduce incidental mortality from collisions.	In high-risk areas, retrofit power lines so that the risk of electrocution of raptors is minimized. In new developments, locate transmission lines underground. Use markers or paint to increase visibility of power lines in high-strike areas. Avoid siting lines over or near wetlands.	2.1 Site/area management	Golden Eagle, Peregrine Falcon (*anatum/tundrius*), Bald Eagle
Collisions with vehicles cause bird mortality.	4.1 Roads and railroads	Reduce mortality from collisions with vehicles	2.7 Reduce incidental mortality from collisions.	Erect road signs or speed bumps to lower vehicle speeds where bird activity is frequent. Remove plants that attract birds from roadsides and medians. Landscape along roads using taller trees and bushes to cause birds to fly higher. Encourage the use of salt management plans to avoid unnecessary use of particulate salt (a bird attractant) on roads.	2.1 Site/area management 1.1 Site/area protection	Common Nighthawk, Short-eared Owl, Barn Swallow, Brown Thrasher, Killdeer, Bald Eagle

Table 27 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
				Avoid locating roads in valuable bird habitat.		
Population effects of collisions are unknown.	12.1 Information lacking	Improve understanding of population effects of mortality from collisions	7.4 Improve understanding of causes of population declines.	Assess the biological importance of bird kills from all sources of collisions.	8.1 Research	All species
Predation by domestic cats						
Predation by domestic and feral cats.	8.1 Invasive non-native/ alien species	Reduce mortality from domestic and feral cats	2.4 Reduce incidental mortality.	Implement a "Cats Indoors!" Campaign following the guidelines of the American Bird Conservancy. Work to reduce feral cat overpopulation through cat control regulations.	5.3 Private sector standards and codes 5.2 Policies and regulations	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting suburban or urban areas
Population effects of cat predation are unknown.	12.1 Information lacking	Improve understanding of population effects of cat predation	7.4 Improve understanding of causes of population declines.	Evaluate which species are most vulnerable to cat predation. Investigate the population-level effects of cat predation through better monitoring of kill rates and the number of feral cats. Continue to monitor bird populations so changes in numbers and distributions can be identified and management of cats can be altered to reflect these changes. Conduct effectiveness monitoring to evaluate if mitigation activities are achieving the desired results.	8.1 Research 8.2 Monitoring	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting suburban or urban areas

Table 27 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
Environmental Contaminants						
Mortality, sub-lethal effects, reductions in prey populations and habitat alteration caused by exposure to/use of pesticides.	9.3 Agricultural & forestry effluents	Reduce mortality and/or sub-lethal effects from exposure to contaminants Reduce the effects of pesticides on the prey species.	2.1 Reduce mortality and/or sub-lethal effects from pesticide use. 5.1 Maintain natural food webs and prey sources.	Substantially reduce the use of pesticides/rodenticides/herbicides in Canada. Where elimination is not possible, they should be used as part of an integrated pest management system. Improve regulation of pesticides/rodenticides/herbicides in Canada to reduce bird mortality.	5.2 Policies and regulations 5.3 Private sector standards and codes	**Direct or indirect poisoning by pesticides:** Common Nighthawk, Bobolink, Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Brown Thrasher, Killdeer, Eastern Meadowlark, Bald Eagle **Reductions in prey due to pesticide use:** Common Nighthawk, Bobolink, Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Brown Thrasher, Killdeer, Eastern Meadowlark, Bald Eagle
Mortality from ingestion of lead shot or tackle.	5.1 Hunting & collecting terrestrial animals 5.4 Fishing & harvesting aquatic resources	Reduce mortality and sub-lethal effects of lead shot and fishing tackle on birds	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with hunters, anglers and industry to eliminate the exposure of birds to shot, sinkers and jigs made of lead. Continue to enforce the use of non-toxic shot in waterfowl hunting, and encourage adoption of non-toxic alternatives in target shooting, upland game bird hunting, and fishing.	4.3 Awareness and communications 5.4 Compliance and enforcement	Bald Eagle, Common Loon
Mortality from heavy metals and other contaminants.	9.2 Industrial & military effluents	Reduce mortality from heavy metals and other contaminants	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants.	Work with industry and policy makers to reduce the quantity of heavy metals and other contaminants released into the environment.	5.3 Private sector standards and codes 5.2 Policies and regulations	**Heavy metals:** Common Goldeneye, Barrow's Goldeneye (Eastern population), Common Loon **PCBs:** Common Goldeneye, Barrow's Goldeneye (Eastern population), Common Loon, Bald Eagle **Other contaminants:** Peregrine Falcon (*anatum/tundrius)*

Table 27 continued

Threats addressed	Threat category	Objective	Objective category	Recommended actions	Action category	Example priority species affected
Mortality of waterbirds from oil pollution.	9. Pollution	Reduce mortality from oil pollution	2.3 Reduce mortality and/or sublethal effects of oil pollution. 5.1 Maintain natural food webs and prey sources.	Improve monitoring and enforcement capacity to reduce chronic oil pollution from illegal dumping of bilge waste and cleaning of oil tanks. Improve education/outreach to make sure that the oil industry and its regulators are aware of the potential impacts on birds and take measures to prevent exposure of birds to oil.	5.4 Compliance and enforcement 4.3 Awareness and communications	**Lethal and sublethal effect of oil exposure:** Common Goldeneye, Barrow's Goldeneye (Eastern population), Common Loon, Bald Eagle
Population effects of pollution are unknown.	12.1 information lacking	Improve understanding of population effects of pollution	7.4 Improve understanding of causes of population declines.	Evaluate the affects of PBDEs and other chemicals on vital rates in birds. Evaluate the extent to which pesticides are reducing prey availability for aerial insectivores. Improve the ability to monitor and understand the effects of contaminant concentrations in birds. Continue to acquire information on oiling of waterbirds through programs like Birds Oiled at Sea.	8.1 Research 8.2 Monitoring	All species

Climate Change

The effects of climate change are already measurable in many bird habitats and have resulted in range shifts and changes in the timing of migration and breeding in some species (National Audubon Society 2009, North American Bird Conservation Initiative, U.S. Committee 2009). Birds in all habitats will be affected by climate change. The most vulnerable are predicted to be those that are dependent on oceanic ecosystems and those found in coastal, island, grassland, arctic and alpine habitats (North American Bird Conservation Initiative, U.S. Committee 2010). Changing climate may also facilitate the spread of disease, the introduction of new predators and the invasion of non-native species that alter habitat structure and community composition (North American Bird Conservation Initiative, U.S. Committee 2009, Faaborg et al. 2010). See Tables 28 and 29 for a summary of impacts of climate change and conservation objectives.

A recent exercise used bioclimatic modeling to predict changes in bird species ranges based on anticipated climate change for different time periods and under different emissions scenarios (Lawler et al. unpublished; Lawler et al, 2009). Bioclimatic models use statistical associations between the current range of a species and a suite of climate variables to predict future ranges under new climate conditions. The study focused on bird species currently found within BCRs in Canada. The results suggest that bird species turnover in Canada will be highest in northern BCRs as species ranges continue to shift northward in the coming decades. Of the 177 species studied in BCR 12-QC, the model predicts that there will be a gain of 28 species, a loss of 10 species for a total turnover (species gains + species losses) of 22%.

To maintain healthy bird populations in the face of a changing climate, conservation must be carefully planned and must be implemented so as to buffer birds from the negative impacts of climate change wherever possible (Faaborg et al. 2010).

Table 28. Examples of the current and anticipated effects of climate change on bird populations in Canada and some affected bird species impacted by each climate change effect.
Note: The species shown here do not represent an exhaustive list; rather, they provide examples of species for which the effects of climate change have been suggested or documented.

Potential and realized effects of climate change	Examples of affected species
Mismatch between peak hatch and peak food abundance	Olive-sided Flycatcher, Rusty Blackbird
Habitat loss as a result of ecosystem changes	Virginia Rail, Sora, Solitary Sandpiper
Increase in severe weather events	Common Nighthawk, Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Olive-sided Flycatcher

Table 29. Proposed conservation objectives and actions to address climate change.

Threats addressed	Threat category	Objective	Objective category	Recommended Actions	Action category	Priority species affected
Climate change impacts habitat and negatively affects survival and productivity of birds	11.1 Habitat shifting and alteration 11.4 Storms and flooding 11.5 Other impacts	Reduce greenhouse gas emissions Mitigate the effects of climate change on bird habitat	6.1 Support efforts to reduce greenhouse gas emissions 6.2 Manage for habitat resilience as climate changes	Support efforts to reduce greenhouse gas emissions. Manage for habitat resilience to allow ecosystems to adapt despite disturbances and changing conditions. Minimize anthropogenic stressors (such as development or pollution) to help maintain resilience. Manage buffer areas and the matrix between protected areas to enhance movement of species across the landscape. Manage ecosystems to maximize carbon storage and sequestration while simultaneously enhancing bird habitat. Incorporate predicted shifts in habitat into landscape level plans (e.g., when establishing protected areas ensure the maintenance of north-south corridors to facilitate northward range shifts of bird species).	5.2 Policies and regulations 2.1 Site/area management 5.2 Policies and regulations	All species, but more specifically: Solitary Sandpiper, Common Nighthawk, Rough-winged Swallow, Bank Swallow, Barn Swallow, Sora, Chimney Swift, Olive-sided Flycatcher, Rusty Blackbird, Virginia Rail
Population-level effects of climate change are unknown	12.1 Information lacking	Improve understanding of climate change on birds and their habitats	7.5 Improve understanding of potential effects of climate change	Evaluate which species are most vulnerable to climate change. Investigate the cumulative effects of climate change.	8.1 Research	All

Table 29 continued

Threats addressed	Threat category	Objective	Objective category	Recommended Actions	Action category	Priority species affected
				Investigate behavioural responses to climate change (such as range shifts, changes in demographic rates, and changes in timing of breeding and migration) through long-term studies. Continue to monitor bird populations so changes in numbers and distributions can be identified. Undertake monitoring to evaluate the effectiveness of mitigation activities.	8.2 Monitoring	

Research and Population Monitoring Needs

Population Monitoring

An estimate of population trend for each species is necessary for the development of elements 1 and 3 (Species Assessment and Population Objectives). However, there are many species for which we are currently unable to estimate a population trend (PT) score. These species were typically assigned a population objective of "assess/maintain." The inability to estimate a PT score may be the result of a lack of monitoring data for the BCR as a whole or may be because certain species are not well captured by common monitoring techniques. To be able to effectively evaluate species believed to be of conservation concern, and to track those not yet of concern for future changes in status, we require more comprehensive monitoring that enables us to generate population trends for all species of birds in Canada. However, it is important to note that for some species, population trends are better understood at scales that are larger or smaller than the BCR unit, and the lack of BCR-scale population trend data should not preclude acting to conserve these species.

The lack of information remains a concern for effective management of priority species in BCR 12-QC. Although there are many standard monitoring programs, they do not provide a complete picture of the status and trends of all species in this region that are contending with many bird conservation issues.

The lack of population status data was considered a significant conservation issue for 47 of the 62 priority species (76%) in BCR 12-QC. Examples of the species concerned are listed in Table 30, which also contains recommended actions for improving population status monitoring.

A recent Environment Canada review (Avian Monitoring Review Steering Committee 2012) of avian monitoring programs in Canada made the following recommendations for each of the four main species groups:

Landbirds

- develop options for on-the-ground monitoring across boreal Canada;
- evaluate the ability of migration monitoring and checklist surveys to contribute to Environment Canada's monitoring needs; and
- evaluate the feasibility and cost-effectiveness of improving demographic monitoring to help understand causes of population change.

Shorebirds

- develop more reliable sampling methods for counting shorebirds in migration to address concerns about bias.

Waterbirds

- evaluate alternative strategies for filling gaps in coverage for both colonial waterbirds and marsh birds;

- consider both costs and potential reduction in risks; and
- carry out any necessary pilot work to evaluate options.

Waterfowl

- develop strategies to reduce expenditures on the prairie and eastern waterfowl breeding surveys, while retaining acceptable precision in population estimates;
- review the information needs and expenditures for duck banding programs.

Table 30. Species categories, monitoring methods and examples of potential priority species in BCR 12-QC for which there are currently not enough data to produce a reliable estimate of the demographic trend across the BCR.

Category	Potential monitoring methods	Examples of priority species
Landbirds	Increase the coverage of the Breeding Bird Survey (BBS) or perform specific surveys of rare, discrete or cryptic birds whose populations are not well known (e.g.: high altitude birds, breeding birds in the boreal forest). Increase the coverage of the Christmas Bird Count. Expand the current migration monitoring program (Canadian Migration Monitoring Network) by implementing and supporting stations.	White-throated Sparrow, Field Sparrow, Rose-breasted Grosbeak, Black-billed Cuckoo, Pine Grosbeak, Ruffed Grouse, Brown Creeper, Bicknell's Thrush, Golden-winged Warbler, Connecticut Warbler, Mourning Warbler, Black-backed Woodpecker , American Three-toed Woodpecker, Rusty Blackbird, Purple Finch, Sedge Wren
Aerial insectivores	Develop and implement specific surveys. If possible, conduct regular colony counts (e.g.: Chimney Swift roosts). Initial surveys may be needed to find the breeding areas, colonies or roosts. Implement or extend targeted twilight surveys for the Common Nighthawk and Eastern Whip-poor-will. These surveys could be based on the United States Nightjar Survey Network model.	Eastern Whip-poor-will, Common Nighthawk, Rough-winged Swallow, Chimney Swift, Olive-sided Flycatcher, Eastern Wood-Pewee
Diurnal raptors	Support Christmas Bird Counts and extend their scope to record the presence of wintering raptors. Support the training of monitors in the identification of raptors. Low density raptors that are poorly represented by regular surveys such as the Breeding Bird Survey require targeted species surveys, especially along the coast.	Golden Eagle, Peregrine Falcon (*anatum/tundrius*), Broad-winged Hawk, Bald Eagle
Nocturnal raptors	Support surveys of hawks and owls and extend their scope. Targeted species surveys may be required for rare species and species poorly represented by traditional survey methods.	Boreal Owl, Northern Saw-whet Owl (*acadicus*), Short-eared Owl
Shorebirds	Conduct surveys of breeding birds in the boreal forest.	Solitary Sandpiper
Inland waterbirds	Support the Marsh Monitoring Program and extend it for better spatial coverage and consider hiring birders to cover remote sites.	American Bittern, Sora, Virginia Rail
Waterfowl	Maintain the banding program to monitor the effects of hunting pressure on priority species. Document travel and acquire demographic data (survival rate, reproductive success). Maintain the three waterfowl monitoring programs: Suivi de la	American Black Duck, Common Goldeneye, Hooded Merganser, Wood Duck

Table 30 continued

Category	Potential monitoring methods	Examples of priority species
	sauvagine des rives du Saint-Laurent [St. Lawrence shoreline waterfowl monitoring program], Suivi de la sauvagine des basses terres du Quebec méridional [Southern Quebec lowlands waterfowl monitoring program], Suivi de la sauvagine des hautes terres du Quebec méridional [Southern Quebec highlands waterfowl monitoring program].	

Research

The focus of this section is to outline the main areas where a lack of information hindered the ability to understand conservation needs and make recommendations on suitable conservation actions. Research objectives presented here are bigger picture questions, and not necessarily a schedule of studies, that are needed to determine the needs of individual species (Table 31). Undertaking research will allow us to improve future iterations of BCR strategies and to focus future implementation, and will also enable the development of new tools for conservation.

Table 31. General research objectives in BCR 12-QC.

Objective	Example priority species affected
Determine the primary drivers of population decline (e.g., productivity, juvenile survival, adult breeding season survival, overwinter survival) in priority bird species which are declining or for which a National or Continental-scale decline is recognized.	**Examples of declining species in BCR 12-QC:** American Bittern, Bobolink, Wood Thrush, Barn Swallow, Chimney Swift, Cerulean Warbler, Golden-winged Warbler, Canada Warbler, Eastern Wood-Pewee, Rusty Blackbird
Develop research projects to fill gaps in knowledge about the acidification of lakes and ecotoxicology.	American Bittern
Map land cover changes that have occurred across the BCR between the baseline time periods established in BCR plans and the current day in order to correlate habitat loss with species declines and assess the main types of habitat transitions that have occurred (e.g., wetland to urban development, old growth to managed forest, tidal flats and flood plains to agriculture, etc.).	All species for which habitat-related declines have occurred or are suspected.
Combine up-to-date land cover information, additional data on bird densities, and detailed bird-habitat relationships for all priority species to allow for the calculation of quantitative habitat targets and to directly link conservation and population objectives.	All priority species.
Identify priority areas for implementation of recommendations in BCR plans.	All priority species.
Determine specific population connectivity and migration routes between breeding and wintering areas, using techniques such as genetic analysis, stable isotopes and geolocators.	All non-resident species.
Where they do not already exist, conduct research to develop sector-specific beneficial management practices documents, with an emphasis on bird and biodiversity conservation. Monitor adherence to these BMPs and assess their effectiveness at preserving and/or increasing priority bird populations.	All priority species.
Determine the population-level significance of bird mortality from collisions with anthropogenic structures of all types and predation by domestic cats. Identify particularly vulnerable species.	All priority species.

Table 31 continued

Objective	Example priority species affected
Continue to engage in and support climate change research with respect to: -links between climate, forage species (e.g., fish, plankton), and priority seabirds; and model potential responses to changes in climatic conditions. -alteration and loss of coastal habitat with predicted sea-level rise, particularly estuaries, saltmarsh, beach/dunes and mud/sand flats; and effects on priority species. -alteration and loss of terrestrial habitats, particularly shifting forest types and loss of alpine habitats. -range expansion or contraction of priority bird species. -identification of vulnerable species.	All priority species.
Assess the potential effects of coastal and offshore wind developments on birds, including both direct (collision mortality) and indirect (habitat loss due to avoidance of turbine installations) effects. Identify particularly vulnerable species.	All birds found in coastal and offshore areas, including migrating individuals/flocks.
Engage in interdisciplinary research to identify additive and interactive effects of multiple invasive species on ecosystem structure and function, in both terrestrial (e.g., introduced Sitka black-tailed deer, rabbits, raccoons, cats and rats; European Starling, House Sparrow, Scotch broom, etc.), freshwater (e.g., purple loostrife, yellow flag iris, etc.) and marine habitats (e.g., *Spartina spp*., green crab, etc.). Identify impacts to priority bird species.	All priority species.

Threats Outside Canada

Many bird species found in Canada (78%) spend a significant part of their life cycle outside the country (Fig. 29). These species face threats while they are outside Canada; in fact, threats to some migratory species may be most severe outside of the breeding season (Calvert et al. 2009). Fifty-two of the 62 priority species (84%) in BCR 12-QC are migratory and spend part of their annual cycle—half of the year or more—outside Canada.

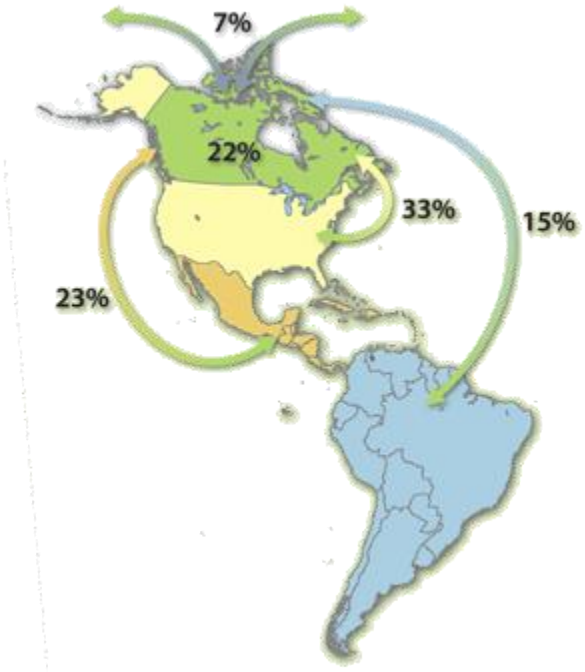

Figure 29. Percent of Canadian breeding birds that migrate to regions outside of Canada for part of their life cycle (North American Bird Conservation Initiative Canada 2012).

Similar to our assessment of threats facing priority species within Canada, we conducted a literature review to identify threats facing priority species while they are outside Canada. A lack of data was a pervasive issue for this exercise. For many species, little is known about threats they face during migration or while on their wintering grounds. Indeed, for some species, their wintering ranges and habitat use are only poorly known, if at all. There is also little information linking specific wintering areas to particular breeding populations, making it difficult to connect declines in breeding populations to potential problems on the wintering grounds. In addition, what data exist on wintering migrant species are heavily biased towards work done in the United States, and little research is available from Mexico, Central and South America. While many of the threats identified in the United States likely affect species throughout their range, unique issues outside of the United States may have been missed. An absence of threats in a region may reflect that the necessary research has not yet been conducted (or may not be published in English). Because information on bird distributions during the non-breeding season is limited, we were unable to assess the scope and severity of threats to priority species while they are outside of Canada.

Nevertheless, some information is available to guide conservation stakeholders outside Canada. Figure 30 shows that many priority bird species in BCR 12-QC are threatened by the loss or degradation of key migration and wintering habitats. The primary causes of habitat loss or degradation are the conversion of grassland and wetlands for agricultural purposes (sub-category 2.1), logging and wood harvesting (sub-category 5.3), and residential development (sub-category 1.1). Loss and degradation of wintering habitat is a greater threat to species with relatively small and concentrated wintering areas, such as the Bicknell's Thrush. The loss or degradation of these areas could have devastating effects on such species.

In addition to habitat loss, priority birds in BCR 12-QC suffer increased mortality due to human-induced threats during migration and wintering. Collisions with human-made structures such as buildings and communication towers represent a significant threat during migration (threat sub-categories 1.1 and 1.2). Exposure to lethal or sub-lethal concentrations of agricultural pesticide (sub-category 9.3) can also cause mortality during migration or at wintering sites, either through direct exposure (poisoning) or indirectly (reduction of prey abundance). Another important cause of mortality among priority species outside Canada is hunting (sub-category 5.1), including lead poisoning (ingestion of hunting pellets), legal or illegal hunting, and accidental mortality.

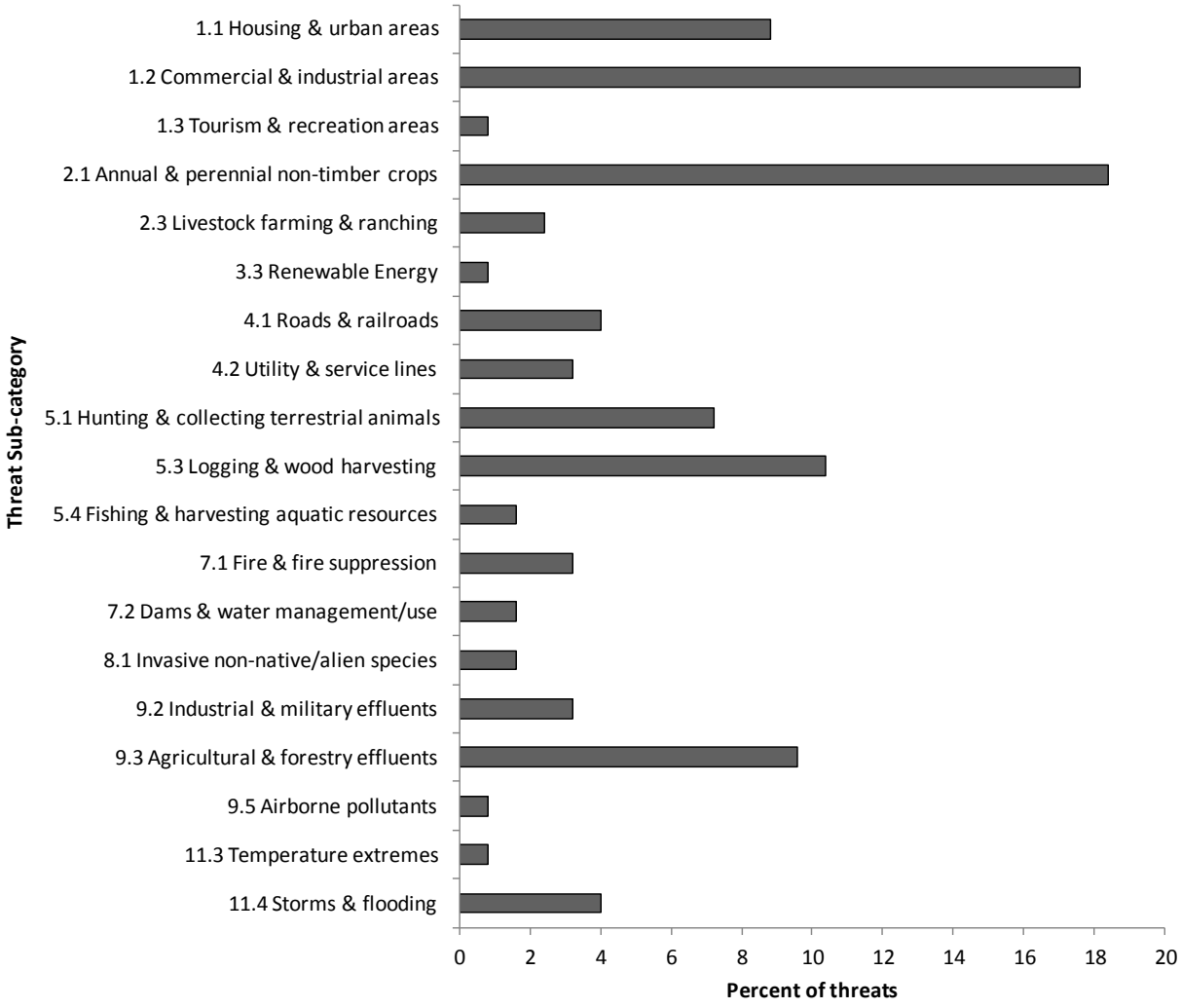

Figure 30. Percent of identified threats to priority species (by threat sub-category) in BCR 12-QC when outside Canada.

Note: The magnitude of threats outside Canada could not be established due to the lack of information on their scope and severity.

Next Steps

The primary aims of BCR strategies are to present Environment Canada's priorities with respect to migratory bird conservation, and to provide a comprehensive overview of the conservation needs of bird populations to practitioners who may then undertake activities that promote bird conservation in Canada and internationally. Users from all levels of government, Aboriginal communities, the private sector, academia, NGOs and citizens will benefit from the information. BCR strategies can be used in many different ways depending on the needs of the user, who may focus on one or more of the elements of the strategy to guide their conservation projects.

BCR strategies will be updated periodically. Errors, omissions and additional sources of information may be provided to Environment Canada at any time for inclusion in subsequent versions.

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Appendix 1

List of All Bird Species in BCR 12-QC

Table A1. Complete list of species in BCR 12-QC when they are in the BCR (breeding, migrant, wintering, seasonal) and their priority status.

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Seasonal	Priority
Empidonax alnorum	Alder Flycatcher	Landbird	X				
Corvus brachyrhynchos	American Crow	Landbird	X				
Falco sparverius	American Kestrel	Landbird	X				
Setophaga ruticilla	American Redstart	Landbird	X				
Turdus migratorius	American Robin	Landbird	X				
Picoides dorsalis	American Three-toed Woodpecker	Landbird	X		X		X
Haliaeetus leucocephalus	Bald Eagle	Landbird	X		X		X
Icterus galbula	Baltimore Oriole	Landbird	X				
Riparia riparia	Bank Swallow	Landbird	X				X
Hirundo rustica	Barn Swallow	Landbird	X				X
Strix varia	Barred Owl	Landbird	X		X		
Setophaga castanea	Bay-breasted Warbler	Landbird	X				X
Megaceryle alcyon	Belted Kingfisher	Landbird	X				X
Catharus bicknelli	Bicknell's Thrush	Landbird	X				X
Mniotilta varia	Black-and-white Warbler	Landbird	X				
Picoides arcticus	Black-backed Woodpecker	Landbird	X		X		X
Coccyzus erythropthalmus	Black-billed Cuckoo	Landbird	X				X
Setophaga fusca	Blackburnian Warbler	Landbird	X				X
Poecile atricapillus	Black-capped Chickadee	Landbird	X		X		
Setophaga striata	Blackpoll Warbler	Landbird	X				
Setophaga caerulescens	Black-throated Blue Warbler	Landbird	X				X
Setophaga virens	Black-throated Green Warbler	Landbird	X				X
Cyanocitta cristata	Blue Jay	Landbird	X				

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Seasonal	Priority
Polioptila caerulea	Blue-grey Gnatcatcher	Landbird	X				
Vireo solitarius	Blue-headed Vireo	Landbird	X				
Dolichonyx oryzivorus	Bobolink	Landbird	X				X
Poecile hudsonica	Boreal Chickadee	Landbird	X		X		
Aegolius funereus	Boreal Owl	Landbird	X		X		X
Buteo platypterus	Broad-winged Hawk	Landbird	X				X
Certhia americana	Brown Creeper	Landbird	X				X
Toxostoma rufum	Brown Thrasher	Landbird	X				X
Molothrus ater	Brown-headed Cowbird	Landbird	X				
Cardellina canadensis	Canada Warbler	Landbird	X				X
Setophaga tigrina	Cape May Warbler	Landbird	X				
Bombycilla cedrorum	Cedar Waxwing	Landbird	X		X		
Setophaga cerulea	Cerulean Warbler	Landbird	X				X
Setophaga pensylvanica	Chestnut-sided Warbler	Landbird	X				X
Chaetura pelagica	Chimney Swift	Landbird	X				X
Spizella passerina	Chipping Sparrow	Landbird	X				
Spizella pallida	Clay-colored Sparrow	Landbird	X				
Petrochelidon pyrrhonota	Cliff Swallow	Landbird	X				
Sialia sialis	Common Bluebird	Landbird	X				
Quiscalus quiscula	Common Grackle	Landbird	X				
Chordeiles minor	Common Nighthawk	Landbird	X				X
Corvus corax	Common Raven	Landbird	X				
Acanthis flammea	Common Redpoll	Landbird	X		X		
Sturnus vulgaris	Common Starling	Landbird	X		X		
Geothlypis trichas	Common Yellowthroat	Landbird	X				X
Oporornis agilis	Connecticut Warbler	Landbird	X				X
Accipiter cooperii	Cooper's Hawk	Landbird	X				
Junco hyemalis	Dark-eyed Junco	Landbird	X				
Picoides pubescens	Downy Woodpecker	Landbird	X		X		

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Seasonal	Priority
Tyrannus tyrannus	Eastern Kingbird	Landbird	X				
Sturnella magna	Eastern Meadowlark	Landbird	X				X
Sayornis phoebe	Eastern Phoebe	Landbird	X				
Caprimulgus vociferus	Eastern whip-poor-will	Landbird	X				X
Contopus virens	Eastern Wood-Pewee	Landbird	X				X
Coccothraustes vespertinus	Evening Grosbeak	Landbird	X		X		
Spizella pusilla	Field Sparrow	Landbird	X				X
Passerella iliaca	Fox Sparrow	Landbird	X				
Aquila chrysaetos	Golden Eagle	Landbird	X				X
Regulus satrapa	Golden-crowned Kinglet	Landbird	X				
Vermivora chrysoptera	Golden-winged Warbler	Landbird	X				X
Ammodramus savannarum	Grasshopper Sparrow	Landbird	X				
Dumetella carolinensis	Gray Catbird	Landbird	X				
Perisoreus canadensis	Gray Jay	Landbird	X		X		
Perdix perdix	Gray Partridge	Landbird	X		X		
Myiarchus crinitus	Great Crested Flycatcher	Landbird	X				
Bubo virginianus	Great Horned Owl	Landbird	X		X		
Picoides villosus	Hairy Woodpecker	Landbird	X		X		
Catharus guttatus	Hermit Thrush	Landbird	X				
Eremophila alpestris	Horned Lark (strigata)	Landbird	X				
Carpodacus mexicanus	House Finch	Landbird	X		X		
Passer domesticus	House Sparrow	Landbird	X		X		
Troglodytes aedon	House Wren	Landbird	X				
Passerina cyanea	Indigo Bunting	Landbird	X				
Ammodramus leconteii	Le Conte's Sparrow	Landbird	X				
Empidonax minimus	Least Flycatcher	Landbird	X				X
Melospiza lincolnii	Lincoln's Sparrow	Landbird	X				
Asio otus	Long-eared Owl	Landbird	X		X		
Parkesia motacilla	Louisiana Waterthrush	Landbird	X				

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Seasonal	Priority
Setophaga magnolia	Magnolia Warbler	Landbird	X				
Cistothorus palustris	Marsh Wren	Landbird	X				
Falco columbarius	Merlin	Landbird	X				
Zenaida macroura	Mourning Dove	Landbird	X		X		
Geothlypis philadelphia	Mourning Warbler	Landbird	X				X
Oreothlypis ruficapilla	Nashville Warbler	Landbird	X				X
Ammodramus nelsoni	Nelson's Sharp-tailed Sparrow	Landbird	X				
Cardinalis cardinalis	Northern Cardinal	Landbird	X				
Colaptes auratus	Northern Flicker	Landbird	X		X		X
Accipiter gentilis	Northern Goshawk (laingi)	Landbird	X		X		
Circus cyaneus	Northern Harrier	Landbird	X				
Surnia ulula	Northern Hawk Owl	Landbird	X		X		
Mimus polyglottos	Northern Mockingbird	Landbird	X				
Setophaga americana	Northern Parula	Landbird	X				
Stelgidopteryx serripennis	Northern Rough-winged Swallow	Landbird	X				X
Aegolius acadicus	Northern Saw-whet Owl (*acadicus*)	Landbird	X		X		X
Parkesia noveboracensis	Northern Waterthrush	Landbird	X				
Contopus cooperi	Olive-sided Flycatcher	Landbird	X				X
Oreothlypis celata	Orange-crowned Warbler	Landbird	X				
Pandion haliaetus	Osprey	Landbird	X				
Seiurus aurocapilla	Ovenbird	Landbird	X				X
Setophaga palmarum	Palm Warbler	Landbird	X				
Falco peregrinus anatum/tundrius	Peregrine Falcon (*anatum/tundrius*)	Landbird	X				X
Vireo philadelphicus	Philadelphia Vireo	Landbird	X				
Dryocopus pileatus	Pileated Woodpecker	Landbird	X		X		
Pinicola enucleator	Pine Grosbeak	Landbird	X		X		X
Spinus pinus	Pine Siskin	Landbird	X		X		

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Seasonal	Priority
Setophaga pinus	Pine Warbler	Landbird	X				
Carpodacus purpureus	Purple Finch	Landbird	X		X		X
Progne subis	Purple Martin	Landbird	X				
Loxia curvirostra	Red Crossbill	Landbird	X		X		
Sitta canadensis	Red-breasted Nuthatch	Landbird	X		X		
Vireo olivaceus	Red-eyed Vireo	Landbird	X				
Buteo lineatus	Red-shouldered Hawk	Landbird	X				
Buteo jamaicensis	Red-tailed Hawk	Landbird	X				
Agelaius phoeniceus	Red-winged Blackbird	Landbird	X				
Spinus tristis	Red-winged Blackbird	Landbird	X				
Columba livia	Rock Dove	Landbird	X		X		
Pheucticus ludovicianus	Rose-breasted Grosbeak	Landbird	X				X
Regulus calendula	Ruby-crowned Kinglet	Landbird	X				
Archilochus colubris	Ruby-throated Hummingbird	Landbird	X				
Bonasa umbellus	Ruffed Grouse	Landbird	X		X		X
Pipilo erythrophthalmus	Rufous-sided Towhee	Landbird	X				
Euphagus carolinus	Rusty Blackbird	Landbird	X				X
Passerculus sandwichensis	Savannah Sparrow	Landbird	X				
Piranga olivacea	Scarlet Tanager	Landbird	X				
Cistothorus platensis	Sedge Wren	Landbird	X				X
Accipiter striatus	Sharp-shinned Hawk	Landbird	X				
Asio flammeus	Short-eared Owl	Landbird	X				X
Melospiza melodia	Song Sparrow	Landbird	X				
Falcipennis canadensis	Spruce Grouse	Landbird	X		X		
Catharus ustulatus	Swainson's Thrush	Landbird	X				
Melospiza georgiana	Swamp Sparrow	Landbird	X				X
Oreothlypis peregrina	Tennessee Warbler	Landbird	X				
Tachycineta bicolor	Tree Swallow	Landbird	X				
Cathartes aura	Turkey Vulture	Landbird	X				

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Seasonal	Priority
Catharus fuscescens	Veery	Landbird	X				X
Pooecetes gramineus	Vesper Sparrow (affinis)	Landbird	X				
Vireo gilvus	Warbling Vireo	Landbird	X				
Sitta carolinensis	White-breasted Nuthatch	Landbird	X		X		
Zonotrichia albicollis	White-throated Sparrow	Landbird	X				X
Loxia leucoptera	White-winged Crossbill	Landbird	X		X		
Meleagris gallopavo	Wild Turkey	Landbird	X		X		
Empidonax traillii	Willow Flycatcher	Landbird	X				
Cardellina pusilla	Wilson's Warbler	Landbird	X				
Troglodytes hiemalis	Winter Wren	Landbird	X				
Hylocichla mustelina	Wood Thrush	Landbird	X				X
Setophaga petechia	Yellow Warbler	Landbird	X				
Empidonax flaviventris	Yellow-bellied Flycatcher	Landbird	X				
Sphyrapicus varius	Yellow-bellied Sapsucker	Landbird	X				X
Coccyzus americanus	Yellow-billed Cuckoo	Landbird	X				
Setophaga coronata	Yellow-rumped Warbler	Landbird	X				
Vireo flavirons	Yellow-throated Vireo	Landbird	X				
Scolopax minor	American Woolcock	Shorebird	X				
Pluvialis squatarola	Black-bellied Plover	Shorebird		X			
Calidris alpina	Dunlin	Shorebird		X			
Tringa melanoleuca	Greater Yellowlegs	Shorebird	X				
Charadrius vociferus	Killdeer	Shorebird	X	X			X
Calidris minutilla	Least Sandpiper	Shorebird		X			
Arenaria interpres	Ruddy Turnstone	Shorebird		X			
Calidris alba	Sanderling	Shorebird		X			
Charadrius semipalmatus	Semipalmated Plover	Shorebird		X			
Calidris pusilla	Semipalmated Sandpiper	Shorebird		X			
Tringa solitaria	Solitary Sandpiper	Shorebird	X				X
Actitis macularius	Spotted Sandpiper	Shorebird	X	X			

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Seasonal	Priority
Bartramia longicauda	Upland Sandpiper	Shorebird	X				
Calidris fuscicollis	White-rumped Sandpiper	Shorebird		X			
Gallinago delicata	Wilson's Snipe	Shorebird	X	X			
Botaurus lentiginosus	American Bittern	Waterbird	X				X
Nycticorax nycticorax	Black-crowned Night-Heron	Waterbird	X				
Gavia immer	Common Loon	Waterbird	X				X
Sterna hirundo	Common Tern	Waterbird	X				
Phalacrocorax auritus	Double-crested Cormorant	Waterbird	X				
Ardea herodias	Great Blue Heron	Waterbird	X				
Butorides virescens	Green Heron	Waterbird	X				
Larus argentatus	Herring Gull	Waterbird	X				
Ixobrychus exilis	Least Bittern	Waterbird	X				
Podilymbus podiceps	Pied-billed Grebe	Waterbird	X				
Larus delawarensis	Ring-billed Gull	Waterbird	X				
Porzana carolina	Sora	Waterbird	X				X
Rallus limicola	Virginia Rail	Waterbird	X				X
Anas rubripes	American Black Duck	Waterfowl	X	X			X
Melanitta americana	American Scoter	Waterfowl		X			
Anas americana	American Wigeon	Waterfowl	X	X			
Bucephala islandica	Barrow's Goldeneye (Eastern population)	Waterfowl	X	X	X		X
Anas discors	Blue-winged Teal	Waterfowl	X	X			
Branta bernicla	Brant	Waterfowl		X			
Bucephala albeola	Bufflehead	Waterfowl	X	X			
Branta canadensis	Canada Goose (Atlantic population)	Waterfowl	X	X			
Branta canadensis	Canada Goose (resident population)	Waterfowl	X	X			
Somateria mollissima dresseri	Common Eider (dresseri)	Waterfowl	X	X			
Bucephala clangula	Common Goldeneye	Waterfowl	X	X			X

Table A1 continued

Scientific Name	Common Name	Bird Group	Breeding	Migrant	Wintering	Seasonal	Priority
Mergus merganser	Common Merganser	Waterfowl	X	X	X		
Anas penelope	Eurasian Wigeon	Waterfowl		X			
Anas strepera	Gadwall	Waterfowl	X	X			
Aythya marila	Greater Scaup	Waterfowl		X			
Anser albifrons	Greater White-fronted Goose	Waterfowl		X			
Anas crecca	Green-winged Teal	Waterfowl	X	X			
Lophodytes cucullatus	Hooded Merganser	Waterfowl	X	X			X
Aythya affinis	Lesser Scaup	Waterfowl		X			
Clangula hyemalis	Long-tailed Duck	Waterfowl		X			
Anas platyrhynchos	Mallard	Waterfowl	X	X	X		
Cygnus olor	Mute Swan	Waterfowl		X			
Anas acuta	Northern Pintail	Waterfowl	X	X			
Anas clypeata	Northern Shoveler	Waterfowl	X	X			
Mergus serrator	Red-breasted Merganser	Waterfowl	X	X			
Aythya americana	Redhead	Waterfowl		X			
Aythya collaris	Ring-necked Duck	Waterfowl	X	X			
Oxyura jamaicensis	Ruddy Duck	Waterfowl	X	X			
Chen caerulescens	Snow Goose	Waterfowl		X			
Melanitta perspicillata	Surf Scoter	Waterfowl	X	X			
Cygnus columbianus	Tundra Swan	Waterfowl		X			
Melanitta fusca	White-winged Scoter	Waterfowl		X			
Aix sponsa	Wood Duck	Waterfowl	X	X			X

Appendix 2

General Methodology for Compiling the Six Standard Elements

Each strategy includes six required elements to conform to the national standard. An extensive manual (Kennedy et al. 2012) provides methods and other guidance for completing each element. The six elements provide an objective means of moving towards multi-species conservation efforts that are targeted to species and issues of highest priority. The six elements are:

1) identifying priority species – to focus conservation attention on species of conservation concern and those most representative of the region
2) attributing priority species to habitat classes – a tool for identifying habitats of conservation interest and a means of organizing and presenting information
3) setting population objectives for priority species – an assessment of current population status compared to the desired status, and a means of measuring conservation success
4) assessing and ranking threats – identifies the relative importance of issues affecting populations of priority species within the planning area as well as outside Canada (i.e., throughout their life-cycle)
5) setting conservation objectives – outlines the overall conservation goals in response to identified threats and information needs; also a means of measuring accomplishments
6) proposing recommended actions – strategies to begin on-the-ground conservation to help achieve conservation objectives

The first four elements apply to individual priority species, and together comprise an assessment of the status of priority species and the threats they face. The last two elements integrate information across species to create a vision for conservation implementation both within Canada and in countries that host priority species during migration and the non-breeding season.

Element 1: Species Assessment to Identify Priority Species

The Bird Conservation Strategies identify "priority species" from all regularly occurring bird species in each subregion. The priority species approach allows management attention and limited resources to focus on those species with particular conservation importance, ecological significance and/or management need. The species assessment processes used are derived from standard assessment protocols developed by the four major bird conservation initiatives.[1]

The species assessment process applies quantitative rule sets to biological data for factors such as:

- population size,
- breeding and non-breeding distribution,

[1] Partners in Flight (landbirds), Wings Over Water (waterbirds), Canadian Shorebird Conservation Plan (shorebirds), North American Waterfowl Management Plan (waterfowl).

- population trend,
- breeding and non-breeding threats, and
- regional density and abundance.

The assessment is applied to individual bird species and ranks each species in terms of its biological vulnerability and population status. The assessments can be used to assign sub-regional (i.e., provincial section of a BCR), regional (BCR) and continental conservation priorities among birds.

Element 2: Habitats Important to Priority Species

Identifying the broad habitat requirements for each priority species in the breeding and non-breeding season allows species with shared habitat-based conservation issues or actions to be grouped. If many priority species associated with the same habitat class face similar conservation issues, then conservation action in that habitat class may support populations of several priority species. In most cases, all habitat associations identified in the literature are listed for individual species. Habitat associations do not indicate relative use, suitability ratings or rankings, nor selection or avoidance; this could be a useful exercise to undertake in the future.

In order to link with other national and international land classification schemes and to capture the range of habitat types across Canada, habitat classes for all priority species are based, at the coarsest level, on the hierarchical approach of the international Land Cover Classification System (LCCS) developed by the United Nations Food and Agriculture Organization (FAO 2000). Some modifications were made to the LCCS scheme to reflect habitat types that are important to birds that are not included in the classification (e.g., marine habitats). Species often are assigned to more than one of these coarse habitat classes. To retain the link to regional spatial data (e.g., provincial forest inventories), or to group species into regionally relevant habitat classes, individual BCR strategies may identify finer scale habitat classes. Finer-scale habitat attributes and the surrounding landscape context were also captured when possible to better guide the development of specific conservation objectives and actions.

Element 3: Population Objectives for Priority Species

A central component of effective conservation planning is setting clear objectives that can be measured and evaluated. Bird Conservation Strategies set objectives based upon the conservation philosophies of national and continental bird initiatives, including the North American Bird Conservation Initiative (NABCI), that support conserving the distribution, diversity and abundance of birds throughout their historical ranges. The baselines for population objectives used in this planning exercise (those existing during the late 1960s, 1970s and 1990s for eastern waterfowl) reflect population levels prior to widespread declines. Most of the four bird conservation initiatives under the umbrella of NABCI have adopted the same baselines at the continental and national scale (waterfowl, shorebirds and landbirds; national and continental waterbird plans have not yet set population objectives). Some regions in the current planning effort have adjusted baselines to reflect the start of systematic monitoring. The ultimate measure of conservation success will be the extent to which population objectives

have been reached. Progress towards population objectives will be regularly assessed as part of an adaptive management approach.

Population objectives for all bird groups are based on a quantitative or qualitative assessment of species' population trends. If the population trend for a species is unknown, the objective is usually "assess and maintain", and a monitoring objective is set. Harvested waterfowl and stewardship species that are already at desired population levels are given an objective of "maintain". For any species listed under the *Species at Risk Act* (SARA) or under provincial/territorial endangered species legislation, Bird Conservation Strategies defer to population objectives in available Recovery Strategies and Management Plans. If recovery documents are not available, objectives are set using the same approach as for other species within that bird group. Once recovery objectives are available, they will replace interim objectives.

Element 4: Threat Assessment for Priority Species

Bird population trends are driven by factors that affect reproduction and/or survival during any point in the annual cycle. Threats that can reduce survival include, for example, reduced food availability at migratory stopovers or exposure to toxic compounds. Examples of threats that can reduce reproductive success may include high levels of nest predation or reduced quality or quantity of breeding habitat.

The threats assessment exercise included three main steps:

1. Conducting a literature review to itemize past, current and future threats for each priority species and classifying the threats following a using a standardized classification scheme (Salafsky et al. 2008).
2. Ranking the magnitude of threats for priority species following a standardized protocol (Kennedy et al. 2012).
3. Preparing a set of threat profiles for the BCR subregion, for broad habitat categories.

Each threat was categorized following the IUCN-CMP threat classification scheme (Salafsky et al. 2008) with the addition of categories to capture species for which we lack information. Only threats stemming from human activity were included in the threats assessment because they can be mitigated; natural processes that prevent populations from expanding beyond a given level were considered and noted, but no actions beyond research and/or monitoring were developed. Threats were ranked by assessing the scope (the proportion of the species' range within the subregion that is affected by the threat) and severity (the relative impact that the threat poses to the viability of the species' populations) of the threat. The scores for scope and severity were combined to determine an overall magnitude low, medium, high or very high. These magnitudes were then rolled-up by threat categories and sub-categories across habitat types (see Kennedy et al. 2012 for details on this process). The threats roll-up allows for comparison of the relative magnitude of the threats among threat categories and habitat types. The scoring and ranking of threats not only helps to determine which threats contribute most to population declines in individual species, but also allows us to focus attention on the threats with the greatest effects on suites of species or in broad habitat classes.

Table A2. IUCN-CMP unified classification of threats (adapted from Salafsky et al. 2008).

Threat Categories	Threat Description
1	Residential & commercial development
1.1	Housing & urban areas
1.2	Commercial & industrial areas
1.3	Tourism & recreation areas
2	Agriculture & aquaculture
2.1	Annual & perennial non-timber crops
2.2	Wood & pulp plantations
2.3	Livestock farming & ranching
2.4	Marine & freshwater aquaculture
3	Energy production & mining
3.1	Oil & gas drilling
3.2	Mining & quarrying
3.3	Renewable energy
4	Transportation & service corridors
4.1	Roads & railroads
4.2	Utility & service lines
4.3	Shipping lanes
4.4	Flight paths
5	Biological resource use
5.1	Hunting & collecting terrestrial animals
5.2	Gathering terrestrial plants
5.3	Logging & wood harvesting
5.4	Fishing & harvesting aquatic resources
6	Human intrusions & disturbance
6.1	Recreational activities
6.2	War, civil unrest & military exercises
6.3	Work & other activities
7	Natural system modifications
7.1	Fire & fire suppression
7.2	Dams & water management/use

Table A2 continued

Threat Categories	Threat Description
7.3	Other ecosystem modifications
8	Invasive & other problematic species & genes
8.1	Invasive non-native/alien species
8.2	Problematic native species
8.3	Introduced genetic material
9	Pollution
9.1	Household sewage & urban waste water
9.2	Industrial & military effluents
9.3	Agricultural & forestry effluents
9.4	Garbage & solid waste
9.5	Air-borne pollutants
9.6	Excess energy
10	Geological events
10.1	Volcanoes
10.2	Earthquakes/tsunamis
10.3	Avalanches/landslides
11	Climate change & severe weather
11.1	Habitat shifting & alteration
11.2	Droughts
11.3	Temperature extremes
11.4	Storms & flooding
11.5	Other impacts
12	Other direct threats

Element 5: Conservation Objectives

Overall, conservation objectives represent the desired conditions, within the subregion that will collectively contribute to achieving population objectives. Objectives may also outline the research or monitoring needed to improve the understanding of species declines and how to best take action.

Currently, most conservation objectives are measurable using qualitative categories (e.g., decrease, maintain, increase) that will allow an evaluation of implementation progress but they

are not linked quantitatively to population objectives. Implementation that incorporates an active adaptive management process is an underlying principle of this conservation effort and will allow for future evaluation of whether or not reaching conservation objectives contributed to achieving population objectives.

Whenever possible, conservation objectives benefit multiple species and/or respond to more than one threat. However, where necessary, they focus on the specific requirements of a single species.

Conservation objectives generally fall into one of two broad categories:

- habitat objectives within the BCR subregion (the quantity, quality and configuration of priority habitats),
- non-habitat objectives within the BCR subregion (minimizing mortality by reducing predation, conducting education and outreach to reduce human disturbance, etc.).

Ideally, habitat objectives would reflect the type, amount and location of habitat necessary to support population levels of priority species outlined in the population objectives. Currently, there is a lack of data and tools at the BCR scale to develop these specific quantitative objectives. Threats-based objectives present the direction of change required to move toward the population objectives using the best available information and knowledge of ecosystem management strategies within broad habitat types.

Element 6: Recommended Actions

Recommended conservation actions are the strategies required to achieve conservation objectives. Recommended actions are usually made at the strategic level rather than being highly detailed and prescriptive. Actions were classified following the IUCN-CMP classification of conservation actions (Salafsky et al. 2008) with the addition of categories to address research and monitoring needs. When possible, more detailed recommendations can be included, for example if beneficial management practices, ecosystem plans or multiple recovery documents are available for a subregion. However, actions should be detailed enough to provide initial guidance for implementation.

The objectives for research, monitoring and widespread issues may not have actions associated with them. These issues are often so multi-faceted that actions are best designed in consultation with partners and subject-matter experts. Implementation teams will be better positioned to address these complex issues, drawing input from various stakeholders.

Recommended actions defer to or support those provided in recovery documents for species at risk at the federal, provincial or territorial level, but because these strategies are directed at multiple species, actions are usually more general than those developed for individual species. For more detailed recommendations for species at risk, readers should consult recovery documents.

Appendix 3

Species Added or Removed from the BCR 12–QC Priority List

Table A3. List of species added or removed from the BCR 12–QC priority list and their assessment characteristics.

Species[1]	Presence[2]	Standardized Assessment: Legal Status[3] Fed.	Standardized Assessment: Legal Status[3] Prov.	Bird Group Score[4]	Reason for which regional experts have added or removed a species (after undergoing a standardized assessment)
ADDED					
LANDBIRDS					
American Three-toed Woodpecker	Br	-	-	-	Precautionary principle (significant habitat loss in BCR 12–QC)
Boreal Owl	Br	-	-	-	Precautionary principle (significant habitat loss in BCR 12–QC)
Brown Creeper	Br	-	-	-	Precautionary principle (significant habitat loss in BCR 12–QC)
Northern Saw-whet Owl (*acadicus*)	Br	-	-	-	Precautionary principle (significant habitat loss in BCR 12–QC)
Ovenbird	Br	-	-	-	Bird group score raised by regional experts
SHOREBIRDS					
Solitary Sandpiper	Br	-	-	3b	Precautionary principle (potentially high habitat loss in BCR 12–QC)
WATERFOWL					
Wood Duck	Br/Mi	-	-	Moderately low	BCR 12-QC accounts for a large percentage of the observations of the species in Quebec
REMOVED					
LANDBIRDS					
Grasshopper Sparrow	Obr	-	-	-	Number of breeding pairs in BCR 12–QC is too low
Louisiana Waterthrush	Ebr	-	-	-	Number of breeding pairs in BCR 12–QC is too low

Table A3 continued

Species[1]	Presence[2]	Standardized Assessment: Legal Status[3] Fed.	Prov.	Bird Group Score[4]	Reason for which regional experts have added or removed a species (after undergoing a standardized assessment)
Nelson's Sharp-tailed Sparrow	Obr	-	-	-	Number of breeding pairs in BCR 12–QC is too low
Willow Flycatcher	Obr	-	-	CC	No major issue for the species in BCR 12-QC (the population is actually increasing in this BCR)
SHOREBIRDS					
American Woolcock	Br	-	-	4a	Logging provides habitat for this species in BCR 12-QC
Black-bellied Plover	Mi	-	-	3a	No known staging sites in BCR 12-QC
Dunlin	Mi	-	-	3a	No known staging sites in BCR 12-QC
Ruddy Turnstone	Mi	-	-	4a, b	No known staging sites in BCR 12-QC
Sanderling	Mi	-	-	4a	No known staging sites in BCR 12-QC
Semipalmated Sandpiper	Mi	-	-	3a	No known staging sites in BCR 12-QC
WATERBIRDS					
Common Tern	Br	-	-	Tier 2	Bird group score lowered by regional experts
Herring Gull	Br	-	-	Tier 2	Bird group score lowered by regional experts
Least Bittern	Br	-	-	Tier 2	Number of breeding pairs in BCR 12–QC is too low
WATERFOWL					
American Scoter	Mi	-	-	High	Number of individuals in BCR 12–QC is too low
Bufflehead	Br/Mi	-	-	Moderately high	Number of breeding pairs in BCR 12–QC is too low
Canada Goose (Atlantic population)	Br/Mi	-	-	Very high	Number of breeding pairs in BCR 12–QC is too low
Greater Scaup	Mi	-	-	Moderately high	Number of individuals in BCR 12–QC is too low
Lesser Scaup	Mi	-	-	High	Number of individuals in BCR 12–QC is too low
Ring-necked Duck	Br/Mi	-	-	Moderately high	Number of breeding pairs in BCR 12–QC is too low
Snow Goose	Mi	-	-	-	Number of individuals in BCR 12–QC is too low
Surf Scoter	Br/Mi/Mo	-	-	High	Number of breeding pairs in BCR 12–QC is too low

Table A3 continued

Species[1]	Presence[2]	Standardized Assessment: Legal Status[3] Fed.	Prov.	Bird Group Score[4]	Reason for which regional experts have added or removed a species (after undergoing a standardized assessment)
White-winged Scoter	Mi	-	-	Moderately high	Number of individuals in BCR 12–QC is too low

[1] Species listed in alphabetical order by bird group. Species names based on the American Ornithologists' Union's list of North American birds, 7th edition and supplements up to supplement 51.

[2] Wi = wintering, Mi = migratory, Mo = moulting, Br = breeder, Obr = occasional breeder (every year), Sbr = seldom breeds (not every year), Ebr = exceptional breeder (only a few times in the BRC).

[3] Federal: Schedule 1 of the *Species at Risk Act* (SARA), E = Endangered; T = Threatened; SC = Special Concern. Keep in mind that the species has been assessed by COSEWIC but is not listed on Schedule 1 of SARA. Provincial: *Loi sur les espèces menacées ou vulnérables* T = Threatened, V = Vulnerable, L = Likely to be designated threatened or vulnerable.

[4] **Landbirds**: CC = continental concern, RC = regional concern (all BCR 12), CS = continental stewardship, RS = regional stewardship (all BCR 12). Information taken from the database downloaded from (see Panjabi et al., 2005 for the analytical method). **Shorebirds**: Conservation concern in the United States of America and Canada, as identified in the Canadian Shorebird Conservation Plan (Donaldson et al., 2000). A score of 5 means "Highly imperilled" and a score of 1 means "Species not at risk." Consult Donaldson et al. (2000) for the complete description of conservation categories. **Waterbirds:** National priority level as identified in Canada's Waterbird Conservation Plan (Milko et al., 2003). **Waterfowl**: Conservation needs for breeding and non-breeding birds as identified in the North American Waterfowl Management Plan (2004). Consult Kennedy et al. (2012) for the thresholds used to classify the species of the various groups for the priority list.

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For more information:

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