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Management Plan for the Rusty Blackbird (*Euphagus carolinus*) in Canada

Rusty Blackbird

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[1] http://www.registrelep-sararegistry.gc.ca

PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed species of Special Concern and are required to report on progress five years after the publication of the final document on the SAR Public Registry.

The Minister of the Environment and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Rusty Blackbird and has prepared this management plan as per section 65 of SARA. To the extent possible, it has been prepared in cooperation with the governments of Yukon, Northwest Territories, Nunavut, British Columbia, Alberta, Ontario, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador, the Laberge Renewable Resources Council, the Wek'èezhìı Renewable Resources Board, the Nunatsiavut Government, the Wildlife Management Advisory Council, the Gwich'in Renewable Resources Board, the Carcross/Tagish First Nation, Essipit First Nation, and Kluane First Nation.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this plan and will not be achieved by Environment Canada, the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this plan for the benefit of the Rusty Blackbird and Canadian society as a whole.

Implementation of this plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=En&n=6B319869-1%20

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EXECUTIVE SUMMARY

The Rusty Blackbird is a medium-sized passerine that occurs exclusively in North America and breeds in boreal wetland habitats in every Canadian province and territory. During the winter, Rusty Blackbirds can be found in forested wetlands throughout much of the eastern United States with particular concentrations in the Mississippi Alluvial Valley and southeastern Coastal Plain.

Rusty Blackbirds have exhibited a significant population decline in the past century. Data from the Christmas Bird Count suggest that between 1966 and 2003, the population declined by approximately 85%, but a review of historical accounts indicates the population was declining even prior to this time period. Range contractions along the southern edge of its breeding range have also been documented. The species is listed as Special Concern on Schedule 1 of the federal *Species at Risk Act* (SARA).

The conversion of wetlands in the winter range and the migratory range (south of the boreal region), and blackbird control programs, are often cited as the most significant threats contributing to past Rusty Blackbird population declines, but research is highlighting other threats for the present and future population. These include conversion of boreal wooded wetlands in the breeding and migratory range, forest clearing, anthropogenic changes to surface hydrology, pollution in the form of mercury contamination, wetland acidification, and agricultural pesticides, climate change and drying of wetlands, and the altered predator and competitor species compositions, as well as disease and parasites.

The management objective for Rusty Blackbird is two-fold. First to stop the decline, and then maintain the population at its 2014 level, and second to increase the population, resulting in a 10-year sustained increase in the population of Rusty Blackbird in Canada. Four broad strategies have been identified to achieve the objective:

1) Address key knowledge gaps regarding Rusty Blackbird population sizes, trends, distributions, reproductive success, and habitat requirements throughout Canada.
2) Identify and better understand threats to Rusty Blackbird throughout its breeding, wintering, and migration ranges.
3) Stewardship and threat mitigation for Rusty Blackbird.
4) Encourage and carry out collaborations pertaining to management and conservation-related activities throughout Rusty Blackbird's range.

This management plan also proposes specific conservation measures, guided by these broad strategies, to achieve the management objective.

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1. COSEWIC[3] SPECIES ASSESSMENT INFORMATION

Date of Assessment: April 2006

Common Name (population): Rusty Blackbird

Scientific Name: *Euphagus carolinus*

COSEWIC Status: Special Concern

Reason for Designation: More than 70% of the breeding range of the species is in Canada's boreal forest. The species has experienced a severe decline that appears to be ongoing, albeit at a slower rate. There is no evidence to suggest that this trend will be reversed. Known threats occur primarily on the winter range, and include habitat conversion and blackbird control programs in the United States.

Canadian Occurrence: Prince Edward Island, Nova Scotia, New Brunswick, Newfoundland and Labrador, Québec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, Yukon, Northwest Territories and Nunavut

COSEWIC Status History: Designated Special Concern in April 2006.

2. SPECIES STATUS INFORMATION

Approximately 86% of the global population of Rusty Blackbird (*Euphagus carolinus*) breeds in Canada (Partners in Flight Science Committee 2013). The species was listed on Schedule 1 of the *Species at Risk Act* (SARA) as Special Concern in March 2009. Newfoundland and Labrador lists Rusty Blackbird as Vulnerable under the *Newfoundland and Labrador Endangered Species Act*. In New Brunswick, it is listed as a Species of Special Concern under New Brunswick's *Species at Risk Act*. In Nova Scotia, it is listed as Endangered under Nova Scotia's *Endangered Species Act*. In Quebec, it is listed as "Susceptible to be listed as Vulnerable or Threatened" (*Act Respecting Vulnerable or Threatened Species*). The species is currently not listed by any other provinces and territories. Although Rusty Blackbird is technically a migratory bird, it is not protected under Canada's *Migratory Bird Convention Act*.

Rusty Blackbird is assessed as Vulnerable on the International Union for Conservation of Nature Red List. Table 1 shows the Nature Serve (2014) conservation ranks throughout its Canadian range.

[3] COSEWIC – Committee on the Status of Endangered Wildlife in Canada

Table 1. Nature Serve conservation status ranks for Rusty Blackbird (NatureServe 2014).

	Global Rank (G)	National Rank (N)	Sub-national Rank (S)
Nature Serve Ranks	G4 (apparently secure)	Canada: N4B (apparently secure, breeding) United States: N5B, N5N	Canada: S2B: Prince Edward Island S2S3B: Nova Scotia S3B: Yukon Territory, Northwest Territories, New Brunswick, Newfoundland Island S3S4: Quebec S3S4B: British Columbia, Manitoba, Labrador S4: Alberta S4B: Saskatchewan, Ontario SNRB:Nunavut

*1: Critically Imperiled; 2: Imperiled; 3: Vulnerable; 4: Apparently Secure; 5: Secure; SNR: Unranked; B: Breeding; N: Non-breeding

3. SPECIES INFORMATION

3.1. Species Description

Rusty Blackbird is a medium-sized passerine belonging to the family Icteridae. Both sexes have long, pointed wings, pale yellow eyes, black feet, and slightly curved black bills that are shorter than the head (COSEWIC 2006, Avery 2013). The adult male breeding plumage is black, however, a greenish gloss on the body and slight violet gloss on the head and neck can be observed at close range (COSEWIC 2006, Avery 2013). Male non-breeding plumage is rusty brown on the crown, nape, back, and tertial edges[4]. The cheek, chin, throat, breast, and sides have lighter brown edgings (COSEWIC 2006, Avery 2013). During the breeding season, the female is slate gray with a bluish-green gloss (Avery 2013). In the fall, the female has a light tan-coloured line above the eye and is generally rust coloured with a dark grey back, tail, and wings (COSEWIC 2006, Avery 2013).

3.2. Populations and Distribution

Rusty Blackbird is found in every province and territory in Canada, and breeds throughout the boreal forest region (COSEWIC 2006), and southward to the beginning of the deciduous forest and/or grasslands (Avery 2013) (Figure 1). Rusty Blackbird is most abundant in northern portions of the boreal forest; 91% of the entire population is thought to breed in the Taiga Shield and Hudson Plains (75%) and Northwestern Interior Forest (16%) Bird Conservation Regions (Partners in Flight Science Committee 2013, BAM 2014).

Wintering Rusty Blackbirds are found throughout much of the eastern United States and sporadically in the southern portions of many Canadian provinces (COSEWIC 2006,

[4] Tertial edges refer to edges of the inner most wing feathers closest to the bird's body.

Avery 2013) (Figure 1). Core wintering areas are thought to occur within the southeastern United States, particularly the Mississippi Alluvial Valley (west of Appalacians) and southeastern Coastal Plain (east of Appalachians) (Hamel and Ozdenerol 2008, Greenberg et al. 2011, Avery 2013). Within the eastern United States, counts of wintering birds tend to exhibit large year to year fluctuations (Hamel et al. 2009). Evidence suggests that Rusty Blackbirds may segregate by age and sex during the winter. Females and young birds may winter farther south than older males (DeLeon 2012), and foraging sites of males and older birds may have higher food availability and quality compared to foraging sites of females and young birds (Mettke-Hofmann et al. 2008, DeLeon 2012).

Stable isotope analysis and band return data suggest a migratory divide in birds wintering to the west and the east of the Appalachians; Rusty Blackbirds wintering in the Mississippi Alluvial Valley originated from a broad boreal region extending from Alaska to western Labrador, whereas birds wintering on the coastal plain originated from more eastern regions of the breeding range (Hamel et al. 2009, Hobson et al. 2010). These results imply that once the threats to the species are better understood, these groups may require different management efforts. Rusty Blackbirds form single species or mixed species flocks during migration (Avery 2013). Groups of a few dozen to several hundred individuals begin to form after the breeding season (late July) (COSEWIC 2006, Avery 2013). Based on eBird data, fall migration begins in August and September, but southward movement can continue into November and December, while the spring migration begins in March and is usually over before the end of May (eBird 2012). Rusty Blackbirds nesting in Alaska and equipped with geolocators exhibited a prolonged stopover period (mid October to late November) during the southward migration, with the Prairie Potholes region, from southern Saskatchewan to Iowa being a particularly important stopover region (Johnson et al. 2012). In Québec, data from the Observatoire d'oiseaux de Tadoussac (1996-2010) suggest important annual variations in Rusty Blackbird abundance and reproductive success in the eastern boreal forest. There, data suggest an ongoing decline in the number of Rusty Blackbirds recorded during the fall migration (Savard et al. 2011).

The extent of occurrence[5] in Canada is estimated to be 5.3 million km^2, but the area of occupancy[6] is unknown (COSEWIC 2006). There is evidence that Rusty Blackbird populations have been reduced along the southern margin of its breeding range (Greenberg et al. 2011, BSC 2012, McClure et al. 2012). Using North American Breeding Bird Survey (BBS) data, McClure et al. (2012) found the breeding range of Rusty Blackbird had retracted 143 km northward since 1966, and they hypothesized that this was linked to climate change. It is uncertain whether this pattern is part of an overall northward shift in the breeding range or a range contraction. Greenberg et al. (2011) noted that several previously occupied wetlands and lakes in western Manitoba and eastern Saskatchewan are no longer occupied and recent surveys of more than 900 small wetlands in Alberta, Saskatchewan, and Manitoba only observed 14 Rusty Blackbirds. In Algonquin Provincial Park (during Ontario's Breeding Bird Atlas), Rusty Blackbirds were

[5] The area included in a polygon without concave angles that encompasses the geographic distribution of all known populations of a wildlife species. (Source: http://www.cosewic.gc.ca/eng/sct2/sct2_6_e.cfm).
[6] The area within 'extent of occurrence' that is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that the extent of occurrence may contain unsuitable or unoccupied habitats. (Source:COSEWIC: http://www.cosewic.gc.ca/eng/sct2/sct2_6_e.cfm as adapted from IUCN 2010).

found in only 25 of 115 (21.7%) 10 x 10 km survey squares from 2001 to 2005, compared to 42 (36.5%) survey squares 20 years prior (Cadman et al. 2007).

Based on Christmas Bird Count data[7], the Rusty Blackbird wintering population declined by approximately 85.0% between 1966 and 2003, with an annual decline rate of 5.1% (Niven et al. 2004, COSEWIC 2006). The decline in the most recent period (1994 – 2003) was approximately 2.1% per year (COSEWIC 2006). Using BBS data[8], a survey-wide decline of approximately 5.7% per year between 1966 and 2009 was estimated (Sauer et al. 2011). More recent analysis of BBS data indicates a long-term annual decline of 6.3% between 1970 and 2012 in Canada (Environment Canada 2014). Both short-term and long-term declines are evident for Rusty Blackbird in all regions across Canada, but in general, declines are largest in southern and eastern regions (where estimated trends are also more reliable because of the sparsity of data in other regions) (Environment Canada 2014). Greenberg and Droege (1999) reviewed historical accounts of Rusty Blackbird and found the species had changed from noticeably abundant to uncommon before modern survey efforts began. Rusty Blackbird was described as very common or abundant in 56% of the published accounts prior to 1920, but this declined to 19% between 1921 and 1950, then to 7% after 1950 (Greenberg and Droege 1999).

3.3. Needs of the Rusty Blackbird

Breeding

Rusty Blackbird breeds in boreal wetlands, but is generally absent from wetlands above the latitudinal tree line and uncommon in high mountainous wetlands[9]. Rusty Blackbird has been observed in many riparian habitats including (but not limited to) wetlands associated with recent burns, peat bogs, riparian scrub, open moss- and lichen-spruce woodlands, sedge meadows, marshes, alder and willow thickets, and estuaries (COSEWIC 2006). Rusty Blackbirds tend to select breeding sites with a combination of freshwater bodies with shallow water and emergent vegetation for foraging that are adjacent to wetlands with conifers or tall shrubs with cover for nesting (Matsuoka et al. 2010a, Matsuoka et al. 2010b, Greenberg et al. 2011). Recent research of Rusty Blackbirds in northern New England found that wetland occupancy was associated with the presence of puddles (pools of shallow water devoid of fish), > 70% conifers in adjacent uplands, and evidence of beavers (Powell et al. 2014).

[7] The COSEWIC assessment of Rusty Blackbird gave most weight to the rates of decline derived from the Christmas Bird Count, because it covers the full wintering range of the species. It was nonetheless acknowledged that this method likely underestimates populations because of the occurrence of Rusty Blackbird in mixed flocks with similar species.

[8] BBS data may not be the optimal tool for tracking declines of Rusty Blackbird in Canada because the core of their habitat is north of the vast majority of BBS routes.

[9] Vagrant birds have been observed in the tundra of Nunavut, up to ~ 1,000 km north of the tree line (eBird 2012).

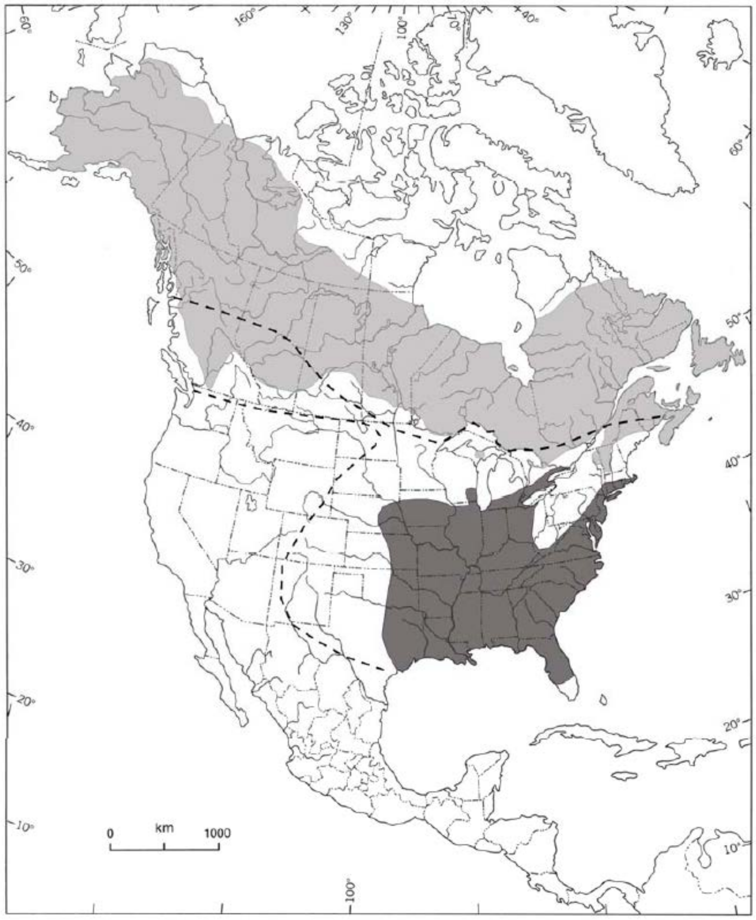

Figure 1. Global range of Rusty Blackbird, showing both the breeding (light grey) and wintering ranges (dark grey). Rusty Blackbird also winters irregularly within the dotted line (from COSEWIC 2006).

Throughout its range (with the exception of interior Alaska, where the species mainly nests in willows), Rusty Blackbird primarily nests in small conifers, specifically spruces (Matsuoka et al. 2010b, Avery 2013). In Canada, nests have also been found in Balsam Fir (*Abies balsamea*), Eastern White Cedar (*Thuja occidentalis*), Paper Birch (*Betula papyrifera*), Balsam Poplar (*Populus balsamifera*), Red Maple (*Acer rubrum*), Pin Cherry (*Prunus pensylvanica*), emergent sedges, cattails, and on the ground on a beaver dam (Matsuoka et al. 2010b).

Rusty Blackbirds nest in isolated pairs, as well as loose colonies that can reach densities of more than 8 territories / km^2 in some parts of its range (LaRue et al. 1995, COSEWIC 2006, Avery 2013). The average home range size of non-colonial individuals in Maine was estimated to be 14.6 ± 5.8 ha, whereas, individuals in loose colonies had home ranges approximately 3 times larger than non-colonial individuals (Powell et al. 2010a).

Non-breeding

During winter, most Rusty Blackbirds occur in forested wetlands. Recent research has shown that wintering Rusty Blackbirds may not be as specialized in their habitat use throughout the Mississippi Alluvial Valley as previously thought (Luscier et al. 2010). Luscier et al. (2010)

found that Rusty Blackbird occupancy could not be consistently predicted at a small scale using canopy cover, tree density, water cover, and / or habitat type (swamp forest, wet forest, moist forest, dry forest, and agriculture). Nevertheless, DeLeon (2012) found that wet ground cover and shallow water were important indicators of site occupancy, abundance, and persistence in Louisiana. In addition to forested wetlands, Rusty Blackbirds have been found in other habitats, such as pecan orchards, agricultural fields, scrub along the edge of open freshwater, swamps, pastures, sewage treatment ponds, and residential areas (COSEWIC 2006, Avery 2013, Newell 2013). Newell (2013) found that Rusty Blackbirds changed their habitat use (and diet) based on weather conditions. In general, pecan groves were used during relatively cold periods, wetlands were used after rain and as weather improved, and residential lawns were used when there was impending precipitation (Newell 2013).

During migration, Rusty Blackbirds have been found in flooded forests and swamps, scrub along the edges of lakes, rivers and streams and beaver ponds, as well as in pastures, plowed fields, and even sewage treatment ponds or roosting in open fields and wooded areas (COSEWIC 2006, Avery 2013).

Diet
Rusty Blackbird has a varied diet that includes aquatic invertebrates, such as insect larvae (particularly Odonata nymphs), snails, and crustaceans, as well as tadpoles, grasshoppers, beetles, and spiders (COSEWIC 2006, Avery 2013). In the winter and during migration, the diet of Rusty Blackbird also includes crushed pecans, a variety of crops, seeds, berries, fruit, acorns, earthworms, and small fish (Edmonds et al. 2010, Avery 2013, Newell 2013). They have also been documented feeding on sparrows, robins, snipe, and other bird species (Avery 2013).

4. THREATS

4.1. Threat Assessment

Table 2. Threat assessment for the Rusty Blackbird in North America.

Threat	Level of Concern[a]	Extent	Occurrence	Frequency	Severity[b]	Causal Certainty[c]
Habitat loss or degradation						
Conversion of wetlands on winter range and migratory range south of the boreal region	High	Widespread	Current/historic	Continuous	High	High
Forest clearing	Medium	Widespread	Current	Continuous	Unknown	Medium
Anthropogenic changes in surface hydrology	Medium	Widespread	Current	Continuous	Unknown	Medium
Conversion of boreal wooded wetlands in breeding and migratory range	Low	Widespread	Current	Continuous	Unknown	High

Threat	Level of Concern[a]	Extent	Occurrence	Frequency	Severity[b]	Causal Certainty[c]
Accidental mortality						
Blackbird control programs	Medium	Localized	Current/historic	Seasonal	Unknown	Medium
Pollution						
Mercury contamination	Medium	Widespread (in central and eastern Canada)	Current	Continuous	Unknown	Medium
Wetland acidification	Medium	Widespread (in central and eastern Canada)	Current	Continuous	Unknown	Medium
Agricultural pesticides	Medium	Widespread	Current	Continuous	Unknown	Medium
Climate and natural disasters						
Climate change and drying wetlands	Medium	Widespread	Current	Continuous	Unknown	Medium
Changes in ecological dynamics						
Altered predator and competitor species compositions	Low	Widespread	Current	Continuous	Unknown	Low
Natural processes or activities						
Disease and parasites	Low	Unknown	Unknown	Unknown	Unknown	Low

[a] *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the management of the species, consistent with the management objective. This criterion considers the assessment of all the information in the table.*
[b] *Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).*
[c] *Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g., expert opinion; Low: the threat is assumed or plausible).*

4.2. Description of Threats

Greenberg and Matsuoka (2010) state that there are many unknowns surrounding the reasons for the decline of Rusty Blackbird in North America. The COSEWIC status report (COSEWIC 2006), Greenberg and Droege (1999), and Greenberg et al. (2011) highlighted plausible threats, but there is still a need for continued research.

<u>Conversion of wetlands on winter range and migratory range south of the boreal region</u>
The conversion of forested wetlands in the southern United States is cited as the most significant factor contributing to past Rusty Blackbird population declines (Greenberg and Droege 1999, COSEWIC 2006). Since European settlement, forested wetlands in the United States have been

converted to agricultural lands and more recently wetlands have been converted to pine plantations or urban development (Hamel et al. 2009, Greenberg and Matsuoka 2010). Wetland losses from the 1780s to 1980s equate to approximately 57% in the Lower Mississippi Alluvial Valley and 36% in the South Atlantic Coastal Plain (Hamel et al. 2009). Portions of habitat that remain are often fragmented, potentially causing increased predation and competition for Rusty Blackbird from other Icterid species (Greenberg and Matsuoka 2010). Efforts to restore marginal agricultural lands to forested wetlands have successfully recruited wintering Rusty Blackbirds (Hamel et al. 2009).

<u>Forest clearing</u>
Forest clearing includes all activities that involve cutting down trees on a medium to large scale. More than 60% of the commercially viable southern boreal forest has been allocated to timber companies and annual forest clearing rates in the boreal plains ecozone range from 0.8% to 1.7% (Hobson et al. 2002). Harvest rates in Canada are highest in Quebec, British Columbia, and Ontario and have been relatively stable in Canada since the 1980s (Masek et al. 2011). Between 2000 and 2012, approximately 11,041,217 ha of forest were harvested throughout Canada (NFD 2014). In New England, breeding Rusty Blackbirds often select young, second growth forests for nesting (Buckley 2013, Powell et al. 2014). Logging was identified as a threat to Rusty Blackbird nest survival by Powell et al. (2010b), however the extent of this threat is still not clear. Nests in stands with no recent harvests were more than twice as likely to fledge young when compared to nests in stands that had been logged within the past 20 years, resulting from increased predation in recently logged areas (Powell et al. 2010b). In contrast, a study of Rusty Blackbird nest success in Maine and New Hampshire found no difference in success between nests in harvested areas compared to nests in non-harvested areas (Buckley 2013).

Since Rusty Blackbirds are associated with forested wetlands throughout their wintering range, forest clearing can affect wintering habitat availability. However, Twedt and Wilson (2007) found that use of closed-canopy, second-growth bottomland forests by wintering Rusty Blackbirds was enhanced by silvicultural thinning.

<u>Anthropogenic changes in surface hydrology</u>
Rusty Blackbird could be sensitive to changes in surface hydrology (Greenberg et al. 2011), and thus activities that result in wetland drainage, changes in water level fluctuations, water diversions and control, and displacement of underground waters could be impacting Rusty Blackbird. Activities on both the wintering grounds (e.g., control of water levels in forested impoundments) and the breeding and migratory grounds (e.g., oil sands development, hydroelectric projects) could be changing the normal surface hydrology of Rusty Blackbird habitat. Currently, there is no research to determine the effects of surface water conditions on Rusty Blackbird survival or success; at this time the suggestion that changes in surface hydrology is a threat is based on the natural history of the species (i.e., their propensity toward wet habitats, particularly for foraging) (Greenberg et al. 2011).

<u>Conversion of boreal wooded wetlands in breeding and migratory range</u>
Boreal wooded wetlands have been lost to a variety of activities including agricultural development, peat production, oil and gas activities, and flooding of reservoirs (Greenberg and Droege 1999, Greenberg and Matsuoka 2010, Greenberg et al. 2011). For example, over

1 million ha of forest have been flooded in central Quebec (Greenberg et al. 2011); 73% of the boreal transition zone in Saskatchewan has been converted to agriculture since European settlement (Hobson et al. 2002), and as of 2003, oil and gas exploration and extraction had directly impacted 8% of the boreal forest biome (Greenberg et al. 2011). Expansion of roads and other infrastructure development into boreal areas may also be degrading habitat, and allowing for the expansion of other competing Icterid species, as well as crows. Buckley (2013) found that nest survival was lower for nests placed near roads in New England, indicating that roads may also concentrate predator activity. Overall, the amount of Rusty Blackbird habitat altered due to habitat conversion in Canada is estimated to be 5% and it is predicted that another 4% will be converted within 50 years (COSEWIC 2006). This threat is likely having the greatest impact in the southern portion of the boreal forest where conversion of boreal wetlands is more prevalent (Pasher et al. 2013).

Blackbird control programs

It is estimated that over 117,000 Rusty Blackbirds were killed by Compound PA-14 Avian Stressing Agent treatments in Kentucky, Tennessee, and Alabama between 1974 and 1992 (Dolbeer et al. 1995) whose purpose was specific to lethal control of winter roosting blackbird (Icterinae) and European Starling (*Sturnus vulgaris*) populations (Heisterberg et al. 1987). The use of PA-14 was discontinued in 1992 (Dolbeer et al. 1995), and in 2011, the United States removed Rusty Blackbird from the US Fish and Wildlife Service Depredation Order for Blackbirds, Cowbirds, Grackles, Crows, and Magpies, thereby reducing the risk of control programs to Rusty Blackbirds (Federal Register 2010, NLWD 2011). Other forms of pest control, such as the use of poison bait to control blackbirds foraging in cattle feedlots, may affect Rusty Blackbirds in migration and on wintering grounds. Rusty Blackbirds tend to roost in mixed flocks with other blackbirds and may still be threatened by these activities. These small-scale programs could potentially have long-term, cumulative effects on Rusty Blackbird populations (Greenberg and Matsuoka 2010), but to date, blackbird control programs have not been directly linked to an impact on Rusty Blackbird populations.

Mercury contamination

Mercury exposure can decrease reproductive success, alter immune responsiveness, and cause behavioural and physiological effects in birds (Scheuhammer et al. 2007). In some parts of its range, Rusty Blackbird may be exposed to elevated methylmercury (MeHg) concentrations in its diet, due to its consumption of predatory insects which contain mercury, and its tendency to forage in acidic wetlands where mercury is easily converted to its toxic form (methylmercury, MeHg) (Greenberg and Matsuoka 2010, Edmonds et al. 2012). Some evidence suggests that blackbirds may be more sensitive to MeHg exposure than other bird groups, such as waterbirds (Heinz et al. 2009, Edmonds et al. 2010). A recent large-scale study of mercury in Rusty Blackbirds emphasized the potential threat of mercury in the Maritimes and New England (Edmonds et al. 2010). The feathers of Rusty Blackbirds breeding in the Acadian forest ecoregion of New England and the Maritimes (Maine, New Hampshire, Vermont, New Brunswick, and Nova Scotia) had mercury concentrations that were 3 to 7 times higher than concentrations observed in the winter regions in the southern US and breeding sites in Alaska (Edmonds et al. 2010).

Long-range atmospheric transport and deposition of mercury is a major source to many aquatic habitats in Canada (Fitzgerald et al. 1998). Bio-available mercury is also mobilized within watersheds by forestry activities, hydroelectric reservoir creation, and various industrial-related activities (Wiener et al. 2003). The increases in MeHg concentrations in forest cleared areas appears to be correlated with the extent of soil disturbance in the area (Porvari et al. 2003).

National sampling of mercury levels in Yellow Perch (*Perca flavescens*) found high mercury exposure in freshwater food webs extended throughout Ontario, Quebec, the Maritimes, and Newfoundland and Labrador (Depew et al. 2013), which conforms with the high levels of mercury observed in Rusty Blackbirds in the Maritimes and New England (Edmonds et al. 2010). This area of eastern Canada constitutes 63% of the Rusty Blackbird global population (Partners in Flight Science Committee 2013) and the areas of steepest population decline according to the BBS (Environment Canada 2014).

<u>Wetland acidification</u>

The eastern portion of the Rusty Blackbird's range has the potential to be most affected by wetland acidification (Schindler 1988, Greenberg and Droege 1999), but the extent to which wetland acidification may impact Rusty Blackbird remains unknown. Increases in acidity can cause changes to the general wetland ecology. Changes in invertebrate assemblages, with shifts away from high calcium-bearing species, were documented in southern New Brunswick (Parker et al. 1992), and acidic soils in The Netherlands were linked to declines in passerine productivity (Graveland et al. 1994). Greenberg and Droege (1999) hypothesized that acidification may cause loss of calcium and other minerals essential for eggshell and bone formation, and noted the high proportion of snails and mollusks in the diet of Rusty Blackbird.

Acidification can cause elevated levels of metals, such as aluminum, and acidic wetlands will also allow mercury to be easily converted to toxic MeHg, increasing the threat of mercury exposure. It is unknown if (or how) the elevated levels of metals affect Rusty Blackbird.

Wetland acidification is usually caused by acid precipitation from industrial pollution, but the presence of acid sulphate soils and occasionally pasture creation can also lead to wetland acidification.

<u>Agricultural pesticides</u>

Mineau and Whiteside (2013) suggested that pesticides be strongly considered in efforts to identify the causes of bird population declines in North America, especially for those species that breed, winter, or migrate through agricultural areas. They were unable to separate between the direct (i.e., toxicity through ingestion of products such as coated seeds, inhalation, absorption through the skin, or by eating contaminated prey) and indirect (e.g., habitat or disruption to the food chain) effects of pesticides and they concluded that both are likely occurring (Mineau and Whiteside 2013). Although largely undocumented for this species, pesticide use has been implicated in direct mortality and habitat loss of many avian species (e.g., Chamberlain et al. 2000, Boatman et al. 2004, Mineau 2005).

Most organochlorine pesticides (chemicals in the same family as dichlorodiphenyltrichloroethane - DDT) have been banned for decades in North America.

Endosulfan, which is primarily used on a wide variety of food crops is an exception to the ban of organochlorine pesticides, but will be phased out of use in the United States by 2016 because it was deemed to pose an unacceptable risk to farmworkers and wildlife (birds, in general, are fairly sensitive to endosulfan poisoning) (U.S. Environmental Protection Agency 2010).

Organophosphorus/organophosphate and carbamate compounds have been used increasingly since the majority of organochlorine pesticides were restricted in North America in the 1970s and banned in the 1980s (Commission for Environmental Cooperation of North America 2003). Birds and other vertebrate species are susceptible if they ingest or otherwise absorb enough organophosphate or carbamate pesticides and birds appear to be more sensitive than other vertebrates (Freedman 1995, Friend and Franson 1999).

Neonicotinoid insecticides were introduced in the 1990s and although their rates of use are poorly known across Rusty Blackbird's range, nearly 11 million ha of cropland across the Canadian Prairies were estimated to be treated with neonicotinoids (Main et al. 2014). Neonicotinoids are generally used on agricultural lands, but have been detected in wetlands (Main et al. 2014) and waterways in Canada (Environment Canada 2011, Xing et al. 2013). The indirect impacts of neonicotinoids on Rusty Blackbirds are unknown. Mineau and Palmer (2013) suggested that the effects of neonicotinoids to birds may not be limited to the farm scale, but likely expand to the watershed or regional scale; therefore neonicotinoids could be impacting insect and bird species found outside of the arable lands. Neonicotinoids are adversely affecting insect populations and in 2013 the European Food Safety Authority declared that they posed "unacceptable" risk to insects (Goulson 2014). In the Netherlands, neonicotinoid concentrations in surface waters were correlated with the declines in farmland insectivorous birds (Hallmann et al. 2014). Hallmann et al. (2014) suggested these declines were likely caused by a reduction of insect prey as a result of insecticide use. The indirect effects of these insecticides have also been noted in Skylark (*Alauda arvensis*), Yellowhammer (*Emberiza citronella*), Whinchat (*Saxicola rubetra*), Reed Bunting (*Emberiza schoeniclus*), and Corn Bunting (*Miliaria calandra*) (Boatman et al. 2004, Gibbons et al. 2014).

Climate change and drying wetlands

Climate change may be causing a range retraction in Rusty Blackbird's southern range. McClure et al. (2012) found the probability of local extinction was highest in Rusty Blackbird's southern breeding range, and that Rusty Blackbird's breeding range boundary shifted northward by approximately 143 km since 1966. They attributed these results to climate change based on findings that Rusty Blackbird's mean breeding latitude was affected by annual weather patterns associated with the Pacific Decadal Oscillation (McClure et al. 2012). This is consistent with the findings of Stralberg et al. (*in press*), who found climate suitability in the southern portion of the breeding range to be low and projected a further decrease in suitability based on future climate change projections. Suitable climates for breeding are projected to move northward and decrease in their availability overtime leading to an 18% decline in potential abundance by 2040, a 37% decline by 2070, and 55% decline by 2100.

Climate change is also affecting the chemical, physical, and biological properties of lakes and other wetlands (Schindler et al. 1997, Winder and Schindler 2004). In particular, climate change is drying wetlands in the northern boreal forest, through permafrost melting and increased evapo-transpiration. This phenomenon is thought to be particularly prevalent in the western portion of Rusty Blackbird's range (Hobson et al. 2010, Greenberg et al. 2011, Price et al. 2013). Drying wetlands in Alaska (Klein et al. 2005) are already exhibiting pronounced changes in invertebrate abundances and plant communities (Corcoran et al. 2009), and McClure et al. (2012) hypothesized that climate change may also be shifting the emergence of invertebrates out of phase with breeding Rusty Blackbirds. To date, these changes in wetlands have not been shown to be directly linked to an impact on Rusty Blackbird individuals and/or populations, but surface area of lakes and ponds are the best predictors of Rusty Blackbird abundance in Alaska (Matsuoka et al. 2010a). Thus, wetland drying from climate change may reduce suitable breeding habitats (Matsuoka et al. 2010a).

Climate change may also result in more frequent and severe storms (IPCC 2007). It is possible these storms may flood nest sites and foraging areas of Rusty Blackbird; in addition, late spring snowstorms may cause breeding failure for this early-nesting species.

Altered predator and competitor species compositions

The expansion of more dominant species, such as Red-winged Blackbird (*Agelaius phoeniceus*) and Common Grackle (*Quiscalus quiscula*), into boreal wetlands is a potential threat to Rusty Blackbird. The areas of Ontario where Red-winged Blackbirds and Common Grackles are absent have the highest abundance of breeding Rusty Blackbirds (Cadman et al. 2007). The reason for this phenomenon is not yet clear, however, it can result from climate change, habitat conversion and fragmentation, and human encroachment which create habitats more favourable for habitat generalists such as Red-winged Blackbird and Common Grackle that are better able to take advantage of both upland and wetland sites than Rusty Blackbird (Yasukawa and Searcy 1995, Peer and Bollinger 1997). These species have been observed acting aggressively toward breeding Rusty Blackbirds, but it is unknown if they significantly influence Rusty Blackbird reproductive success.

Another study has indicated that correlations between the number of Rusty Blackbirds and vole (Arvicolinae) abundance, climate, and weather conditions suggest complex direct and indirect food web interactions (Savard et al. 2011). However, the actual mechanism remains uncertain, although a fluctuation in predator pressure is plausible (Savard et al. 2011).

Raptor populations have exhibited substantial increases since DDT bans were established throughout North America, possibly increasing recent predation pressures on Rusty Blackbird (Greenberg and Matsuoka 2010). Raptors known to prey upon Rusty Blackbird include Accipiters, falcons, and owls (Avery 2013). All documented mortalities of radio-marked Rusty Blackbirds wintering in South Carolina and Georgia were the result of Accipiter predation (Newell 2013).

Disease and parasites

Blood samples taken from Rusty Blackbirds in Maine, Vermont, New Hampshire, Nova Scotia and New Brunswick indicated prevalence of blood parasites in the range of previously published accounts, whereas blood parasite loads in Rusty Blackbirds on their wintering grounds had higher prevalence than expected (compared to past research on Rusty Blackbirds and other passerines) (Barnard 2012). Although the parasites identified in this study were not considered harmful to Rusty Blackbird survival, the high prevalence of parasites during winter, when parasite levels are usually reduced, suggests that Rusty Blackbirds may be stressed and/or have a compromised immune system on their wintering grounds (Barnard et al. 2010, Barnard 2012). A compromised immune system may lead to an increased threat of disease and infection of other parasites. Currently, the significance of disease and parasites in relation to population declines and recovery is unknown.

5. MANAGEMENT OBJECTIVE

The management objective for Rusty Blackbird is twofold. First to stop the decline, and then maintain the population at its 2014 level, and second to increase the population, resulting in a 10-year sustained increase in the population of Rusty Blackbird in Canada.

Given that the significance of many potential threats facing Rusty Blackbird is poorly understood, stopping the decline, and maintaining the Rusty Blackbird population at its 2014 level is an appropriate short-term objective for the next 10 years. As threats are identified and more thoroughly understood, and potential mitigation measures become more focused, the long-term objective will be to demonstrate a 10-year sustained increase in the population of Rusty Blackbird that is to be determined by analysis of population trend and other indices. Population indices will be inferred using a combination of available data sources, including Christmas Bird Counts, Breeding Bird Surveys, and Breeding Bird Atlases, and other methods should they become available. Due to the existing knowledge gaps, it is not feasible to address distribution objectives until more information is gathered.

6. BROAD STRATEGIES AND CONSERVATION MEASURES

6.1. Actions Already Completed or Currently Underway

Actions specific to monitoring and/or conserving Rusty Blackbird, that have been completed or are currently underway, include:

- Rusty Blackbird has been (and continues to be) monitored using various initiatives in Canada and throughout its range. Monitoring initiatives include the North American Breeding Bird Survey (BBS), Christmas Bird Count (CBC), Breeding Bird Atlases (BBA), migrating bird observatories, and nest record schemes.

- The International Rusty Blackbird Working Group (IRBWG), formed in 2005, has increased collaboration between partners throughout the Rusty Blackbird's range, helped identify potential threats to Rusty Blackbird, and developed a special section of the peer-reviewed journal *The Condor*, highlighting research findings (IRBWG 2014). The research initiatives of the IRBWG continue to provide information, including population trends, threats, and habitat requirements.

- A Rusty Blackbird migration banding program occurred in southern Yukon, 2005-2010, and included investigation of age determination methods (Mettke-Hofmann et al. 2010), feather samples for stable isotope analysis (connectivity studies), and colour-banding (P. Sinclair, pers. comm.).

- A Rusty Blackbird migration monitoring program in Tadoussac, Québec (1996-2013), used standardized visual counts to track yearly fluctuations in abundance and a banding program to track productivity (B. Drolet pers. comm.). This is an important source of data for Rusty Blackbird in Québec and suggests the existence of a 5-year cycle in the productivity of Rusty Blackbirds in the eastern boreal forest; a trend that could make this species more vulnerable.

- A retrospective study on Rusty Blackbird in the Mackenzie Valley of Northwest Territories highlighted that occurrences of Rusty Blackbird did not appear to significantly change in the Mackenzie Valley over a 33 year timeframe (early 1970s to 2006) (Machtans et al. 2007).

- A study of migratory connectivity using isotope analysis was conducted comparing birds from different parts of the wintering grounds to specimens from the breeding grounds (new feathers are grown on the breeding grounds); results showed a divide between eastern and western populations (Hobson et al. 2010).

- In 2011, the Government of Newfoundland and Labrador released a provincial Rusty Blackbird Management Plan that identified actions to help conserve Rusty Blackbird throughout Newfoundland and Labrador (NLWD 2011).

- Scientists in Environment Canada (Science and Technology Branch and Canadian Wildlife Service) are examining changes in Rusty Blackbird distribution in relation to mercury levels in the Maritimes and Ontario (N. Burgess, pers. comm. 2013).

- Researchers at Dalhousie University are developing a species distribution model and index of suitable habitat for Rusty Blackbird in southeastern Nova Scotia (A. Westwood, pers. comm.).

- The steering committee of the International Rusty Blackbird Working Group is drafting an International Conservation Strategy for Rusty Blackbird (P. Sinclair, pers. comm.).

- An International Rusty Blackbird Spring Migration Blitz was initiated in 2014 to identify important migration stopover sites (IRBWG 2014).

- Researchers with the Boreal Avian Modelling Project are forecasting changes in the distribution and abundance of Rusty Blackbird (and other boreal songbirds) relative to future projections of climate change across Canada and the Northwestern Interior Forest Bird Conservation Region (BAM 2014, Stralberg et al. *in press*).

- Rusty Blackbird is considered within provincial and federal environmental assessments, and as a result mitigation measures and monitoring initiatives are often put in place.

- Species at Risk information booklets have been released to help identify Rusty Blackbirds and all other species considered to be at risk, their typical habitat, potential threats, and their ranges in the Northwest Territories.

6.2. Broad Strategies

The broad strategies of this management plan are as follows:

1) Address key knowledge gaps regarding Rusty Blackbird population sizes, trends, distributions, reproductive success, and habitat requirements throughout Canada.
2) Identify and better understand threats to Rusty Blackbird throughout its breeding, wintering, and migration ranges.
3) Stewardship and threat mitigation for Rusty Blackbird.
4) Encourage and carry out collaborations pertaining to management and conservation-related activities throughout Rusty Blackbird's range.

6.3. Conservation Measures

The following implementation schedule is proposed to meet the broad strategies outlined in section 6.2.

Table 3. Conservation measures and implementation schedule

Conservation Measure	Priority	Threats or Concerns Addressed	Timeline
Broad Strategy: Address key knowledge gaps regarding Rusty Blackbird population sizes, trends, distributions, reproductive success, and habitat requirements throughout Canada.			
Determine, and track changes in, breeding and post-breeding distribution and habitat use throughout Canadian range	High	Knowledge gaps	2015-ongoing
Assess the quality of available population and abundance data across the breeding grounds, identify knowledge gaps, and enhance survey techniques and analysis where required.	High	Knowledge gaps	2015-2016
Encourage citizen-based reporting of Rusty Blackbirds within existing citizen science programs (e.g., eBird, Rusty Blackbird Migration Blitz, BBS, CBC, Backyard Bird Count, EPOQ)	High	Knowledge gaps	2015-2023
Determine fine-scale connectivity between breeding and wintering populations to define appropriate population units for management	High	Knowledge gaps	2015-2019
Compare demographic variables (i.e., survivorship, breeding success, and age distribution) between different breeding and wintering regions	High	Knowledge gaps	2016-2019
Develop habitat-use models for Rusty Blackbird's breeding grounds	Medium	Knowledge gaps	2018-2021
Determine if the breeding range is contracting or shifting north	Medium	Knowledge gaps	2018-2021

Conservation Measure	**Priority**	**Threats or Concerns Addressed**	**Timeline**
Broad Strategy: Identify and better understand threats to Rusty Blackbird throughout its breeding, wintering, and migration ranges.			
Investigate historical changes in distribution and abundance in Rusty Blackbird's breeding range (range-wide and regionally), in relation to land use change and habitat change, to better understand the causes of population declines	High	Conversion of wetlands (breeding range), forest clearing, anthropogenic changes in surface hydrology, wetland acidification, agricultural pesticides, climate change and drying wetlands, and knowledge gaps	2015-2018
Assess the role of mercury in population declines in eastern Canada	High	Mercury contamination and knowledge gaps	2015-2018
Further determine the impacts of habitat changes on abundance, survival, and reproductive success	High	Conversion of wetlands (breeding range), forest clearing, anthropogenic changes in surface hydrology, wetland acidification, agricultural pesticides, climate change and drying wetlands, and knowledge gaps	2016-2020
Investigate Rusty Blackbird use of human-altered habitats such as cattle feedlots, agricultural fields, and landfills during migration, to assess threats from blackbird control measures, agricultural pesticides, etc.	Medium	Blackbird control, agricultural pesticides, knowledge gaps	2016-2020
Determine the influence of competition from Red-winged Blackbird, Common Grackle, or other species on Rusty Blackbird habitat occupancy and/or breeding success	Medium	Altered predator and competitor species compositions and knowledge gaps	2017-2020
Examine the role of disease and parasites in the population decline	Low	Disease and parasites, and Knowledge gaps	2020-2023
Broad Strategy: Stewardship and threat mitigation for Rusty Blackbird			
Consider Rusty Blackbird requirements in management plans for public lands, environmental assessments, and land-use (forestry, mining, agriculture, etc) planning initiatives	High	Conversion of wetlands (breeding, migratory, and wintering range), forest clearing, anthropogenic changes in surface hydrology, mercury contamination, wetland acidification, agricultural pesticides, and altered predator and competitor species composition	Ongoing
Support enforcement of existing acts and regulations pertaining to threats impacting the Rusty Blackbird and its habitat, and encourage additional protection where necessary	High	Conversion of wetlands (breeding and migratory range) and forest clearing	2015-2017
Identify, encourage, and facilitate conservation of key sites (e.g., areas of high nesting abundance	High	Conversion of wetlands (breeding, migratory, and	2016-2023

Conservation Measure	Priority	Threats or Concerns Addressed	Timeline
and areas of high concentrations post-breeding or during migration) that are not currently conserved		wintering range), forest clearing, anthropogenic changes in surface hydrology, mercury contamination, wetland acidification, agricultural pesticides, climate change, and altered predator and competitor species composition	
Develop 'best practices' for Rusty Blackbird conservation	High	Conversion of wetlands (breeding, migratory, and wintering range), forest clearing, anthropogenic changes in surface hydrology, mercury contamination, wetland acidification, agricultural pesticides, climate change and drying wetlands, and altered predator and competitor species composition	2015-2023
Promote Rusty Blackbird conservation and management with landowners, forest managers, industry, conservation organizations, Aboriginal groups, and governments	Medium	Conversion of wetlands (breeding, migratory, and wintering range), forest clearing, anthropogenic changes in surface hydrology, mercury contamination, wetland acidification, agricultural pesticides, climate change and drying wetlands, and altered predator and competitor species composition	Ongoing
Participate in initiatives aimed at reducing climate change, mercury contamination, and wetland acidification	Medium	Anthropogenic changes in surface hydrology, mercury contamination, wetland acidification, climate change and drying wetlands	Ongoing
Broad Strategy: Encourage and carry out collaborations pertaining to management and conservation-related activities throughout Rusty Blackbird's entire range.			
Ensure and increase active Canadian participation in the International Rusty Blackbird Working Group (IRBWG) and collaborate with other international partners where appropriate	High	All threats and knowledge gaps	Ongoing
Identify opportunities and conservation measures that can align and integrate with those identified in the forthcoming International Conservation Strategy for Rusty Blackbird	Medium	All threats and knowledge gaps	Ongoing

7. MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the management objectives.

- The short-term indicator of progress will be that the population is maintained at its 2014 level.
- The long term indicator of progress (i.e., > 10 year objective) is an increased population in comparison to its current level (2014).
    - Population level will be inferred using a standardized methodology and combination of available data sources, including Christmas Bird Counts, Breeding Bird Surveys, Breeding Bird Atlases, and any other appropriate program.

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PERSONAL COMMUNICATIONS

A. Westwood. 2013. Ph.D. Candidate, Department of Biology, Dalhousie University, Halifax, Nova Scotia.

B. Drolet. 2013. Biologist - Population assessment, Canadian Wildlife Service – Québec region. Environment Canada – Canadian Wildlife Service. QC-Region

N. Burgess. 2011. Wildlife Toxicologist, Environment Canada, Science and Technology Branch. 6 Bruce Street, Mount Pearl, Newfoundland, A1N 4T3.

P. Sinclair. 2011. Bird Conservation Biologist, Environment Canada – Canadian Wildlife Service. 91780 Alaska Highway, Whitehorse, Yukon, Y1A 5X7.

V. Carignan. 2012. Senior Species at Risk Recovery Biologist, Environment Canada – Canadian Wildlife Service. 105, McGill, 7th Floor, Montreal, Quebec, H2Y 2E7.

APPENDIX A: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[10]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or achievement of any of the Federal Sustainable Development Strategy's[11] (FSDS) goals and targets.

Conservation planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that plans may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the plan itself, but are also summarized below.

Activities that benefit Rusty Blackbird are likely to benefit a large suite of fauna naturally found throughout the boreal forest, particularly those associated with wetlands. Other avifauna breeding in boreal wetlands have exhibited high rates of decline, and it is expected that measures taken to alleviate threats pertaining to Rusty Blackbird will positively influence these species as well (Greenberg and Matsuoka 2010, Greenberg et al. 2011). These species include (but are not limited to) Horned Grebe (western population) (*Podiceps auritus*), White-winged Scoter (*Melanitta fusca),* Olive-sided Flycatcher (*Contopus cooperi*), Lesser Yellowlegs (*Tringa flavipes*), and Solitary Sandpiper (*T. solitaria*) (Greenberg and Matsuoka 2010, Greenberg et al. 2011). Although it is possible that this management plan may negatively influence other species (such as Red-winged Blackbird and Common Grackle), it is concluded that it is unlikely to produce significant negative effects, given the non-intrusive nature of the proposed actions and the abundant populations of potentially-affected species.

[10] http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[11] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1