

Recovery Strategy for the Horned Lark *strigata* subspecies (*Eremophila alpestris strigata*) with consideration for the Vesper Sparrow *affinis* subspecies (*Pooecetes gramineus affinis*) in Canada

Horned Lark *strigata* subspecies and Vesper Sparrow *affinis* subspecies



July 2007



About the *Species at Risk Act* Recovery Strategy Series

What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is “*to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity.*”

What is recovery?

In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of the species’ persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (www.sararegistry.gc.ca/the_act/default_e.cfm) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. Three to four years is allowed for those species that were automatically listed when SARA came into force.

What’s next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the SARA Public Registry (www.sararegistry.gc.ca/) and the Web site of the Recovery Secretariat (www.speciesatrisk.gc.ca/recovery/default_e.cfm).

**Recovery Strategy for the Horned Lark *strigata* subspecies
(*Eremophila alpestris strigata*) with consideration for the Vesper
Sparrow *affinis* subspecies (*Pooecetes gramineus affinis*) in Canada
[Proposed]**

July 2007

Recommended citation:

Environment Canada. 2007. Recovery Strategy for the Horned Lark *strigata* subspecies (*Eremophila alpestris strigata*) with consideration for the Vesper Sparrow *affinis* subspecies (*Pooecetes gramineus affinis*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vii + 30 pp.

Additional copies:

Additional copies can be downloaded from the SARA Public Registry (www.sararegistry.gc.ca/)

Cover illustration: Horned Lark *strigata*: Randall Moore

Également disponible en français sous le titre
« Programme de rétablissement de l'Alouette hausse-col de la sous-espèce *strigata* (*Eremophila alpestris strigata*) considérant aussi le Bruant vespéral de la sous-espèce *affinis* (*Pooecetes gramineus affinis*) au Canada [Proposition] »

© Her Majesty the Queen in Right of Canada, represented by the Minister of the Environment, 2007. All rights reserved.

ISBN *To come*

Cat. no. *To come*

Content (excluding the illustrations) may be used without permission, with appropriate credit to the source.

DECLARATION

This recovery strategy has been prepared in cooperation with the jurisdictions responsible for the Horned Lark *strigata* and the Vesper Sparrow *affinis*. Environment Canada has reviewed and accepts this document as its recovery strategy for the Horned Lark *strigata*, as required under the *Species at Risk Act*. This strategy will also benefit the Vesper Sparrow *affinis*. This recovery strategy also constitutes advice to other jurisdictions and organizations that may be involved in recovering the species.

The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives.

This recovery strategy will be the basis for one or more action plans that will provide details on specific recovery measures to be taken to support conservation and recovery of the species. The Minister of the Environment will report on progress within five years.

Success in the recovery 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 strategy and will not be achieved by Environment Canada or any other jurisdiction alone. In the spirit of the Accord for the Protection of Species at Risk, the Minister of the Environment invites all responsible jurisdictions and Canadians to join Environment Canada in supporting and implementing this strategy for the benefit of the Horned Lark *strigata* and the Vesper Sparrow *affinis*, and Canadian society as a whole.

RESPONSIBLE JURISDICTIONS

Environment Canada – Pacific and Yukon Region
Government of British Columbia
Parks Canada Agency

AUTHORS

Suzanne Beaudesne – Western Wildlife Research
John Cooper – Manning Cooper and Associates
Kevin Fort – Canadian Wildlife Service

ACKNOWLEDGMENTS

The authors would like to thank the members of the Garry Oak Ecosystems Recovery Team's Vertebrates at Risk Recovery Implementation Group for their ongoing work with respect to the conservation of the Horned Lark *strigata* and Vesper Sparrow *affinis*. We would also like to thank all the members of the Horned Lark *strigata* and Vesper Sparrow *affinis* Recovery Team for the invaluable contribution of their time and individual expertise. The Recovery Team also benefited immeasurably from the expertise of Recovery Team advisors Scott Pearson and Bob

Altman. These two individuals have generously shared information from their research on these species in Washington and Oregon and have actively participated in team meetings and provided extensive reviews of earlier drafts of this document. We would also like to thank past and present managers of the Nanaimo Airport for granting access to the site and for their cooperation and assistance with vegetation management issues. Kevin Fort would also like to thank Lucy Reiss for providing constant guidance and insights on format, content, and SARA compliance policy through numerous drafts of this document.

STRATEGIC ENVIRONMENTAL ASSESSMENT

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*. 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.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies 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 on non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of the Horned Lark *strigata* and Vesper Sparrow *affinis*. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: Habitat and biological needs; Effects on other species; and Recommended approach for recovery implementation.

RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* [Subsection 2(1)].

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SARA public registry: www.sararegistry.gc.ca/plans/residence_e.cfm

PREFACE

The Horned Lark *strigata* and the Vesper Sparrow *affinis* are migratory birds listed under the *Migratory Birds Convention Act, 1994* and are under the management jurisdiction of the federal government. The *Species at Risk Act* (SARA, Section 37) requires the competent minister to prepare recovery strategies for listed extirpated, endangered, or threatened species. The Horned Lark *strigata* was listed as Endangered under SARA in 2005. The Vesper Sparrow *affinis* was assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in April 2006 and is currently under consideration for listing on SARA Schedule 1 as Endangered. The Canadian Wildlife Service – Pacific and Yukon Region, Environment Canada, led the development of this recovery strategy in close cooperation with the Garry Oak Ecosystems Recovery Team’s Vertebrates at Risk Recovery Implementation Group.

The recovery strategy was developed in cooperation or consultation with:

- Government of British Columbia
- Federal government – Canadian Wildlife Service (National Capital Region, Pacific and Yukon Region); Parks Canada Agency
- Conservation organizations – Nanaimo Area Land Trust, American Bird Conservancy, Garry Oak Ecosystems Recovery Team
- Industry stakeholders – Vancouver Airport Authority, Nanaimo Airport
- State of Washington (Department of Fish and Wildlife) via representation on the Horned Lark *strigata* and Vesper Sparrow *affinis* Recovery Team (advisors to the team).

This document was prepared in consultation with the authors of the State of Washington Range-wide Streaked Horned Lark (*Eremophila alpestris strigata*) Assessment and Preliminary Conservation Strategy (2005), as well as those of the Recovery Strategy for Multi-Species at Risk in Maritime Meadows associated with Garry Oak Ecosystems in Canada (2006), to ensure no management conflicts.

Should the Vesper Sparrow *affinis* be added to Schedule 1 of the *Species at Risk Act* an updated recovery strategy for the Horned Lark *strigata* and the Vesper Sparrow *affinis*, or an addendum to this strategy, will be posted according to the timeline associated with the Vesper Sparrow *affinis*.

Should the Vesper Sparrow *affinis* not be added to Schedule 1 of the *Species at Risk Act*, the taxon will continue to be managed in accordance with the *Migratory Birds Convention Act, 1994* and this recovery strategy document will continue to provide guidance on how the species could be managed. In addition, recovery activities directed at the Horned Lark will consider the Vesper Sparrow *affinis* where management actions may affect both species or their habitat.

EXECUTIVE SUMMARY

This recovery strategy outlines a multi-species approach for the Horned Lark *strigata* and Vesper Sparrow *affinis*. It was recognized that there is considerable overlap between these species with respect to current and historical distribution in Canada, general ecological requirements, and principal threats to the species and their habitat. In addition, many of the professional biologists involved have extensive knowledge of both species. Adopting a multi-species approach to recovery planning also represents an opportunity to make efficient use of conservation resources. Current and historical populations of both species are patchily distributed and, together with isolated populations in the United States, each comprises a single metapopulation in the Pacific Northwest. Thus, recovery of Canadian populations will contribute significantly to the global recovery of the two subspecies.

Horned Lark *strigata*

The Horned Lark *strigata* (*Eremophila alpestris strigata*) was designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2003.

The Horned Lark *strigata* is a subspecies of the Horned Lark, a small tan and yellow passerine with a black facial mask and ear tufts or “horns.” The Horned Lark *strigata* is an open habitat specialist, breeding in both dune and grassland habitats which have a high percentage of bare ground, short, sparse herbs or grasses, and few or no trees and shrubs. No individuals are currently known to occur or breed in Canada, but numerous confirmed historical breeding records exist. The historical distribution of the Horned Lark *strigata* in Canada is restricted to southwestern British Columbia, where it occurred only on southeastern Vancouver Island and in the lower Fraser River valley from Chilliwack west to the mouth of the Fraser River.

No critical habitat can be identified for the Horned Lark *strigata* at this time, as it is not known whether sites with suitable habitat remain. The persistence of this species in Canada is threatened primarily by loss or degradation of habitat due to urban and industrial development, increased disturbance at remaining suitable or restorable sites, modern agricultural practices, and infilling of most remaining open spaces by exotic vegetation. In addition, lark dune habitat has been lost due to improved dyking techniques in the Fraser River delta.

The recovery goal for this species is to re-establish a breeding population of at least 10 breeding pairs at a minimum of three sites within its historical breeding range in Canada. Recovery objectives include identification and assessment of suitable and restorable sites, securement and protection of candidate sites, and determination of the feasibility of habitat creation and reintroduction methods. These initiatives should be implemented in cooperation with the Garry Oak Ecosystems Recovery Team Vertebrates at Risk Recovery Implementation Group where appropriate or in partnership with recovery efforts for other listed species that use coastal open habitats.

Vesper Sparrow *affinis*

The Vesper Sparrow *affinis* was assessed as Endangered by COSEWIC in April 2006. It is currently under consideration for listing on Schedule 1 of SARA.

The Vesper Sparrow *affinis* is a subspecies of the Vesper Sparrow, a large sparrow with a whitish eye ring, a chestnut shoulder patch, and white outer tail feathers. Like the Horned Lark *strigata*, the Vesper Sparrow *affinis* is a bird of open habitats, favouring areas with a high percentage of bare ground and short, sparse herbs or grasses. In contrast, however, it selects open habitats with scattered trees or shrubs, which it uses for singing perches and escape cover. In Canada, the Vesper Sparrow *affinis* currently breeds only on Vancouver Island at a single location. Historically, it has been reported during the breeding season on Vancouver Island from the Englishman River estuary in the north to Cobble Meadows and Mill Bay to the south. It was also formerly a local breeder in the Fraser Lowland on British Columbia's southwest mainland coast.

Because the species is not listed on Schedule 1 of the *Species at Risk Act*, no critical habitat can be identified at this time. Like the Horned Lark *strigata*, the persistence of this species in Canada is threatened primarily by loss or degradation of habitat due to urban and industrial development, increased disturbance at remaining sites, modern agricultural practices, and infilling of most remaining open spaces by exotic vegetation. In addition, future development at the Nanaimo airport may pose a threat to the persistence of the species in Canada, depending on the specific nature and on-site location of the development. Furthermore, conservation actions at the Nanaimo Airport site, such as habitat modification or enhancement, must be compliant with Transport Canada regulations. Public safety considerations clearly supersede those governing species at risk where the two are in conflict.

The goal for this species is to re-establish a breeding population of at least 30 breeding pairs at a minimum of at least three sites within its historical breeding range in Canada. Objectives include identification and assessment of suitable and restorable sites, augmentation of the population at the existing site, protection of candidate sites, and determination of the feasibility of habitat creation and reintroduction methods. These initiatives should be implemented in cooperation with the Garry Oak Ecosystems Recovery Team Vertebrates at Risk Recovery Implementation Group where appropriate or in partnership with recovery efforts for other listed species that use coastal open habitats.

TABLE OF CONTENTS

DECLARATION	i
RESPONSIBLE JURISDICTIONS	i
AUTHORS	i
ACKNOWLEDGMENTS	i
STRATEGIC ENVIRONMENTAL ASSESSMENT	ii
RESIDENCE	ii
PREFACE	iii
EXECUTIVE SUMMARY	iv
1. BACKGROUND	1
1.1 Species Assessment Information from COSEWIC	1
1.2 Description	2
1.3 Populations and Distribution	2
1.4 Habitat and Biological Needs of the Horned Lark <i>strigata</i> and Vesper Sparrow <i>affinis</i>	6
1.5 Threats to the Horned Lark <i>strigata</i> and Vesper Sparrow <i>affinis</i>	8
1.5.1 Habitat Loss and Degradation	8
1.5.2 Changes in Ecological Dynamics or Natural Process	10
1.5.3 Disturbance	11
1.5.4 Accidental Mortality	12
1.6 Actions Already Completed or Under Way	13
1.7 Knowledge Gaps	14
2. RECOVERY	15
2.1 Rationale for Recovery Feasibility	15
2.2 Recovery Goals	15
2.3 Recovery Objectives	16
2.4 Approaches Recommended to Meet Recovery Objectives	17
2.4.1 Broad strategies to effect recovery	17
2.4.2 Narrative to support Recovery Planning Table	19
2.5 PERFORMANCE MEASURES	19
2.6 CRITICAL HABITAT	20
2.6.1 Identification of critical habitat	20
2.6.2 Schedule of studies for the identification of critical habitat	21
2.7 Existing and Recommended Approaches to Habitat Protection	21
2.8 Effects on Other Species	22
2.9 Recommended Approach for Recovery Implementation	23
2.9.1 Statement of when one or more action plans in relation to the recovery strategy will be completed	24
3. REFERENCES	25
4. RECOVERY TEAM MEMBERS	30

LIST OF TABLES

Table 1: Recovery planning table for the Horned Lark *strigata*..... 17
Table 2: Recovery planning table for the Vesper Sparrow *affinis*..... 18
Table 3. Evaluation of success of recovery efforts 19

LIST OF FIGURES

Figure 1: Current and historic Horned Lark *strigata* breeding localities and possible historic nesting or uncertain breeding season locations..... 3
Figure 2: Breeding range of the Vesper Sparrow *affinis* 5

1. BACKGROUND

This recovery strategy outlines a multi-species approach for the Horned Lark *strigata* and Vesper Sparrow *affinis*. It was recognized that there is considerable overlap between these species with respect to current and historical distribution in Canada, general ecological requirements, principal threats to the species and their habitat, and biological expertise. Adopting a multi-species approach to recovery planning also represents an opportunity to make efficient use of conservation resources.

1.1 Species Assessment Information from COSEWIC

Date of Assessment: November 2003

Common Name: Horned Lark *strigata*

Scientific Name: *Eremophila alpestris strigata*

COSEWIC Status: Endangered

Reason for Designation: Although this subspecies has always been rare in Canada, it has declined steadily throughout its range over the last 50 years and is now nearly extirpated from Canada.

Canadian Occurrence: British Columbia

COSEWIC Status History: Designated Endangered in November 2003. Assessment based on a new status report.

Date of Assessment: April 2006

Common Name: Vesper Sparrow *affinis*

Scientific Name: *Pooecetes gramineus affinis*

COSEWIC Status: Endangered

Reason for Designation: This songbird, a subspecies of the Vesper Sparrow, is found in Canada only in coastal grasslands in the extreme southwestern corner of British Columbia, where it now breeds only at one site with a population of about 5 pairs. The taxon is declining in the United States as well, where it has a restricted distribution in western Washington and Oregon. Habitat loss is the greatest threat, both through direct destruction of habitat for urban development and through invasion by alien plant species.

Canadian Occurrence: British Columbia

COSEWIC Status History: Designated Endangered in April 2006. Assessment based on a new status report.

1.2 Description

Horned Lark *strigata*

The Horned Lark (*Eremophila alpestris*) is the only true North American member of the lark family (Alaudidae). It is a slender ground-dwelling passerine of open country. The adult male is distinctively marked with a dark facial mask and breast band that contrasts with the pale face and throat. The “horns” for which the species is named are tiny, black feather tufts that are apparent only at close range. The tail is square and blackish with pale central feathers and whitish edges that are evident in flight. The Horned Lark *strigata* is smaller than the other subspecies. The upperparts are dark brown, and the nape is walnut brown. The bird has a yellow throat and eye stripe and yellowish underparts (Beason 1995). There is heavy brown streaking on the sides of the breast that should allow separation of males to subspecies in the field (Sibley 2000). In the hand, the longest uppertail covert is distinctly streaked (Pyle 1997). Adult females are similar to males, but they are duller and smaller and lack “horns.” Females cannot be separated to subspecies in the field. Juveniles of both sexes are generally duller than adult females (Sibley 2000).

Vesper Sparrow *affinis*

The Vesper Sparrow (*Pooecetes gramineus*) is a medium- to large-sized sparrow (length approximately 16 cm) with a chestnut shoulder patch (lesser coverts), white outer tail feathers, and a whitish eye ring (Sibley 2000). Sexes are similar in appearance. Juveniles are similar in appearance to adults, but duller, and they usually lack chestnut lesser coverts (Pyle 1997).

The three Canadian subspecies of Vesper Sparrow (*P. g. confinis*, *P. g. gramineus*, and *P. g. affinis*) are similar in appearance and cannot be reliably separated in the field, varying only in shading and measurements. The Vesper Sparrow *affinis* has medium greyish brown upperparts and white underparts with a buff tinge. Vesper Sparrow *confinis*, the common B.C. interior subspecies, has pale greyish brown upperparts and creamy underparts. Vesper Sparrow *affinis* is slightly smaller overall than *confinis* and has a shorter tail (Pyle 1997).

1.3 Populations and Distribution

Current and historical populations of both taxa in Canada, together with those in the United States, likely comprise a single metapopulation.

Horned Lark *strigata*

Horned Larks are found across much of North America and Eurasia. The breeding distribution of the Horned Lark *strigata*, however, is restricted to the Georgia Basin/Puget Trough, the coast of Washington, and islands in the lower Columbia River (Beason 1995; Rogers 2000; Pearson and Altman 2005; Stinson 2005) (see Figure 1). The centre of its breeding distribution is the glacial outwash prairies of the south Puget Sound area of western Washington (Rogers 2000). The Canadian population is extremely small, and may be extirpated: the last observation of a Horned

Lark in Canada was made in 2002 (COSEWIC 2003). U.S. researchers have estimated that the Washington and Oregon population is likely fewer than 1000 individuals (an estimated 774 individuals, based on recent breeding and winter surveys; Pearson and Altman 2005).

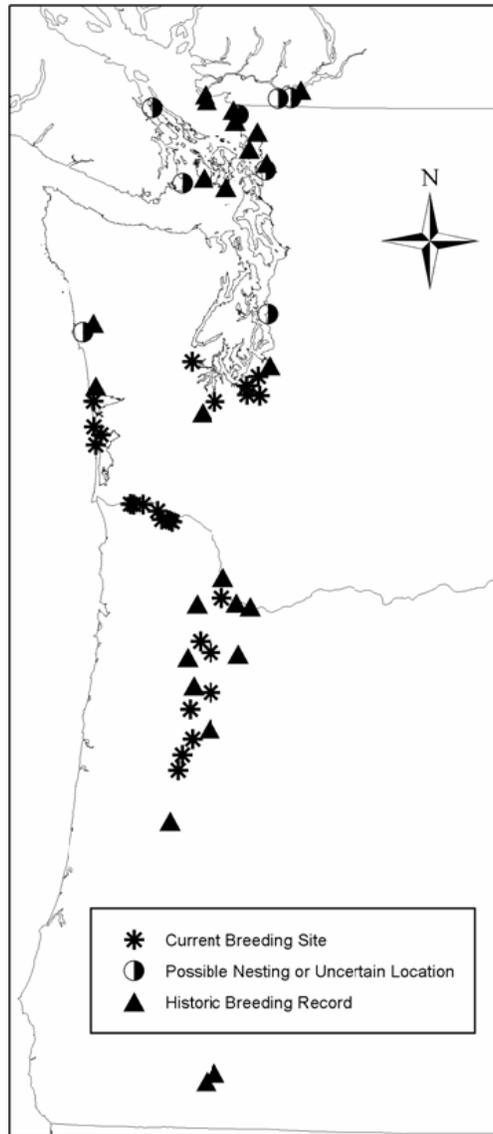


Figure 1. Current and historic Horned Lark *strigata* breeding localities and possible historic nesting or uncertain breeding season locations (information from Altman 1999; Rogers 2000; Pearson and Hopey 2005; Stinson 2005). All current breeding sites are in Washington and Oregon states.

The distribution of the Horned Lark *strigata* in Canada is restricted to southwestern British Columbia, where it historically occurred only on southeastern Vancouver Island and in the lower Fraser River valley from Chilliwack west to the mouth of the Fraser River (Campbell et al. 1997). Breeding has not been documented on Vancouver Island or the southern Gulf Islands.

However, it is possible that this subspecies did breed at these locations in the past, as some suitable habitat would have been available and birds were known to occur in the area (Munro and Cowan 1947; Beaudouin 2003; COSEWIC 2003). Central eastern Vancouver Island probably represents the northern limit of suitable habitat and range of this subspecies. Although most historical records for the Horned Lark *strigata* on Vancouver Island are not from the peak breeding season, it seems likely that these sightings were of breeding birds, occurring as they did in presumed nesting habitat. The Horned Lark *strigata* is known to have bred in the lower Fraser River valley. Breeding records are concentrated near the mouth of the Fraser River on Sea Island, Iona Island, and Lulu Island. Other confirmed historical breeding localities include the University of British Columbia at Point Grey and near Chilliwack (Campbell et al. 1997). Historically, the Vancouver Island and lower Fraser River valley populations were likely very small and locally distributed. Given that these areas represent the northern extent of the geographic range of this taxon, it is also likely that not all apparently suitable habitats were utilized.

NatureServe (2006) ranks the Horned Lark *strigata* subspecies globally as an imperilled subspecies of a globally common species (G5T2); the subspecies is also ranked as nationally imperilled (N2) in the United States and as presumed extirpated (NX) in Canada. The NatureServe ranks for Washington and Oregon are critically imperilled (S1B) and imperilled (S2B), respectively (B refers to a breeding population). The British Columbia rank is presumed extirpated (SX). The B.C. Conservation Data Centre (2006) lists the Horned Lark *strigata* on the Red List.

Vesper Sparrow *affinis*

Vesper Sparrows are widespread in appropriate habitat across North America. The Vesper Sparrow *affinis* subspecies occurs in a disjunct population in the Pacific Northwest, separated from the interior populations (i.e., Vesper Sparrow *gramineus*, *confinis*, and *altus*) by the Cascade Mountain Range. This subspecies' breeding range extends from southeastern Vancouver Island and the lower Fraser River valley south through western Washington and Oregon to extreme northwestern California (Figure 2). The Vesper Sparrow *affinis* is the only subspecies found west of the Cascades (AOU 1957; Pyle 1997; Cannings 1998; Rogers 2000; Campbell et al. 2001; Jones and Cornely 2002; Altman 2003). In Canada, the population on southeastern Vancouver Island is estimated to number between 6 and 10 pairs (Beaudouin 2006).



Figure 2. Breeding range of the Vesper Sparrow *affinis*, shown in light green; Nanaimo airport site shown as red dot. The interior subspecies of the Vesper Sparrow (*P. g. confinis*) breeds in grassland areas shown in the satellite image as a buff colour, separated from the coastal grasslands by high mountains (dark green and white).

In Canada, the Vesper Sparrow *affinis* is currently known to breed only on Vancouver Island at a single location: the Nanaimo airport, near Cassidy (Beauchesne 2002a, 2003, 2004a).

Historically, it has been reported during the breeding season on Vancouver Island from the Englishman River estuary in the north to Cobble Meadows and Mill Bay to the south. It was also formerly a local breeder in the Fraser Lowland on British Columbia's southwest mainland coast. The last confirmed breeding record for that area is from 1968 (Campbell et al. 2001). The historical population size is unknown, but it is likely that the subspecies was never common in Canada, as it was never recorded in large numbers or from more than a few localities.

NatureServe (2006) ranks the Vesper Sparrow *affinis* subspecies globally as a vulnerable subspecies of a globally common species (G5T3). The subspecies has not yet been ranked by NatureServe in the United States or Canada (NNR). The NatureServe ranks for Washington and Oregon are critically imperilled (S1B) and imperilled (S2B), respectively (B refers to a breeding population). The British Columbia rank is critically imperilled (S1B). The B.C. Conservation Data Centre (2006) lists the Vesper Sparrow *affinis* on the Red List.

1.4 Habitat and Biological Needs of the Horned Lark *strigata* and Vesper Sparrow *affinis*

Horned Lark *strigata*

The Horned Lark *strigata* is a ground-nesting passerine. Across their range, Horned Larks are birds of open areas with short, low-density vegetation (Beason 1995). Horned Lark *strigata* habitat requirements are similar to those of other subspecies. In British Columbia, larks have used agricultural fields, airports, beaches, sand dunes, short-grass playing fields, roadsides, and other areas with a high percentage of bare ground. Documented breeding habitat is restricted to short-grass fields in agricultural areas, airports, and estuaries and to sparsely vegetated, sandy beaches along the lower Fraser River (Butler and Campbell 1987; Campbell et al. 1997). Based on habitat requirements, the Horned Lark *strigata* may have used Garry oak ecosystems, especially those recently burned by First Nations peoples, but this has not been documented.

In Washington State, the Horned Lark *strigata* breeds primarily in the glacial outwash prairies of south Puget Sound. These prairies are remnant grasslands that likely developed shortly after the last ice age. Subsequent regional climate change, beginning about 6000 years ago, resulted in a shift to moister conditions that typically produced a succession to forest ecosystems. However, prairie conditions were maintained in some areas as a result of a high frequency of low-intensity fires, most set by First Nations peoples (Crawford and Hall 1997). The soils of these prairies are deep, have low nutrient levels, and drain rapidly. These characteristics, along with the frequent anthropogenic burning, also helped maintain the prairie grassland condition.

Other breeding sites in Washington and Oregon include airfields, dredge spoil islands in the Columbia River, sandy coastal beaches, and disturbed areas on military training bases (Rogers 2000; Pearson and Altman 2005). In the Willamette Valley of Oregon, the Horned Lark *strigata* breeds in agricultural fields, generally selecting sparsely vegetated fallow fields (Pearson and Altman 2005). The majority of the global population of the Horned Lark *strigata* is believed to winter along the lower Columbia River and in the Willamette Valley (Pearson and Altman 2005).

The common characteristics of all breeding sites are short sparse vegetation dominated by grasses and forbs with very few or no trees or shrubs and a relatively high percentage of bare (i.e. non-vegetated) ground (Pearson and Altman 2005). The size of the habitat patch is also likely important. Grassland sites may need to be very large to be effective. In the United States, habitat patches in the Puget Lowlands grassland areas used by the Horned Lark *strigata* ranged in size from 131 to 390 ha. In coastal areas, the Horned Lark *strigata* breeds adjacent to expanses of open water; under these conditions, it uses habitat patches as small as 10 ha (S. Pearson, pers. comm.).

Availability of large patches of suitable breeding habitat with low levels of disturbance during the nesting period appears to limit the extant distribution of this species in Canada. In many areas with otherwise suitable habitat, activity of machinery, people, livestock, or domestic pets can destroy or depredate nests directly. Additionally, anthropogenic disturbance can lead to frequent flushing of nesting birds, resulting in nest abandonment and increased rates of nest predation (Pearson and Altman 2005).

Vesper Sparrow *affinis*

The Vesper Sparrow *affinis* is also a ground-nesting passerine. Like the Horned Lark *strigata*, the principal limiting factor for this species is believed to be the availability of suitable habitat with low disturbance levels during the nesting season. Vesper Sparrows are grassland birds, preferring dry, open areas with short, sparse grass or herbaceous cover (Campbell et al. 2001; Dechant et al. 2001; Jones and Cornely 2002). Structural diversity of vegetation is important, however: taller vegetation, such as scattered or edge shrubs or trees, is used for cover and for singing perches, whereas areas with shorter vegetation are used for foraging and nesting (Davis and Duncan 1999; Beaudesne 2002a, 2003, 2004). In foraging areas of western Washington, the Vesper Sparrow *affinis* used sites with a mean cover of 32% bare ground, with the remaining cover consisting of grasses and forbs (Rogers 2000). Fence posts, wire fences, and other human-made structures may also be used as singing perches (Beaudesne 2002b). A combination of short-grass and herbaceous ground cover, bare dirt, and scattered taller vegetation seems to be preferred (see numerous citations in Dechant et al. 2001).

Several studies indicate that Vesper Sparrows avoid permanent pasture and hayfields (see Campbell et al. 2001; Jones and Cornely 2002) or areas where shrubs were completely removed and planted to grass (Castrale 1982). In Saskatchewan, Vesper Sparrows did occur in hayfields (McMaster et al. 2005). However, sparrows initiated nesting in habitat that had clumps of short vegetation with considerable amounts of bare dirt until mid-June, after which the vegetation grew in height and density. On southeastern Vancouver Island, hayfields tend to support dense, tall vegetation early in the breeding season, precluding nesting by the Vesper Sparrow *affinis*. Breeding territories at the Nanaimo airport occur in areas adjacent to, but not within, areas used for hay production (Beaudesne 2002a, 2003, 2004a).

Habitat patch size may also be important (Kershner and Bollinger 1996; Rogers 2000). For example, in Washington, the Vesper Sparrow *affinis* is currently found primarily in large prairie areas, but not in small patches of similar habitat (S. Pearson, pers. comm.). In eastern Oregon, however, Vesper Sparrows have been recorded breeding in areas smaller than 4 ha (Jones and Cornely 2002), and on Vancouver Island, the extant population occurs in an area of suitable habitat of approximately 10 ha (Beaudesne 2002a). Populations of Vesper Sparrow *affinis* may therefore be able to persist in smaller habitat patches than those required for the Horned Lark *strigata*. However, the minimum habitat patch size requirement for Vesper Sparrow *affinis* is currently unclear.

On Vancouver Island, the plant community at the known breeding site includes both native and non-native flora. Birds frequently use clumps of introduced Scotch broom (*Cytisus scoparius*) for singing perches and escape cover. They forage on the ground in adjacent open areas with gravelly soil and sparse forb and grass cover (Beaudesne 2002a, 2003, 2004a). Two of three nests found at the Nanaimo airport were in a mixed forb/grass area, concealed within a clump of non-native English plantain (*Plantago lanceolata*). The third nest was in a rocky area, placed against the side of a tuft of mown broom (Beaudesne 2006).

Multi-species Habitat Management

Given their similar habitat requirements, management of habitat at a single site for the Vesper Sparrow *affinis* and the Horned Lark *strigata* is possible. However, for management purposes, it is important to recognize that Vesper Sparrows require some shrub cover in open areas, whereas larks avoid shrubby areas. In many open habitats, the lark may nest in the middle of larger open areas and the sparrow may use the edges where both short and tall vegetation are available. This has been demonstrated at study sites in Washington State, where both species occur (Rogers 2000). In this recovery strategy, it is not recommended that any sites be managed specifically for both species, as the currently most suitable candidate sites for each species are not likely to overlap geographically.

1.5 Threats to the Horned Lark *strigata* and Vesper Sparrow *affinis*

1.5.1 Habitat Loss and Degradation

Habitat loss

Loss of high-quality breeding habitat is considered the primary limiting factor for both species. Although the extent of breeding habitat in the Georgia Basin for the Horned Lark *strigata* has always been limited, suitable open habitats, including 95% of the Garry oak and associated ecosystems (Fuchs 2001), have been lost as a result of industrial, commercial, and residential developments and dyking. It is assumed that prior to European settlement, Garry oak ecosystems, prairies associated with Garry oak ecosystems, and other sparsely vegetated or burnt areas would have been the key open habitats used by the breeding Vesper Sparrow *affinis*. Urban development, modern agricultural practices, and infilling of most remaining open spaces by invasive exotic shrubs have resulted in loss of this habitat.

A lack of suitable winter habitat in known wintering areas along the lower Columbia River and in the Willamette Valley is also of concern for the Horned Lark *strigata*. Very few of the sites used by the Horned Lark *strigata* for breeding or wintering are protected or are managed primarily for larks (Pearson and Altman 2005).

The Vesper Sparrow *affinis* is believed to winter in California (AOU 1957). However, the exact location of winter habitat and the extent to which it is threatened are not known.

For both species, habitat loss is a known threat and it is current, ongoing, and widespread across the historical ranges.

Habitat Degradation

For both species, many potential habitat areas have been degraded due to disturbance from increased human activity, changes in agricultural practices, or ingrowth by both native and non-native vegetation (Campbell et al. 2001). Most remaining open areas (e.g. city parks, golf courses, backyards, gardens) contain shrubs, turf, and non-native grasses unsuitable for ground-nesting birds (Jones and Bock 2002). Development has fragmented or destroyed most suitable habitat in British Columbia (Campbell et al. 1997), and continuing pressures from development will likely destroy most of the remaining habitat (Dawe et al. 2001).

At the Nanaimo airport, the existing breeding Vesper Sparrow *affinis* population uses an area that is away from the vicinity of buildings and human activity. However, habitat in this area is vulnerable to potential future activities, such as airport expansion (new or longer runways), construction of new airport infrastructure (airport buildings, aircraft hangars, parking areas for vehicles and equipment), and expansion of ancillary commercial operations (expanded recreational vehicle sales or other new businesses). As this site is the only extant breeding location for the subspecies in Canada, future development at this site may pose a threat to the persistence of the species in Canada. The extent to which any particular proposed development might negatively impact Vesper Sparrow *affinis* or its habitat would depend on the specific nature and on-site location of the development.

Habitat Fragmentation

Human activities in the region have resulted in changes to the size and spatial configuration of suitable habitat patches. The minimum patch size for the Horned Lark *strigata* may vary depending on the landscape context. Although the Horned Lark *strigata* may require patches no larger than 5–10 ha within an open landscape (e.g. dunes, coastal island or coastal prairie habitats), a suitable habitat patch would likely need to be larger if surrounded by forest, buildings or other tall structures that reduce visibility. In general, U.S. data suggest that smaller patches are suitable only in habitats directly adjacent to the coast, whereas inland sites must be much larger (S. Pearson and B. Altman, pers. comm.).

The Vesper Sparrow *affinis* appears to tolerate smaller areas of suitable habitat (B. Altman, pers. comm.). For example, at the Nanaimo airport, the population is breeding in an area less than 10 ha in size (Beauchesne 2004a). Similar sized patches of suitable habitat within close proximity to the existing population appear to be lacking, and this may reduce the chances of the current population expanding into neighbouring sites (Beauchesne 2003, 2004a).

Consequently, for both species, the threat of fragmentation of habitat is suspected, but not known, although fragmentation of habitat is ongoing and widespread across the historic ranges.

Agricultural Practices

Agriculture probably benefited both species from the late 19th to early 20th century through creation of open short-grass habitats, some of which would have been suitable for breeding (COSEWIC 2003). However, intensified agriculture typical of the latter half of the 20th century has reduced the suitability of some farmland areas that were previously used for nesting. Agricultural practices that involve mechanical procedures (e.g. tilling, mowing) can destroy active nests, significantly reducing reproductive success of ground-nesting birds. Modern crop “improvements,” involving more rapid growth with earlier and more frequent harvest, exacerbates this risk to ground-nesting birds. For the Vesper Sparrow *affinis*, the modern “clean farming” practice of removing shrubby hedgerows eliminates an important habitat structural feature, reducing the suitability of some pasture habitat (Rodenhouse et al. 1993; Sauer et al. 2004). In addition, industrial agricultural practices increasingly rely on chemicals, which likely have detrimental consequences for most species of birds (Gard et al. 1993).

Intensive grazing, where livestock are concentrated, reduces the suitability of the habitat if grazing is too severe, and there is an increased likelihood of nests being trampled or predated

(Bock et al. 1999; Nack and Ribic 2005). While grassland species are known to reproduce successfully in grazed areas in the interior of British Columbia, livestock stocking density is generally higher in coastal areas, potentially resulting in an increased risk of nest destruction through trampling.

Finally, manipulation of water levels in an agricultural context may also pose a threat, as flooding during the breeding season may result in nest failure.

While agricultural practices have resulted in known loss and degradation of habitat for both species, no extant or potential suitable sites are known to be currently threatened by agricultural activities.

1.5.2 Changes in Ecological Dynamics or Natural Process

Fire Suppression

For both species, suitable habitat in the Georgia Basin may have been more abundant in the past due to more frequent fires, both natural and of First Nations origin. Fire suppression has resulted in the infilling of previously suitable habitats by native plants, such as Douglas-fir (*Pseudotsuga menziesii*) and common snowberry (*Symphoricarpos albus*). In a recent controlled burn experiment in the United States, the Horned Lark *strigata* was more abundant in burned plots versus control plots in the post-breeding period (Pearson and Hopey 2005). Late summer burns appear to be more beneficial for the Horned Lark *strigata*, as regeneration of vegetation is not as vigorous, possibly allowing birds to locate and capture invertebrate prey more easily.

The impacts of fire suppression are thus suspected, but not known. Fire suppression has resulted in the loss of suitable habitat in the past and remains a concern, especially in Garry oak and affiliated ecosystems.

Dyking

Improved dyking of the Fraser River delta in the latter half of the 20th century has reduced the amount of sparsely vegetated sandy shoreline along the edges of the Fraser River. Coastal sand dunes are an important breeding habitat for the Horned Lark *strigata* in Washington State (S. Pearson, pers. comm.) and were one of the known breeding habitats used in British Columbia (Campbell et al. 1997).

Dyking is a known, but historical, threat that reduced available habitat for the Horned Lark *strigata* along the lower Fraser River.

Predators

The effects of predators may also limit these species. Predation was the primary source of nest failure in the Horned Lark *strigata* at nearly all sites studied in the Puget Lowlands, Washington coast, Columbia River, and Willamette Valley (n = 166 nests: Altman 1999; Pearson and Hopey 2005). Vesper Sparrow researchers have found that predation is a major cause of nest failure, with rates of up to 63% (see numerous studies cited in Jones and Cornely 2002).

Known predators on both adult and young grassland birds include corvids, raptors, snakes, and small mammals. American Crows (*Corvus brachyrhynchos*) and garter snakes (*Thamnophis* sp.) have been observed depredating Horned Lark *strigata* nests (Pearson and Hopey 2005). Breeding male Horned Larks may be more vulnerable to aerial predators than Vesper Sparrows, owing to their flight display behaviour. For both species, urbanization and other human activities tend to lead to increased predation pressure from introduced predators, particularly domestic and feral cats (George 1974; Cooper 1993; Coleman et al. undated). No nest predation information is available for the Vesper Sparrow *affinis* population at the Nanaimo airport, although domestic and feral cats have been observed at the site (S. Beauchesne, pers. comm.).

Nest predation is a known and ongoing threat for both species, wherever they occur. For both species, the proximity of any known or potential suitable sites to urbanized areas increases the risk of predation from introduced predators.

Infilling of Open Habitats by Shrubs and Exotic Grasses

Fire suppression is a prevalent policy around developed areas. Historically, some ecosystems burned frequently, but current practices have allowed natural succession to infill open habitats that were historically maintained by fire. The introduction of invasive plants such as Scotch broom, common gorse (*Ulex europaeus*), Himalayan blackberry (*Rubus discolor*), and tall non-native grasses has exacerbated the situation, as these species are well suited to rapidly colonize open spaces. This change in vegetation structure has reduced the suitability of most of the remaining old-field, Garry oak, and sand dune habitats for the Horned Lark *strigata* (Fraser et al. 1999).

Because the Vesper Sparrow *affinis* requires a combination of short vegetation, bare ground, and shrub cover, this species tolerates some infilling by invasive species such as Scotch broom and will even use that plant as a singing perch and for escape and nest cover (Beauchesne 2002a, 2003, 2004a). However, Vesper Sparrows are excluded from areas where shrubs completely dominate open areas (Jones and Cornely 2002). If left unmanaged, Scotch broom can degrade formerly open habitats to the point where they become unsuitable. Other invasive plant species may have structural similarities to native species and may be beneficial to breeding birds of either species. For example, Vesper Sparrow *affinis* nests at the Nanaimo airport site have been situated directly adjacent to English plantain (Beauchesne 2006).

1.5.3 Disturbance

Human Disturbance

Within the range of both species in British Columbia, rapid human population growth has increased recreational usage in the few remaining areas with suitable habitat. Most of these areas are small. Small, multi-use areas are generally not compatible with ground-nesting birds. U.S. researchers report that the Horned Lark *strigata* will flush when approached within 30 m by people or dogs (S. Pearson and B. Altman, pers. comm.). Recreational activities such as hiking, dog walking, bird watching, horseback riding, bike riding, fireworks, all-terrain vehicle use, or “sand-bogging” in any form of vehicle can result in destruction of nests or cause disturbances leading to nest failure if too frequent (Rogers 2000; Pearson and Altman 2005).

Researchers in Colorado found that although some habitat within or adjacent to urban areas appeared suitable, Vesper Sparrows tended to occur in lower density in these areas than further away from the urban edges where human disturbance is presumably lower (Bock et al. 1999). Elsewhere, researchers have found that this species was significantly more abundant on control transects away from disturbance than on transects along recreational trails (see Miller et al. 1998 in Jones and Cornely 2002).

At least in part, preference for low levels of disturbance likely explains the persistence of the Vesper Sparrow *affinis* at the Nanaimo airport. The birds occur almost entirely within a restricted area where they are subjected to noise from planes but very little foot or vehicular traffic. Although planes and helicopters are very loud, they do not come in close contact with the birds and do not cause flushing behaviour. These birds do flush when approached by researchers on foot or if they are close to the roadside when a vehicle passes (S. Beauchesne, pers. comm.). However, Vesper Sparrows appear to be less likely to flush than Horned Larks, and researchers have indicated anecdotally that Vesper Sparrows flush from the nest only when individuals approach within a few metres (S. Beauchesne and P. Krannitz, pers. comm.).

While human disturbance is a well-documented ongoing threat for both species elsewhere in their global range, as it results in the destruction of nests and nest failure, the extant population of the Vesper Sparrow *affinis* at the Nanaimo airport appears to experience fairly low levels of human disturbance.

1.5.4 Accidental Mortality

Bird Strikes

U.S. military reports indicate that Horned Larks are the most commonly reported aviation bird strike victim of any species (BASH 2006). Horned Lark flight behaviour, including a tendency to fly at considerable altitude during mating displays, likely exposes them to a greater risk than that experienced by other grassland species. Horned Larks (*strigata* subspecies) have been found dead along the runways of military airport breeding locations in Washington State (Pearson and Altman 2005). During the breeding season, the Horned Lark *strigata* is also vulnerable to automobile strikes, as it often selects nest sites on or directly adjacent to gravel roads (S. Pearson and B. Altman, pers. comm.).

As the Vesper Sparrow *affinis* is not known to frequent roadside habitats, the risk of automobile strikes for this species is likely lower. Despite the subspecies' presence at the Nanaimo airport, air strikes are also less likely, as Vesper Sparrows do not engage in high-altitude flights to the same extent as do larks. Also, they tend to frequent areas farther away from runways at this site, since the shrub component is removed from areas within 100 m of the strip.

Although mortality from bird strikes has been documented for the Horned Lark *strigata* elsewhere in its range, it remains merely a suspected threat for the Vesper Sparrow *affinis*, despite the proximity of the population to aircraft.

Small Population/Distribution Effects

A recent estimate of Horned Lark *strigata* population size in the United States, based on breeding and winter surveys, by U.S. researchers put the population at approximately 774

individuals (Pearson and Altman 2005). Preliminary genetic work suggests that the remaining birds have little genetic diversity. Samples all shared the same haplotype, whereas all other Horned Lark subspecies exhibited multiple haplotypes (Drovetski et al. 2005). Genetic data do not currently exist for the Vesper Sparrow *affinis*, although patterns of genetic differentiation for other coastal grassland species suggest that this subspecies will be genetically distinct and isolated from subspecies occurring elsewhere in North America (Ruegg and Smith 2002; Drovetski et al. 2005). Small population size and low genetic diversity cause these subspecies to be especially vulnerable to stochastic events, such as severe weather events or disease outbreaks. Given that source populations for the Horned Lark *strigata* in British Columbia are now remote (i.e. nearest populations are in south Puget Sound in Washington State), the probability of recolonization after a catastrophic event would be extremely low. The nearest U.S. population of the Vesper Sparrow *affinis* is on the San Juan Islands, but that population has suffered severe declines, and only a few individuals are thought to remain there. The Vesper Sparrow *affinis* population in the Willamette Valley in Oregon State is comparable with that of the Horned Lark *strigata* there (i.e. about 400 individuals) (B. Altman, pers. comm.). However, as the Vesper Sparrow *affinis* is more abundant at the southern end of the range, the total population of the subspecies is estimated to be larger than that of the Horned Lark *strigata*.

Because the Vesper Sparrow *affinis* currently occurs in very small numbers at a single site in Canada, this population is particularly vulnerable to extirpation. A single catastrophic event on the airport grounds or adverse weather conditions on the wintering grounds have the potential to eliminate the entire breeding population.

The risk of extirpation due to stochastic events is known, is ongoing, and would affect any extant or future subpopulations of either species.

1.6 Actions Already Completed or Under Way

- i) A stewardship agreement was in place with the Nanaimo Regional Airport, designed to promote protection of Vesper Sparrow nesting habitat (Beauchesne 2002c) but has since lapsed.
- ii) The Nanaimo Area Land Trust has developed a stewardship program with some of the local landowners adjacent to the Nanaimo Regional Airport.
- iii) The Garry Oak Ecosystems Recovery Team is coordinating conservation and recovery of Garry oak ecosystems in British Columbia. The Vertebrates at Risk Recovery Implementation Group of the Garry Oak Ecosystems Recovery Team is coordinating recovery actions for five species of birds associated with these ecosystems, including the Horned Lark *strigata* and the Vesper Sparrow *affinis* (Beauchesne 2004b).
- iv) Habitat restoration work is under way in a number of protected areas within the range of the Horned Lark *strigata* and the Vesper Sparrow *affinis*, some of which will benefit these species and other ground-nesting birds.
- v) Research is under way to better document habitat used by the breeding Vesper Sparrow *affinis* at the Nanaimo airport (Beauchesne 2002a, 2003, 2004a, 2006).

- vi) Inventory of the breeding population and habitats used by individual Vesper Sparrows at the Nanaimo airport is being enhanced in 2005 through colour banding of adults and nestlings.

1.7 Knowledge Gaps

In addition to the knowledge gaps preventing complete identification of critical habitat, outlined in Section 2.6.1 below, a number of knowledge gaps not pertaining directly to identification of critical habitat have been identified.

For both species, the feasibility of either passive or active reintroduction is not known. The likelihood of passive introduction of either species to suitable habitat from existing populations in the United States or Canada through natural dispersal mechanisms is unknown. Knowledge of dispersal distances would be useful to determine optimal inter-patch distances when selecting potential new sites for the Vesper Sparrow *affinis*. For the Horned Lark *strigata*, more knowledge of dispersal distances may inform habitat restoration decision-making regarding investments in northern Puget Sound sites (should this prove feasible) relative to Canadian sites. Active introduction techniques have not been developed for grassland bird species.

For the Vesper Sparrow *affinis*, minimum patch size requirements are essentially unknown and would help to determine the suitability of sites for protection and restoration. Data on productivity, survival, and mortality of the Nanaimo airport population are also lacking. These data could be used to develop a population model, which in turn could be used to help identify key limiting factors. Also unknown is the extent to which the population may respond and adapt to future changes to the habitat at the existing site, and whether techniques such as call-playback can successfully be used to encourage individuals to settle in areas not being considered for future development. Events on the wintering grounds may also be limiting the Vesper Sparrow *affinis*, but nothing is known about wintering locations of the Canadian population.

The primary nest predators have not been identified for Horned Lark *strigata* populations in the United States, although nest predation has been identified as the primary source of nest failure (Pearson and Altman 2005). Because this subspecies is migratory, events on the wintering grounds (i.e. primarily the Willamette Valley) may also be limiting populations. Nothing is known about the relative importance of wintering versus breeding events in regulating populations of larks in the United States.

2. RECOVERY

2.1 Rationale for Recovery Feasibility

Horned Lark *strigata*

Recovery of the Horned Lark *strigata* in Canada is technically and biologically feasible, as it meets all four criteria for determining recovery feasibility recommended in the draft Environment Canada Policy on Feasibility of Recovery (Environment Canada 2005). The U.S. population represents a potential source for either passive or active reintroduction of the subspecies in Canada. Although suitable habitat is likely limited at the present time, some suitable habitat likely exists and more could be made available through habitat restoration activities. In addition, there is significant potential for creation of new habitat through deposition of dredge spoils. It is possible to address or mitigate all known significant threats to the Horned Lark *strigata* through recovery actions at priority sites. Effective recovery techniques exist, including, but not limited to, invasive species removal and predator control.

Vesper Sparrow *affinis*

Recovery of the Vesper Sparrow *affinis* in Canada is technically and biologically feasible, as it meets all four criteria for determining recovery feasibility recommended in the draft Environment Canada Policy on Feasibility of Recovery (Environment Canada 2005). A small breeding population persists in British Columbia, the population appears to be self-sustaining, and an additional potential source population exists in the United States, with the next closest breeding population on San Juan Island, Washington, approximately 18 km to the south. Some additional suitable habitat may currently be available in British Columbia, and other areas are potentially available for restoration (e.g. Gulf Islands National Park Reserve). Effective recovery techniques exist, including, but not limited to, habitat restoration and population enhancement through invasive species removal and predator control.

2.2 Recovery Goals

Recovery goal for Horned Lark *strigata*

- Re-establish a breeding population of at least 10 breeding pairs at a minimum of three sites across its historical breeding range in Canada.

Historical occurrence and habitat availability data suggest that this species was never abundant, and was possibly ephemeral, in Canada; consequently, achieving a “minimum viable population” is not a reasonable goal, as such a small population will always be vulnerable to extirpation due to stochastic events in Canada or on the wintering grounds. Populations likely increased in the Fraser River valley as a result of anthropogenic activities that created temporary suitable habitat in the first half of the 20th century. Subsequent agricultural intensification and urbanization in this region have resulted in the elimination of the vast majority of this habitat. Based on U.S. patch size data for Horned Lark *strigata* populations utilizing inland grassland sites (see Section

1.4), the remaining patches in the Fraser Valley are likely not large enough to be suitable. From this perspective, the historical breeding range should be limited to sparsely vegetated coastal dune or meadow habitats in the Lower Mainland and southeastern Vancouver Island. The recovery goal considers the limited available information on historical abundance and is believed to be achievable given the likely extent of remaining suitable and restorable habitat.

Goal for Vesper Sparrow *affinis*

- Re-establish a breeding population of at least 30 breeding pairs at a minimum of at least three sites within its historical breeding range in Canada.

Like the Horned Lark *strigata*, this species was likely never abundant, and was possibly ephemeral, in Canada; consequently, achieving a “minimum viable population” is not a reasonable goal, as such a small population will always be vulnerable to extirpation due to stochastic events in Canada or on the wintering grounds. However, given the existence of an apparently persisting population of 5–9 pairs at one site on southeastern Vancouver Island, it is reasonable to set a higher population target for the Vesper Sparrow *affinis*. The rationale is that there is an opportunity to exploit the existing population as a “source” from which to increase the overall Canadian population both at that site and at suitable neighbouring sites, thus increasing the probability of persistence from a metapopulation perspective. The goal is both reasonable in light of the limited available information on historical abundance and achievable given the extent of remaining suitable and restorable habitat.

2.3 Recovery Objectives

Recovery objectives for Horned Lark *strigata*

- 1) Identify and assess candidate sites featuring sparsely vegetated coastal dune or meadow habitat for suitability by 2008.
- 2) Analyze the feasibility of active reintroduction of the Horned Lark *strigata* to suitable unoccupied habitat by 2008.
- 3) Secure, restore, create, protect, or manage 3–6 of the most suitable sites by 2011.
- 4) Increase the probability of passive reintroduction from U.S. populations by 2009.

Objectives for Vesper Sparrow *affinis*

- 1) Analyze the feasibility of active reintroduction of the Vesper Sparrow *affinis* to suitable unoccupied habitat by 2008.
- 2) Increase the existing population by 2–3 pairs by 2010.
- 3) Assess candidate sites with appropriate structural characteristics for suitability by 2008.
- 4) Secure, restore, protect, or manage two additional sites of the most suitable candidates identified by 2010.

2.4 Approaches Recommended to Meet Recovery Objectives

2.4.1 Broad strategies to effect recovery

Broad strategies to effect recovery of the Horned Lark *strigata* and the Vesper Sparrow *affinis* are outlined in Tables 1 and 2, respectively.

Table 1: Recovery Planning Table for Horned Lark *strigata*

Priority	Threat addressed	Broad strategy to address threats	Recommended approaches to meet recovery objectives
Objective 1: Identify and assess candidate sites featuring sparsely vegetated coastal dune or meadow habitat for suitability by 2008			
Urgent	Habitat loss or degradation	Research	<ul style="list-style-type: none"> • Identify candidate sites using expertise internal to the team • Map sites • Develop habitat suitability ratings and conduct site assessments, in cooperation with U.S. researchers • Develop a prioritized list of suitable sites
Objective 2: Analyze the feasibility of active reintroduction of the Horned Lark <i>strigata</i> to suitable unoccupied habitat by 2008			
Necessary	Small population/distribution effects	Research	<ul style="list-style-type: none"> • Design and implement feasibility research program • Consult with U.S. researchers • Assess probability of passive reintroduction to selected Canadian sites
Objective 3: Secure, restore, create, protect, or manage 3–6 of the most suitable sites by 2011			
Necessary	Habitat loss or degradation; human disturbance; predators; infilling by invasives	Habitat protection; habitat restoration	<ul style="list-style-type: none"> • Assess habitat restoration requirements • Determine feasibility of habitat creation techniques (e.g. dredge spoil islands) and, if feasible, create new sites • Recruit landowners and volunteers to participate in restoring landscape connectivity • Develop and implement regional and site-specific management plans at existing sites and, if determined to be feasible, create habitat at potential sites in the Fraser River delta and on southeastern Vancouver Island. • Maintain relationships with U.S. researchers to benefit from continuing research, in particular with respect to demographic rates in natural versus anthropogenic habitats and patch size requirements for birds nesting in sparsely vegetated coastal dune or meadow habitats
Objective 4: Increase the probability of passive reintroduction from U.S. populations by 2009			
Necessary	Small population/distribution effects	Habitat restoration	<ul style="list-style-type: none"> • Participate in U.S. habitat restoration efforts in northern Puget Sound

Table 2: Planning Table for Vesper Sparrow *affinis*

Priority	Threat addressed	Broad strategy to address threats	Recommended approaches to meet objectives
Objective 1: Analyze the feasibility of active reintroduction of the Vesper Sparrow <i>affinis</i> to suitable unoccupied habitat by 2008			
Beneficial	Small population/distribution effects	Research	<ul style="list-style-type: none"> • Design and implement feasibility research program • Consult with U.S. researchers
Objective 2: Augment the existing population by 2–3 pairs by 2010			
Urgent	Habitat loss or degradation; human disturbance; predators; infilling by invasives	Research; habitat protection; habitat restoration	<ul style="list-style-type: none"> • Renegotiate stewardship agreement with Nanaimo airport • Continue monitoring of extant breeding population • Experimentally evaluate the effect of Scotch broom management on habitat selection and productivity of Vesper Sparrow <i>affinis</i>, using currently unoccupied areas of the site • Increase Vesper Sparrow <i>affinis</i> suitable breeding habitat by at least 300% through conversion of hayfields
Objective 3: Assess candidate sites with appropriate structural characteristics for suitability by 2008			
Necessary	Habitat loss or degradation	Research	<ul style="list-style-type: none"> • Compile a list of candidate sites within the subspecies' historical range in Canada for consideration as potential habitat for the Vesper Sparrow <i>affinis</i> by 2007. • Identify candidate sites using expertise internal to the team by 2007 • Develop a research program to combine data and potential research opportunities from the extant population at the Nanaimo airport (including habitat manipulation experiments) with data from U.S. breeding sites to produce a predictive habitat model for the Vesper Sparrow <i>affinis</i> by 2010. Use the results of this model to verify site selection choices and to maximize the effectiveness of site management recommendations, including the eventual replacement of the invasive Scotch broom with native shrub species. • Map sites • Develop habitat suitability ratings and conduct assessment • Develop a prioritized list of suitable sites; prioritize sites within 10 km of the existing Nanaimo airport site to encourage increased probability of metapopulation persistence via opportunities for inter-patch movement and dispersal
Objective 4: Secure, restore, protect, or manage two additional sites of the most suitable candidates identified by 2010			
Necessary	Habitat loss or degradation; predators; human disturbance; infilling by invasives	Habitat protection; habitat restoration	<ul style="list-style-type: none"> • Assess habitat restoration requirements • Through expansion of the existing landowner contact program, recruit landowners and volunteers to participate in restoring landscape connectivity • Develop and implement regional and site-specific management plans

2.4.2 Narrative to support Recovery Planning Table

Four threats identified in Section 1.5 are not addressed in the recovery planning tables. These are fire suppression, dyking, agriculture, and bird strikes. These threats were either historical or hypothetical. If they are shown to be current threats to the species, then an approach to address them will be developed.

2.5 PERFORMANCE MEASURES

Measurable objectives are needed to evaluate the success of recovery efforts (Table 3). Many of these effectiveness measures will need to be derived from recommended habitat enhancements, site acquisition and management, inventory, monitoring, and research objectives outlined above. These performance measures are to be used as part of the mandatory five-year reporting requirement associated with this recovery strategy.

Table 3: Evaluation of Success of Recovery Efforts

Indicator	Objective	Evaluation
Habitat action plan	Horned Lark: 3 Vesper Sparrow: 4	Has a detailed management plan (or plans) been developed for selected sites to be managed for these species? Have management plans been implemented?
Funding	Horned Lark: 1-4 Vesper Sparrow: 1-4	Are sufficient funds in place or expected to implement all components of the recovery strategy and anticipated management plans?
Population	Horned Lark: 3, 4 Vesper Sparrow: 2, 4	Are extant populations monitored annually to determine population status and trend with respect to population objectives? Where possible, are habitat selection and demographic data being used to adaptively manage extant populations?
Status	Horned Lark: 3 Vesper Sparrow: 4	Has the Horned Lark <i>strigata</i> reestablished a population in Canada? Has the Vesper Sparrow <i>affinis</i> established additional breeding sites in Canada?
Critical habitat	Horned Lark: 3	Has proposed critical habitat been identified, designated, and effectively protected via s. 11 stewardship agreement or similar mechanism? Have additional candidate sites been assessed as not suitable, suitable, or restorable? If so, proceed with identification of additional suitable sites as critical habitat in an action plan or revised recovery strategy.
Habitat acquisition	Horned Lark: 3 Vesper Sparrow: 4	Have highly suitable or restorable potential sites been acquired, if practical, for the purposes of recovery of these two species?
Habitat stewardship	Horned Lark: 3 Vesper Sparrow: 4	Have majority of landowners who have suitable or restorable habitats been contacted, consulted, and provided stewardship guidance with respect to these two species? Are the landowners engaged and participating in recovery?
Habitat restoration and creation	Horned Lark: 1, 3 Vesper Sparrow: 3, 4	Have potential restoration sites been identified and prioritized? Has restoration been attempted at any of the identified sites? Have restoration techniques been successful? Have any habitat creation methods been determined to be feasible?
Feasibility of active reintroduction	Horned Lark: 2 Vesper Sparrow: 1	Has the feasibility of active reintroduction of both species been researched and assessed?

2.6 CRITICAL HABITAT

2.6.1 Identification of critical habitat

Horned Lark *strigata*

It is not possible to identify critical habitat for the Horned Lark *strigata* at this time.

No individuals are currently known to breed or over-winter within the historical range of this species in Canada. For the purposes of passive or active reintroduction, it is not known whether any sites with suitable or restorable habitat remain, although it is likely that some does. Passive reintroduction would involve colonization of currently suitable, restorable, or newly created habitat by dispersing individuals from U.S. populations. It is difficult to assess the likelihood of passive colonization at this time, in part because currently suitable or restorable sites have not been identified. Active reintroduction would involve direct reintroduction of birds captured and imported from U.S. populations and subsequent intensive management and monitoring. Methodologies for successful reintroduction of grassland passerines are currently not well developed. Also, there is uncertainty concerning the feasibility of introducing individuals from U.S. populations, as those populations are also at risk and the species remains a candidate for addition to the U.S. *Endangered Species Act*. Finally, the relative potential of natural (e.g. dune, natural grassland) versus anthropogenic (e.g. airports, dredge spoil islands) habitats to sustain populations of the Horned Lark *strigata* is unknown. Some anthropogenic habitat types (e.g. airports) may be population sinks for the Horned Lark *strigata*, in that populations breeding at these sites would need constant augmentation of new individuals in order to persist.

These knowledge gaps will be addressed in the manner described in the schedule of studies below (Section 2.6.3). It is recommended that no critical habitat be identified until candidate sites are assessed as being currently suitable or are restored to a condition of suitability.

Vesper Sparrow *affinis*

At the time that this recovery strategy is to be posted, the Vesper Sparrow *affinis* will be under consideration for listing on Schedule 1 of the *Species at Risk Act*. As such, critical habitat cannot be proposed for this species.

An updated recovery strategy for the Horned Lark *strigata* and the Vesper Sparrow *affinis* or an addendum to this strategy will be posted according to the timeline associated with the Vesper Sparrow *affinis* if the taxon is added to Schedule 1 of the *Species at Risk Act*. The update will deal specifically with potential critical habitat for the Vesper Sparrow *affinis*, as well as any other sites identified as critical habitat for Horned Lark *strigata* during the intervening time period.

2.6.2 Schedule of studies for the identification of critical habitat

Horned Lark *strigata*

- 1) Compile a list of candidate sites within the subspecies' historical range in Canada for consideration as potential habitat for the Horned Lark *strigata* by 2008.
- 2) With the assistance of species experts, identify and assess candidate sites as unsuitable, suitable, or restorable by 2007.
- 3) Identify, map, and prioritize suitable sites featuring sparsely vegetated coastal dune and meadow habitats for the Horned Lark *strigata* by 2007.
- 4) Identify, map, and prioritize coastal sites with habitat restoration potential for the Horned Lark *strigata* by 2008.

2.7 Existing and Recommended Approaches to Habitat Protection

Stewardship

Although the only known Vesper Sparrow breeding site in Canada is not formally protected and is actively managed as an airport, a stewardship agreement has, until recently, been in place between the Nanaimo airport and the Garry Oak Ecosystems Recovery Team's Vertebrates at Risk Recovery Implementation Group. Therefore, some consideration has been given to Vesper Sparrows in vegetation management decisions. However, airport management must adhere to Federal Aviation Authority rules, which stipulate heights of vegetation near the runway; therefore, some mowing during the breeding season is required, and this site can never be fully protected for sparrows.

An updated stewardship agreement is very important for recovery as are stewardship agreements with any other landowners now or in the future.

Secure suitable habitat areas

Securing areas through acquisition is costly, but ensures that they can be managed for long-term conservation purposes. In many instances, outright purchase may not be possible. Other options for securing habitat are conservation covenants or conservation or stewardship agreements.

Conserve and manage secured sites for the Horned Lark *strigata* and Vesper Sparrow *affinis*

- 1) Management plans for areas with open habitats need to specifically address threats to ground-nesting species.
- 2) Manage recreational activities on breeding sites to reduce or eliminate negative impacts. At sites with breeding populations, humans, vehicles, and domestic pets should be excluded during the breeding season.

- 3) Minimize impacts to nesting via management of mowing regimes at airports and other sites. Mowing is necessary to maintain airport safety. A mowing program also maintains habitat for both the Horned Lark and the Vesper Sparrow and therefore benefits these birds, provided all mowing is completed before the breeding season begins or after young have left the area (Vesper Sparrows fledge early, before they are able to fly, so fledging is not an indication that it is safe to mow). Mowing areas with short vegetation should be scheduled for before mid-March and again after the end of August.
- 4) Selectively control non-native and invasive shrubs at breeding site. Areas designated as potentially suitable Horned Lark habitat should have most shrubs removed. This may be done mechanically or, where practical, through controlled burning. Taller vegetation left at the edges of clearings or the occasional shrub missed in the clearing process should ensure that the habitat has potential for Vesper Sparrows as well.
- 5) Where Vesper Sparrows are the focus of vegetation management, shrubs should be thinned to create a mosaic of shrub cover and open spaces. Natural grasslands used by this species tend to have high variability, and no precise model exists for shrub cover versus open space for this species (Winter et al. 2005). Site-level managers should therefore provide a variety of options for these birds in terms of density of shrubbery (authors suggest a range of 1–50%).
- 6) Control predators. Feral and domestic cats in particular should be live-trapped and removed from breeding sites.

2.8 Effects on Other Species

Efforts to restore and protect open grassland and coastal sand dune habitats will be beneficial to many species that rely on these scarce and declining ecosystems. Any success in increasing habitat supply (area and quality) and reducing disturbance in these habitats will be especially beneficial to other ground-nesting birds that use sparsely vegetated habitats, such as Killdeer (*Charadrius vociferus*), Common Nighthawk (*Chordeiles minor*), and Savannah Sparrow (*Passerculus sandwichensis*).

Other listed species with similar habitat requirements include two arthropods. The Taylor's checkerspot (*Euphydryas editha taylori*) is listed as Endangered by COSEWIC and requires sparsely vegetated grasslands (Environment Canada 2006). The sand verbena moth (*Copablepharon fuscum*) is also listed as Endangered in Schedule 1 and is an obligate herbivore of yellow sand verbena (*Abronia latifolia*), a plant that occurs only in sand dune environments (Environment Canada 2006). Contorted-pod evening primrose (*Camissonia contorta*) was assessed as Endangered by COSEWIC in April 2006 and also utilizes dry, open, and sandy coastal habitats on southeastern Vancouver Island. Management of habitats for both the Horned Lark *strigata* and the Vesper Sparrow *affinis* can be compatible with the requirements of these three species.

There are, however, many species that do not favour sparsely vegetated habitats or that may be damaged by habitat restoration efforts (e.g. rare plant species affected by controlled burns). All sites will have to be carefully evaluated to determine which suite of species will benefit the most from restoration and management efforts. A balance will be required to ensure that all species have sufficient habitat areas for recovery and survival.

In the United States, the Horned Lark *strigata* now breeds on sites formerly used by Caspian Terns (*Sterna caspia*). Terns were removed from these sites prior to utilization of the sites by the Horned Lark *strigata*. Habitat creation through the deposition of dredge spoils may result in creation of tern habitat as well. Although Caspian Terns are not common in the Lower Mainland, at least one breeding colony does occur in the Fraser River delta. If the presence of terns reduces the suitability of newly created habitat, it may be necessary to manage these sites to prevent colonization by terns.

2.9 Recommended Approach for Recovery Implementation

Recovery of the Horned Lark *strigata* in Canada will likely prove to be more problematic than recovery of the Vesper Sparrow *affinis*. Larks require larger areas, no Canadian breeding sites currently exist, sites formerly used are almost completely lost or degraded, sites to be restored may need to be purchased, and new habitats need to be constructed. Despite these barriers, new nesting habitat may be created with relative ease from dredge spoils; this factor may compensate for other challenges in Horned Lark *strigata* recovery.

A more detailed action plan is needed to focus recovery efforts in Canada. A plan will be developed following identification and assessment of suitable or restorable sites for both species and evaluation of the best habitat enhancement/creation methods.

Conservation efforts in the United States have focused on identifying and monitoring existing populations, identifying habitat features important to successful breeding, testing methods for creating habitat, restoring degraded habitats, and restricting some human uses on breeding sites (Pearson and Altman 2005). Managers of potentially suitable sites in Canada should use habitat creation and restoration techniques that have proven successful south of the border.

It is recognized that most suitable habitat for these two subspecies in Canada and the United States occurs either at airports or on military reserves. Both land use types offer open areas with short vegetation and protection from disturbance by people and pets. Focusing recovery actions at airports and on military reserves may be problematic due to other management considerations. This strategy recognizes that public safety considerations clearly supersede those governing Species at Risk where the two are in conflict and that conservation actions such as habitat modification or enhancement must be compliant with Transport Canada regulations. Even with these restrictions, maintaining suitable habitat at airports and on military land will likely offer the best chance for successful recovery of these two species. Working relationships with land managers at these sites should be fostered and maintained.

Recovery actions should be coordinated with efforts to restore populations of these species in the United States.

Recovery actions should be coordinated with overall Garry Oak Ecosystems Recovery Team habitat mapping and restoration and species recovery efforts, in part to increase effectiveness of recovery actions and in part to eliminate any potential for conflicting recovery activities (e.g. damage to rare plant populations by controlled burning). To date, the Vertebrates at Risk Recovery Implementation Group of the Garry Oak Ecosystems Recovery Team has taken the

lead in the conservation and management of habitats for these species on southeastern Vancouver Island and will continue to be involved with related issues in that region (Fuchs et al. 2002).

The Horned Lark *strigata* and Vesper Sparrow *affinis* Recovery Team may reconvene as a Recovery Implementation Group in order to expand the work initiated by the Vertebrates at Risk Recovery Implementation Group to include potential coastal dune sites on southeastern Vancouver Island and the Lower Mainland. Alternatively, habitat management, restoration, and/or creation could be implemented through formation of an additional Recovery Implementation Group, with specialization in dune and grassland habitats, especially if other listed species are determined to be affected. In this, the recommended approach, the Garry Oak Ecosystems Recovery Team Vertebrates at Risk Recovery Implementation Group would continue to implement recovery actions where appropriate (i.e. most recovery activities associated with the Vesper Sparrow *affinis*), but a coastal dune and related ecosystems Recovery Implementation Group would address conservation needs affecting the Horned Lark *strigata* as well as a suite of other federally and provincially listed species associated with this habitat type (e.g. sand verbena moth, contorted-pod evening primrose, pink sand verbena, *Abronia umbellata*, yellow sand verbena).

2.9.1 Statement of when one or more action plans in relation to the recovery strategy will be completed

An action plan will be completed by March 2009.

3. REFERENCES

- Altman, B. 1999. Status and conservation of grassland birds in the Willamette Valley. Unpublished report submitted to Oregon Department of Fish and Wildlife, Corvallis, Oregon.
- Altman, B. 2003. Vesper Sparrow. Pp. 542–545 *in* Birds of Oregon: A general reference. D.B. Marshall, M.G. Hunter, and A.L. Contreras, Eds. Oregon State University Press, Corvallis, Oregon.
- AOU (American Ornithologists' Union). 1957. Check-list of North American birds. 5th edition. American Ornithologists' Union, Baltimore, Maryland. 691 pp.
- BASH (Bird/wildlife Aircraft Strike Hazard Team). 2006. Top 50 USAF wildlife strikes by count. Aviation Safety Division, U.S. Air Force URL: [http://afsafety.af.mil/SEF/Bash/web_spec_count_stat.html] Accessed July 5, 2006.
- B.C. Conservation Data Centre. 2006. BC Species and Ecosystems Explorer. B.C. Ministry of Environment, Victoria, B.C. (<http://srmapps.gov.bc.ca/apps/eswp/>; accessed April 7, 2006).
- Beason, R.C. 1995. Horned Lark (*Eremophila alpestris*). *In* The Birds of North America, No. 195. A. Poole and F. Gill, Eds. Academy of Natural Sciences, Philadelphia, Pennsylvania, and American Ornithologists' Union, Washington, D.C. 24 pp.
- Beauchesne, S.M. 2002a. Coastal Vesper Sparrow inventory on southeastern Vancouver Island, 2002. Report prepared for the Garry Oak Ecosystems Recovery Team, Victoria, B.C.
- Beauchesne, S.M. 2002b. Coastal Vesper Sparrow stewardship account. Report prepared for the Garry Oak Ecosystems Recovery Team, Victoria, B.C.
- Beauchesne, S.M. 2002c. Coastal Vesper Sparrow Stewardship Agreement between the Nanaimo Airport and the Garry Oak Ecosystems Recovery Team Vertebrates at Risk Recovery Action Group. Report prepared for the Garry Oak Ecosystems Recovery Team, Victoria, B.C.
- Beauchesne, S.M. 2003. Coastal Vesper Sparrow inventory on southeastern Vancouver Island, 2003. Report prepared for the Garry Oak Ecosystems Recovery Team, Victoria, B.C.
- Beauchesne, S.M. 2004a. Coastal Vesper Sparrow inventory on southeastern Vancouver Island, 2004. Report prepared for the Garry Oak Ecosystems Recovery Team, Victoria, B.C.
- Beauchesne, S.M. 2004b. Recovery challenges for birds at risk in Garry oak ecosystems of British Columbia. Species At Risk Conference, Victoria, B.C.
- Beauchesne, S.M. 2005. Draft COSEWIC status report on the Vesper Sparrow *affinis* subspecies. Report prepared for the Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario.

Beauchesne, S.M. 2006. Coastal Vesper Sparrow monitoring at the Nanaimo airport, 2005. Report prepared for the Garry Oak Ecosystems Recovery Team, Victoria, B.C.

Bock, C.E., J.H. Bock, and B.C. Bennett. 1999. Songbird abundance in grasslands at a suburban interface on the Colorado high plains. Pp. 131–136 *in* Ecology and conservation of grassland birds of the Western Hemisphere. P.D. Vickery and J.R. Herkert, Eds. Cooper Ornithological Society, Camarillo, California (Studies in Avian Biology 19).

Butler, R.W. and R.W. Campbell. 1987. The birds of the Fraser River delta: populations, ecology, and international significance. Occasional Paper No. 65. Canadian Wildlife Service, Ottawa, Ontario. 73 pp.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, M.C.E. McNall, and G.E.J. Smith. 1997. The birds of British Columbia. Vol. 3: Passerines. Flycatchers through vireos. University of British Columbia Press, Vancouver, B.C. 693 pp.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, A.C. Stewart, and M.C.E. McNall. 2001. The birds of British Columbia. Vol. 4: Passerines. Wood warblers through Old World sparrows. Royal British Columbia Museum, Victoria, B.C., and Canadian Wildlife Service, Delta, B.C. 739 pp.

Cannings, R.J. 1998. The birds of British Columbia — a taxonomic catalogue. Wildlife Bulletin No. B-86. Wildlife Branch, B.C. Ministry of Environment, Lands and Parks, Victoria, B.C. vii + 252 pp.

Castrale, J.S. 1982. Effects of two sagebrush control methods for nongame birds. *Journal of Wildlife Management* 46:945–952.

Coleman, J.S., S.A. Temple, and S.R. Craven. Undated. Cats and wildlife: a conservation dilemma. Unpublished report prepared for the University of Wisconsin (<http://wildlife.wisc.edu/extension/catfly3.htm>; accessed September 1, 2003).

Cooper, J.M. 1993. Breeding Bird Surveys in the Airport Reserve on Sea Island, Richmond, British Columbia. Unpublished report prepared by LGL Limited for Transport Canada, Richmond, B.C. 34 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2003. COSEWIC assessment and update status report on the Horned Lark *strigata* subspecies *Eremophila alpestris strigata*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario. vi + 23 pp.

Crawford, R.C. and H. Hall. 1997. Changes in the south Puget Sound prairie landscape. Pp. 11–15 *in* Ecology and conservation of the south Puget Sound prairie landscape. P. Dunn and K. Ewing, Eds. The Nature Conservancy of Washington, Seattle, Washington. 289 pp.

- Davis, S.K. and D.C. Duncan. 1999. Grassland songbird occurrence in native and crested wheatgrass pastures of southern Saskatchewan. Pp. 211–218 *in* Ecology and conservation of grassland birds of the Western Hemisphere. P.D. Vickery and J.R. Herkert, Eds. Cooper Ornithological Society, Camarillo, California (Studies in Avian Biology 19).
- Dawe, N.K., I. McTaggart-Cowan, R.W. Campbell, and A.C. Stewart. 2001. What lies in store for the birds of British Columbia? New philosophies, concerns and conservation challenges. Pp. 679–695 *in* The birds of British Columbia. Vol. 4: Passerines. Wood warblers through Old World sparrows. University of British Columbia Press, Vancouver, B.C.
- Dechant, J.A., M.F. Dinkins, D.H. Johnson, L.D. Igl, C.M. Goldade, and B.R. Euliss. 2001. Effects of management practices on grassland birds: Vesper Sparrow. Northern Prairie Wildlife Research Center, Jamestown, North Dakota. 40 pp. URL: [<http://www.npwrc.usgs.gov/resource/literatr/grasbird/download/vesp.pdf>] Accessed July 5, 2006.
- Drovetski, S.V., S.F. Pearson, and S. Rohwer. 2005. Streaked Horned Lark *Eremophila alpestris strigata* has distinct mitochondrial DNA. Conservation Genetics 6(6):875–883.
- Environment Canada. 2005. Policy on feasibility of recovery (draft). *Species at Risk Act* Policy. Environment Canada, April.
- Environment Canada. 2006. Species at risk (<http://www.speciesatrisk.gc.ca>).
- Fraser, D.F., W.L. Harper, S.G. Cannings, and J.M. Cooper. 1999. Rare birds of British Columbia. Wildlife Branch and Resource Inventory Branch, B.C. Ministry of Environment, Lands and Parks, Victoria, B.C. viii + 244 pp.
- Fuchs, M.A. 2001. Towards a recovery strategy for Garry oak and associated ecosystems in Canada: ecological assessment and literature review. Technical Report GBEI/EC-00-0300. Canadian Wildlife Service – Pacific and Yukon Region, Environment Canada. 106 pp.
- Fuchs, M.A., B. Reader, R. Bennett, L.K. Blight, C. Bryce, B. Costanzo, M. Dunn, T. Ennis, M. Fairbarns, R. Feldman, T. Fleming, D.F. Fraser, H.J. Gibbard, T. Gillespie, R.J. Hebda, C. Junck, A. MacDougall, C. Maslovat, M.D. Meagher, A. Pollard, D. Polster, A. Robinson, G.P. Sirk, and K. Stewart. 2002. National Recovery Strategy for Garry Oak and associated ecosystems and their associated species at risk in Canada: Phase I. Draft: August 2002. Garry Oak Ecosystems Recovery Team, Victoria, B.C. (<http://www.goert.ca>).
- Gard, N.W., M.J. Hooper, and R.S. Bennett. 1993. Effects of pesticides and contaminants on neotropical migrants. *In* Status and management of neotropical migratory birds. D.M. Finch and P.W. Stangel, Eds. General Technical Report RM-229. Forest Service, U.S. Department of Agriculture, Fort Collins, Colorado. 422 pp.
- George, W.G. 1974. Domestic cats as predators and factors in winter shortages of raptor prey. Wilson Bulletin 86:384–396.

- Jones, S.L. and J.E. Cornely. 2002. Vesper Sparrow (*Pooecetes gramineus*). In The Birds of North America, No. 624. A. Poole and F. Gill, Eds. The Birds of North America, Inc., Philadelphia, Pennsylvania. 28 pp.
- Jones, Z.F. and C.E. Bock. 2002. Conservation of grassland birds in an urbanizing landscape: a historical perspective. *Condor* 104(3):643–651.
- Kershner, E.L. and E.K. Bollinger. 1996. Reproductive success of grassland birds at east-central Illinois airports. *American Midland Naturalist* 136(2):358–366.
- McMaster, D.G., J.H. Devries, and S.K. Davis. 2005. Grassland birds nesting in haylands of southern Saskatchewan: landscape influences and conservation priorities. *Journal of Wildlife Management* 69:211–221.
- Miller, S. G., R. L. Knight, C. K. Miller. 1998. Influence of recreational trails on breeding bird communities. *Ecol. Applic.* 8: 162–169. [cited in Jones and Cornely 2002].
- Munro, J.A. and I. McTaggart-Cowan. 1947. A review of the bird fauna of British Columbia. Special Publication No. 2. B.C. Provincial Museum, Victoria, B.C. 285 pp.
- Nack, J.L. and C.A. Ribic. 2005. Apparent predation by cattle at grassland bird nests. *Wilson Bulletin* 117(1):56–62.
- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.7. NatureServe, Arlington, Virginia (<http://www.natureserve.org/explorer>; accessed April 7, 2006).
- Pearson, S.F. and B. Altman. 2005. Range-wide Streaked Horned Lark (*Eremophila alpestris strigata*) assessment and preliminary conservation strategy. Washington Department of Fish and Wildlife, Olympia, Washington. 25 pp.
- Pearson, S.F., and M. Hopey. 2005. Streaked Horned Lark nest success, habitat selection, and habitat enhancement experiments for the Puget lowlands, coastal Washington and Columbia River Islands. Natural Areas Program Report 2005-1. Washington Dept. of Natural Resources. Olympia, WA.
- Pyle, P. 1997. Identification guide to North American birds: Part 1. Slate Creek Press, Bolinas, California. 732 pp.
- Rodenhouse, N. L., L. B. Best, R. J. O'Connor, and E. K. Bollinger. 1993. Effects of temperate agriculture on Neotropical migrant landbirds. Pages 280-294 in D. M. Finch and P. W. Stangel, eds. Status and management of Neotropical migratory birds. U.S. For. Serv. Gen. Tech. Rep. RM-229. Rocky Mountain For. Serv. and Range Exp. Sta., Ft. Collins, CO.

Rogers, R.E., Jr. 2000. The status and microhabitat selection of Streaked Horned Lark, Western Bluebird, Oregon Vesper Sparrow, and Western Meadowlark in western Washington. M.Sc. Thesis, Evergreen State College, Olympia, Washington. xi + 178 pp.

Ruegg, K.C. and T.B. Smith. 2002. Not as the crow flies: a historical explanation for circuitous migration in Swainson's Thrush (*Catharus ustulatus*). Proceedings of the Royal Society of London, Series B 269:1375–1381.

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, results and analysis 1966-2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, MD, USA.

Sibley, D.A. 2000. National Audubon Society: the Sibley guide to birds. Random House, Toronto, Ontario.

Stinson, D.W. 2005. Washington State status report for the Mazama Pocket Gopher, Streaked Horned Lark, and Taylor's Checkerspot. Washington Department of Fish and Wildlife, Olympia, Washington. 129 + xii pp.

Winter, M., D.H. Johnson, and J.A. Shaffer. 2005. Variability in vegetation effects on density and nesting success of grassland birds. Journal of Wildlife Management 69:185–197.

4. RECOVERY TEAM MEMBERS

Bob Altman – American Bird Conservancy (advisor to the Recovery Team)

Suzanne Beaudesne – Western Wildlife Research

Alaine Camfield – Graduate Researcher, University of British Columbia

Trudy Chatwin – British Columbia Ministry of the Environment

John Cooper – Manning and Cooper Associates

Wendy Easton – Canadian Wildlife Service

Kevin Fort (Chair) – Canadian Wildlife Service

Libor Michalak – Next Environmental Inc.

Nicholas Page – Raincoast Applied Ecology

Scott Pearson – Washington Department of Fish and Wildlife (advisor to the Recovery Team)

Simon Robinson – Vancouver International Airport Authority