COSEWIC
Assessment and Status Report

on the

McCown's Longspur
Rhynchophanes mccownii

in Canada

THREATENED
2016

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Previous report(s):

COSEWIC 2006. COSEWIC assessment and status report on the McCown's Longspur *Calcarius mccownii* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 23 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

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McCown's Longspur — Photo ©Gord Court.

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COSEWIC
Assessment Summary

Assessment Summary – May 2016

Common name
McCown's Longspur

Scientific name
Rhynchophanes mccownii

Status
Threatened

Reason for designation
This grassland bird has experienced a severe population decline since at least the late 1960s, and there is evidence of a substantial, continuing decline. The species is primarily threatened by continuing loss and degradation of grassland habitats within both its breeding and wintering grounds.

Occurrence
Alberta, Saskatchewan

Status history
Designated Special Concern in April 2006. Status re-examined and designated Threatened April 2016.

COSEWIC
Executive Summary

McCown's Longspur
Rhynchophanes mccownii

Wildlife Species Description and Significance

The McCown's Longspur (*Rhynchophanes mccownii*) is a grey or greyish brown sparrow-like songbird with an inverted black "T" pattern on its white tail. Males have a mostly white head with a black crown, moustache stripe, and bib patch. As an endemic species of the northern prairies, the species is a useful indicator of that habitat's condition.

Distribution

The breeding range extends from southern Alberta and eastern Montana east to southern Saskatchewan and the western edge of the Dakotas. It has a slightly disjunct range in eastern Wyoming that extends slightly into neighbouring states. Historically, the range extended eastward to Minnesota and southward to Oklahoma. The wintering range is in the southwestern US (mainly Texas, New Mexico, and Arizona) and northern Mexico (mainly Chihuahua and Sonora).

Habitat

The species breeds in dry, sparse, short-cropped grassland with bare patches and few shrubs or forbs. Such habitat includes short-grass prairie, non-native pastures, closely grazed mixed-grass prairie, and some cultivated fields. Breeding habitat declined historically through the last century, and habitat loss and degradation continue, mainly because native grasslands are being converted for agriculture.

Biology

Birds probably breed in their first year. They are monogamous and territorial, and raise one, or, more rarely, two broods per year. Hatching success is high and starvation is rare, but predators take 30-75% of nests. Otherwise, demographic variables, particularly return and survival rates, are poorly known. Invertebrates, especially grasshoppers, are the main food provided to nestlings, but otherwise the species feeds mainly on seeds. Birds leave Canada for the wintering grounds starting in August, and return to Canada starting in April.

Population Sizes and Trends

The Canadian population is estimated from Breeding Bird Survey (BBS) results as 138,000 adults, which is about 23% of the global population. The best available information on trends, from the BBS, suggests the species declined by 98% in Canada between 1970 and 2012 and by at least 30% in the 10-year period between 2002 and 2012.

Threats and Limiting Factors

Threats include natural system modifications, agricultural effluents, oil and gas drilling, annual and perennial non-timber crops, renewable energy, and transportation and service corridors. Overall, threats were scored as having high to moderate impacts.

Protection, Status and Ranks

The species is protected under the *Migratory Birds Convention Act* of 1994 and listed as Special Concern under Schedule 1 of the *Species at Risk Act*. It is ranked as Apparently Secure globally, but as imperilled or vulnerable in most of the states in its US range. In Alberta and Saskatchewan it is ranked as vulnerable or apparently secure.

TECHNICAL SUMMARY

Rhynchophanes mccownii

McCown's Longspur

Plectrophane de McCown

Range of occurrence in Canada: Alberta, Saskatchewan

Demographic Information

Generation time Value given here is an estimate based on generation times for other small passerines.	Probably 2-3 yrs
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Yes (observed, inferred and projected)
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations]. Estimated from Breeding Bird Survey (BBS) data for Canada.	Estimated decline over 10 years is >30%.
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Projected to be >30% decline based on historical and present rates of population change, as well as level of calculated threats.
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Estimated to be >30% decline based on historical and present rates of population change, as well as level of calculated threats.
Are the causes of the decline a.clearly reversible and b.understood and c. ceased?	a. No b. No c. No
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence	115,794 km²
Index of area of occupancy (IAO) (Always report 2x2 grid value).	>2000 km²
Is the population "severely fragmented" ie. is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. No b. No

Number of "locations"* (use plausible range to reflect uncertainty if appropriate)	Unknown, but >> 10
Is there an [observed, inferred, or projected] decline in extent of occurrence?	Unknown
Is there an [observed, inferred, or projected] decline in index of area of occupancy?	Unknown, but a decline can probably be inferred as a result of habitat loss.
Is there an [observed, inferred, or projected] decline in number of subpopulations?	Not applicable
Is there an [observed, inferred, or projected] decline in number of "locations"*?	Unknown
Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?	Yes; observed declines in area, extent and quality of habitat in both the breeding and wintering grounds.
Are there extreme fluctuations in number of subpopulations?	Not applicable
Are there extreme fluctuations in number of "locations"∗?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each subpopulation)

Subpopulations (give plausible ranges)	**N Mature Individuals**
Total	138,000

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	No analysis done.

Threats (actual or imminent, to populations or habitats, from highest impact to least)

i. Natural system modifications
ii. Agricultural effluents
iii. Oil and gas drilling
iv. Annual and perennial non-timber crops
v. Renewable energy
vi. Transportation and service corridors

Was a threats calculator completed for this species and if so, by whom? Yes, by Jon McCracken, Dwayne Lepitzki, Andrew Horn, Ruben Boles, Julie Perrault, Patricia Rosa, Stephen Davis, and Brandy Downey.

* See Definitions and Abbreviations on COSEWIC web site and IUCN (Feb 2014) for more information on this term.

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Long-term declining population in the US.
Is immigration known or possible?	Yes
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes, but declining
Are conditions deteriorating in Canada?	Yes
Are conditions for the source population deteriorating?	Yes
Is the Canadian population considered to be a sink?	Unknown
Is rescue from outside populations likely?	Unlikely; substantial immigration is needed to rescue a population that has been in such strong decline. There is also ongoing loss of habitat in both Canada and the US.

Data Sensitive Species

Is this a data sensitive species? No

Status History

COSEWIC: Designated Special Concern in April 2006. Status re-examined and designated Threatened April 2016.

Status and Reasons for Designation:

Status:	**Alpha-numeric codes:**
Threatened	A2bc+3bc+4bc
Reasons for designation: This grassland bird has experienced a severe population decline since at least the late 1960s, and there is evidence of a substantial, continuing decline. The species is primarily threatened by continuing loss and degradation of grassland habitats within both its breeding and wintering grounds.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Meets Threatened, because the 10-year population decline exceeds 30% (A2bc) and is projected to exceed 30% over the next 10 years (A3bc) and is estimated to exceed 30% over any 10-year period (A4bc).
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. Exceeds thresholds for extent of occurrence and index of area of occupancy.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Population size is too large.
Criterion D (Very Small or Restricted Population): Not applicable. Population size is too large.
Criterion E (Quantitative Analysis): Not conducted.

PREFACE

Since the previous status report, the species' genus and family have changed, the estimated population size is lower (but within the same range of uncertainty), trend information has been re-analyzed, and the area of occupancy measure has been replaced with an index of area of occupancy. Also new are several studies of habitat requirements and measures of habitat trends.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2016)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment and Climate Change Canada
Canadian Wildlife Service
Environnement et Changement climatique Canada
Service canadien de la faune
Canada

The Canadian Wildlife Service, Environment and Climate Change Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

The McCown's Longspur, *Rhynchophanes mccownii*, is a songbird (Class Aves, Order Passeriformes) in the longspur family (Calcariidae). The species is closely related to other longspurs, genus *Calcarius*, and was included in that genus, and in the sparrow family Emberizidae, when the previous status report was prepared. Since then, however, the species has been placed in its own genus, because of recent molecular evidence that supports its long-suspected stronger relationship to Snow Buntings, genus *Plectrophena*, than shown by the other longspurs (Carson and Spicer 2003; Klicka *et al.* 2003; Chesser *et al.* 2010). Moreover, the longspurs (and Snow Buntings) as a whole are now considered to be sufficiently distinct from sparrows and other emberizids to be in their own family, Calcaridae (Chesser *et al.* 2010).

Morphological Description

All longspurs superficially look like sparrows, but are distinctive in having particularly long rear claws (thus "longspur"). The McCown's Longspur is about 15 cm long and weighs about 25 g. It has a chunky build, thick bill, chestnut wing patch and short tail that bears a diagnostic upside-down black "T". Males in breeding plumage are mostly grey, with a chestnut wing patch and whitish head that has a black crown, moustache stripe, and bib patch. The breeding season flight display is distinctive; males glide downward from about 10 m with spread tails and wings, delivering a tinkling song (With 2010).

Females, young birds, and males in winter are grey to greyish brown overall and quite similar to other longspurs. They can be distinguished by their plainer face and breast, pinkish bill, T pattern on the tail, and distinctive flight call, which is a dry rattle (Sibley 2000; With 2010).

Population Spatial Structure and Variability

Population spatial structure and variability have not been studied. Populations appear to be fragmented on both landscape and range-wide scales (see Distribution, below), but disappearance and reappearance of birds at particular sites suggest that the species is highly dispersive or nomadic, even though there are no banding or tracking studies to confirm this (With 2010).

Designatable Units

No subspecies are recognized. Geographical variation in morphology, behaviour, or genetics appears to be minimal (With 2010), but it has not been formally studied.

Special Significance

The McCown's Longspur is one of only a handful of North American songbirds that is taxonomically distinct enough to be classified in its own genus. It is one of a suite of species that are endemic to the northern prairie of North America, the habitat of which historically depended on cycles of drought, grazing, and fire that were later disrupted by European settlement (Askins *et al.* 2007). It is an indicator species for prairie habitat. Several other such species are assessed as at risk in Canada, including Chestnut-collared Longspur (*Calcarius ornatus*), Sprague's Pipit (*Anthus spragueii*), Burrowing Owl (*Athene cunicularia*), Ferruginous Hawk (*Buteo regalis*), Greater Sage-Grouse (*Centrocercus urophasianus*), Long-billed Curlew (*Numenius americanus*), Mountain Plover (*Charadrius montanus*) and Swift Fox (*Vulpes velox*; Environment Canada 2014a).

DISTRIBUTION

Global Range

The breeding distribution consists of two main, but somewhat disjunct portions (Figure 1). The northern portion extends from southern Alberta and Montana east of the Rockies to southern Saskatchewan, western North Dakota, and the northwestern corner of South Dakota. The southern portion includes eastern Wyoming and small portions of neighbouring states. Before the early 1900s, the breeding range included more of southeastern Saskatchewan and the Dakotas, and extended to Minnesota, Oklahoma, and perhaps Manitoba (Environment Canada 2014a).

The wintering range extends from the panhandle of Oklahoma through central and western Texas and the plateau regions of north central Mexico, and includes small portions of southern Arizona and New Mexico (Figure 1). Some birds may winter in southern California, southeastern Colorado, western Kansas, and eastern Texas. The species occurs on migration between the breeding and wintering areas, and individuals have appeared as vagrants as far away as the East Coast (With 2010).

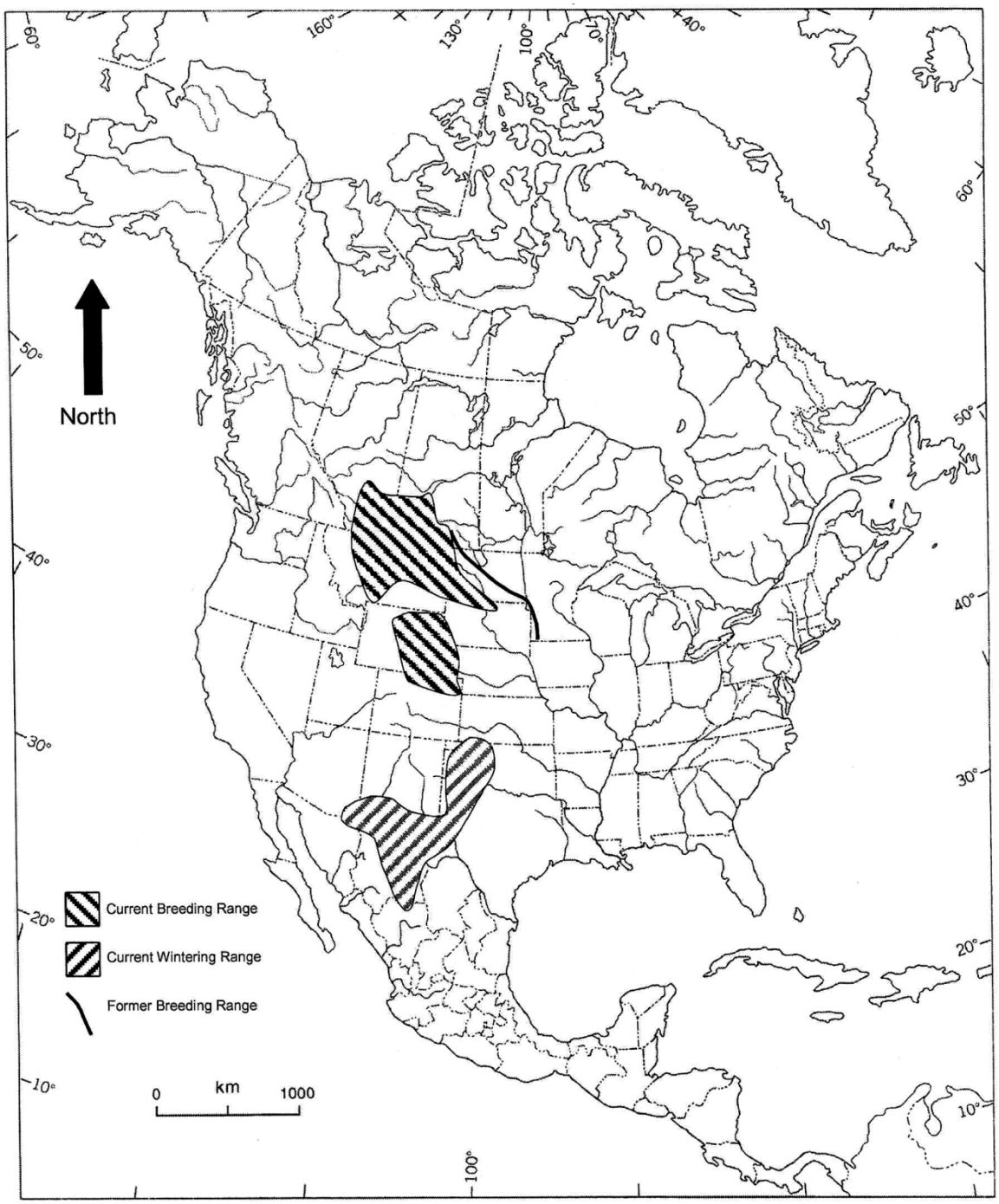

Figure 1. Breeding and wintering range of the McCown's Longspur (from COSEWIC 2006).

Canadian Range

Canada holds 23% of the species' global breeding range (RMBO 2012). Here, it breeds only in southeastern Alberta and southwestern Saskatchewan, excluding the higher elevations of the Cypress Hills (Figure 2). In Alberta, it breeds in the Grassland Natural Region, south of Hanna and Youngstown and east of Drumheller, Vulcan, and Lethbridge, with most breeding south of the Red Deer River (COSEWIC 2006; Federation of Alberta Naturalists 2007). In Saskatchewan, it breeds in the Prairie Ecozone south of Saskatoon and west of Regina, and may occasionally breed on the southern edge of the Parkland near Saskatoon (Smith 1996; COSEWIC 2006; Saskatchewan Data Conservation Centre 2014). Breeding Bird Survey data show most breeding to be in the far southwest of the province (Sauer *et al.* 2014).

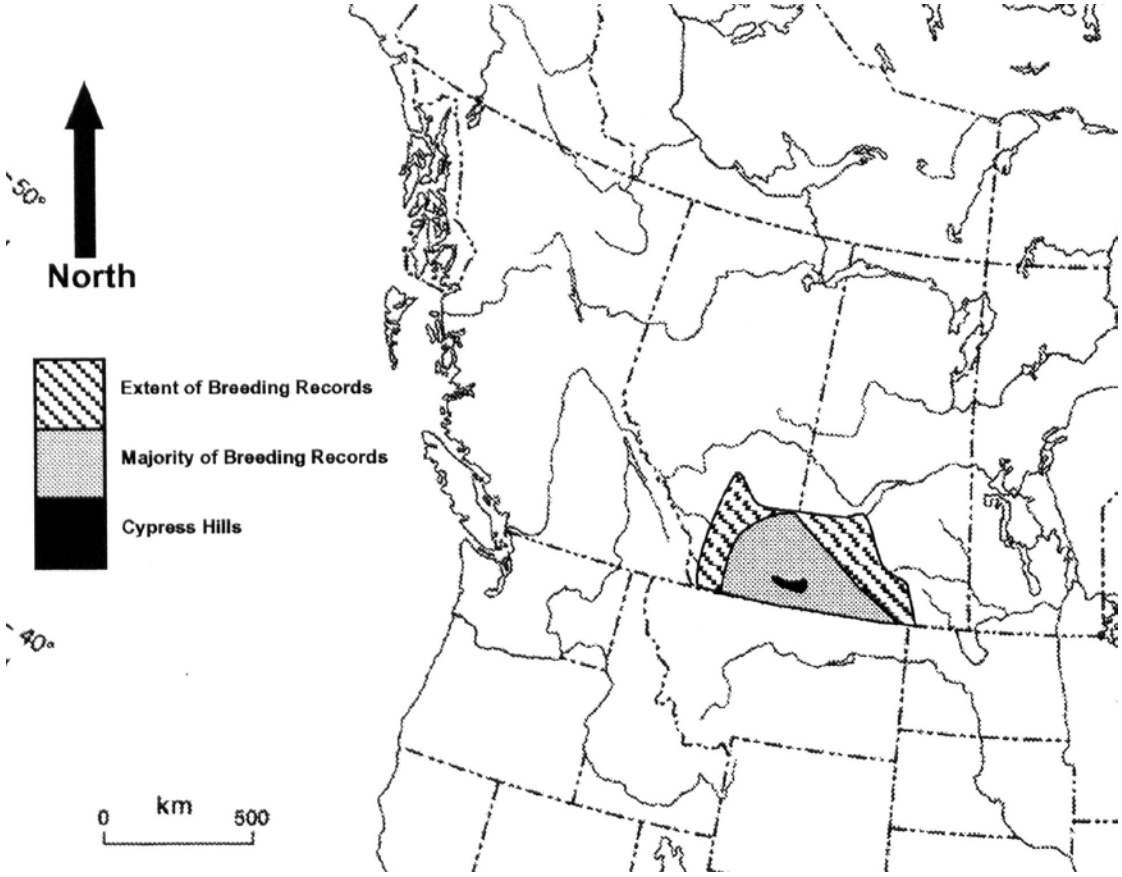

Figure 2. Breeding range of the McCown's Longspur in Canada (from COSEWIC 2006). Longspurs are uncommon on the edge of their breeding range (diagonal stripes) and are absent from the high elevations of Cypress Hills (black).

Extent of Occurrence and Area of Occupancy

The extent of occurrence (EOO) for McCown's Longspur, based on a minimum convex polygon around the range of the majority of breeding records as indicated in Figure 2, is 115,794 km^2 (J. Wu, pers. comm.). The index of area of occupancy (IAO) cannot be calculated precisely, but is >2000 km^2 (J. Wu, pers. comm.).

Search Effort

The McCown's Longspur is readily recognized and, because of its distinctiveness and rarity, is sought after by birders and other naturalists. It is also monitored by yearly surveys throughout its summer and wintering ranges (see "Sampling Effort and Methods"), although coverage of the southern portion of the wintering range in Mexico is sparse.

HABITAT

Habitat Requirements

The species breeds in semi-arid short-grass steppe and other grassland habitats that are similarly arid and close-cropped, including closely grazed mixed-grass prairie, tame pastures, and cultivated fields. Typical habitat has mostly short-cropped (~ 5 cm) grass [especially buffalograss (*Buchloe dactyloides*) and blue grama (*Bouteloua gracilis*)], 25-50% bare ground, and limited mid-grass (i.e., mixed grass of medium height), forbs, shrubs, or litter (Sedgwick 2004; With 2010; Bogard and Davis 2014; Henderson and Davis 2014; Sparks *et al.* 2005, 2014; Environment Canada 2014a). Birds are most likely to occupy areas where these features are maintained by grazing, fire, and/or periodic drought (Sedgwick 2004; Bleho 2009; Richardson 2012; Augustine and Baker 2013).

In addition to short-grass prairie, the species breeds on pastureland in mixed-grass prairie, provided that it is grazed frequently or heavily enough to simulate short-grass prairie (DeChant *et al.* 2002; Richardson 2012). The species is strongly associated with native and non-native grasslands, and is negatively associated with several kinds of human-modified habitats such as crop, hayfields, and roads (With 2010; Wellicome *et al.* 2014). Nonetheless, birds do also breed in wheat fields, stubble, and fallow fields. Indeed, results from Canada showed that 19 to 42% of observed McCown's Longspurs were in some type of crop (Dale *et al.* 2005). Moreover, one Alberta study suggested birds preferred to settle in conventionally tilled fields rather than minimally tilled fields (Martin and Forsyth 2003).

In Saskatchewan, territories established early in the season on snow-free southern slopes are often relocated to nearby areas that are exposed as the snow melts (With 2010). Occupancy and density vary dramatically on a local scale across years in response to habitat conditions, especially precipitation. The species can be locally absent in wet years and abundant in dry years (COSEWIC 2006; With 2010).

The microhabitat for the species' open-cup nest consists of a small depression, often near a clump of taller vegetation, such as a grass tussock, shrub, or cactus, or, more rarely, cow or horse dung (Dechant *et al.* 2002; With 2010). One study (in Colorado) showed that 75-80% of nests near shrubs were depredated (With 1994). Also, reproductive success declines with an increase in the density of shrubs (With 1994).

The species' need for 'large' areas of uninterrupted habitat has been noted in the literature, but a preferred size-range has not been explicitly noted. The species may prefer larger patches of grassland for breeding, because territories are clumped in space and do not decrease in size at high densities (With 2010). Also, fewer birds breed in patchier landscapes, in which grassland is interspersed with other habitats, such as agriculture or shrubland (McLachlan 2007). Conversely, large areas of apparently suitable habitat that is left unoccupied suggests that local populations are not limited by the availability of breeding habitat (Sedgwick 2004).

Winter habitat is similar to breeding habitat, consisting mainly of short-grass steppe dominated by *Bouteloua* and *Buchloe* grasses, but also includes pasture, plowed fields, and playas (Sedgwick 2004; Smith *et al.* 2004; With 2010). Playas are shallow lakebeds that alternately dry and flood and are characteristic of the southern plains in North America.

Habitat Trends

Over 70% of native grasslands in the Great Plains has disappeared since the late 1800s. This includes at least 40-50% loss of the mixed-grass and short-grass prairie in the McCown's Longspur's breeding and wintering range in Canada and the US (Samson *et al.* 2004). The species' main breeding habitat in Canada, dry mixed-grass prairie, is only 54% of its original area in Alberta and 38% in Saskatchewan (Canadian Prairie Partners in Flight 2004).

Most of this habitat was converted to agriculture, and much of what remains is heavily degraded (Hammermeister *et al.* 2001; Nernberg and Instrup 2005; Askins *et al.* 2007), especially by fragmentation and invasive species (Hammermeister *et al.* 2001; Gauthier and Wiken 2003; Roch and Jaeger 2014). The natural processes that maintained the species' short-cropped, partially bare habitat, specifically drought at a regional scale and grazing and fire at a more local scale, have been disrupted through altered hydrological patterns, more intensive and uniform grazing by cattle than by native grazing mammals, and fire suppression (Samson *et al.* 2004; CEC and TNC 2005).

More recently, native grassland in agricultural landscapes in the Canadian prairies declined by 10% (95% CI: 13-8%) between 1985 and 2001, mainly because remnant fragments of grassland have been converted to tame (planted) grass and cropland (Watmough and Schmoll 2007). The latest available census figures show a decrease in pastureland of 2% in Alberta and 4% in Saskatchewan between 2006 and 2011 (Statistics Canada 2014). Conversion of pastureland to cropland, especially spring wheat and oil seed, is projected to continue within the species' range, especially in Alberta (Rashford *et al.* 2011). In southern Alberta and Saskatchewan, oil and gas development, which destroys

and fragments habitat, has increased by 200-300% since the 1980s (Linnen 2008; Davies and Hanley 2010), although this is not all necessarily within the breeding range of the longspur.

On the wintering grounds, habitat trend information for Mexico is poor. However, at least 50% of original native grassland has been lost, and conversion to crops is continuing at a high rate (Desmond and Montoya 2006; Macias-Duarte *et al.* 2009) and appears to be increasing (Pool and Panjabi 2011). In the Valles Centrales of Chihuahua, which is centrally located in the species' wintering range, grassland decreased by 6.25% and cropland increased by 34% between 2006 and 2011 (Pool *et al.* 2014). In Texas, habitat fragmentation, as measured by the number of owners per ranch or farm area, increased by over 20% between 1997 and 2012, and is expected to continue (Texas Land Trends 2014). About 60% of the dry lakebeds that the species uses during migration and winter in the US were severely degraded by 1970, mainly through sedimentation from agricultural runoff, and this degradation is projected to continue (Burris and Skagen 2013).

BIOLOGY

With (2010) provides a comprehensive review of the species' biology and Sedgwick (2004) reviews aspects relevant to conservation. The account below is based mainly on those reviews.

Life Cycle and Reproduction

Birds arrive on the Canadian breeding grounds from mid-April to early May (With 2010). They are territorial and appear to mate monogamously, although genetic studies of parentage are lacking. Clutch size is 3-4 eggs and average brood sizes range from 1.7-2.8 nestlings across published studies. Young fledge after 10 days and are independent of parents about 3 weeks later (With 2010).

Reproductive success averages 1-2 fledglings per nesting attempt (Sedgwick 2004; With 2010). The main sources of nest failure are predators (listed below), which take 30-80% of nests. In one Colorado study, about half of pairs that had successfully raised one brood attempted a second brood, of which only about half were successful (With 1994).

Age at first breeding is unknown, but is likely 1 year, as in most other songbirds (With 2010). Lifespan is also unknown, but assuming that it is the 4 years typical of small songbirds, generation time would be about 2-3 years. Sources of mortality include predation, inclement weather that causes partial or complete nest failure (With 1994), and, historically at least, agricultural pesticides (see Threats).

Average territory sizes range from 0.6 to 1.4 ha across published studies (With 2010). Because territories have a minimum size and occur in clusters, breaks in habitat discourage settlement (McLachlan 2007). Also, the species' need for particular conditions, especially short-cropped grass and areas of bare ground, makes it dependent on factors that maintain

that habitat, such as drought, grazing, and fire. Finally, the species' heavy reliance on grasshoppers may expose it to pesticides used to control them (With 2010), especially within cropland.

Physiology and Adaptability

The one aspect of the McCown's Longspur's physiology that has been studied, its adrenocortical response to stress, shows a pattern typical of songbirds that normally produce only one brood per breeding season (Lynn *et al.* 2003). This restriction might be an adaptation for focusing care on one brood, given that frequent severe storms and heavy nest predation limit the prospects of raising two or more broods (Lynn *et al.* 2003).

Dispersal and Migration

In the only study of dispersal, none of 74 banded nestlings was detected again as an adult returning to the study site (With 2010), suggesting low fidelity to natal areas. Reoccupation of breeding sites across years suggests that adult site fidelity is also low, although it has not been studied (With 2010). On the wintering grounds, high annual variation in abundance at specific sites suggests that birds are highly mobile in response to variations in local conditions (Dieni *et al.* 2003; Panjabi *et al.* 2010), as is typical of grassland birds in general (Pool *et al.* 2012).

Post-breeding flocks begin forming in early August. Migration south from Canada begins between early August to the first week of October, and birds begin arriving on the wintering grounds from late September in the US to November in Mexico (With 2010). In spring, birds start leaving their wintering grounds between late February and late April and arrive back in Canada in mid- to late April (Grzybowski 1982; With 2010).

Interspecific Interactions

Predation rates on nests are high, especially at the nestling stage, and can affect 30-80% of nests (With 2010). Nests late in the season, in heavily grazed areas, or placed under grass clumps, forbs, or cowpats are especially prone to predation (With 2010). Known predators include Thirteen-lined Ground Squirrels (*Spermophilus tridecimlineatus)*, which prey on nest contents and adults, as well as Short-eared Owls (*Asio flammeus*), Swainson's Hawks (*Buteo swainsoni*), and Loggerhead Shrikes (*Lanius ludovicianus*), which prey on adults (Dubois 1937; With 1994). The species' predators (on nests and adults) presumably include the whole range of mid-sized predators of songbirds that are found in their breeding and wintering habitats, including gulls, raptors, corvids, rodents, mustelids, canids, and snakes (With 2010).

The diet of adult McCown's Longspurs consists mainly of seeds from a broad range of plant species, supplemented by a variety of arthropods, but the diet fed to nestlings is heavily (>80%) dependent on grasshoppers (With 2010).

Brown-headed Cowbirds (*Molothrus ater*), which lay their eggs in the nests of many North American songbirds, leaving the hosts to raise the young, rarely parasitize McCown's Longspurs (With 2010).

Outside the breeding season, McCown's Longspurs flock with Sprague's Pipits (*Anthus spragueii*), Chestnut-collared Longspurs (*Calcarius ornatus*), and, especially, Horned Larks (*Eremophila alpestris*; With 2010).

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

The North American Breeding Bird Survey (BBS) provides the most reliable source of population trend estimates for this species (Environment Canada 2011). The survey consists of annual visits to 40-km roadside routes that were selected through a stratified random design to cover the entire US and southern Canada. Each breeding season, volunteers count all birds detected during 50, 3-min. stops along each route. Species that avoid roads or occur in larger blocks of grassland, such as McCown's Longspur and several other grassland species, are under-sampled by the BBS (Dale *et al.* 2005; Wellicome 2014). Also, coverage of grassland BBS routes is inconsistent across years (Environment Canada 2014a). For these reasons, in 1996 the Grassland Bird Monitoring Program added 35 BBS routes along passable roads (rather than secondary or primary roads, as in the BBS), in grasslands in southeastern Alberta and southwestern Saskatchewan.

A second source of information on trends is the Christmas Bird Count (CBC), a one-day annual count of all the birds volunteers can find in a 15-mile-diameter circle within two weeks of Christmas. The circles are scattered throughout Canada, the US, and Mexico, according to interest and tradition rather than any statistical sampling design. Methods are not standardized as they are for the BBS, so accounting for effort is problematic (Sauer *et al.* 2004). Also, the presence of grassland songbirds, especially McCown's Longspur, at particular sites is erratic across years, yielding unreliable trend information (Pool *et al.* 2014). Moreover, few counts are conducted in areas of Mexico where McCown's Longspurs winter.

A final potential source of information on trends at a national scale is the Alberta Breeding Bird Atlas, in which volunteers searched for all breeding species within 10x10 km squares throughout the province for 5 years. The Alberta atlas was conducted in 1987-1992 and 2000-2005, so the likelihood that a given species was detected in particular squares in both time periods offers a coarse measure of population trend in the 13 years between those time periods (Federation of Alberta Naturalists 2007). However, survey effort was not recorded well, which reduces the reliability of results. There is an ongoing 'atlas' program in Saskatchewan, but so far it has not offered information on abundance or trends (Smith 1996; Saskatchewan Conservation Data Centre 2014).

Abundance

BBS data yield a population estimate of 138,000 adult McCown's Longspurs in Canada (RMBO 2012). While another estimate (based on expert opinion) gives the number as falling anywhere from 50,000 to 500,000 adults (Environment Canada 2011), the RMBO estimate is more reliable.

Fluctuations and Trends

In Canada over the long term (1970-2012, Figure 3, Table 1), the BBS shows a trend of -9.01% per year (95% CI: -13.8, -4.61, n=38), which is a decline over that period of 98% (Environment Canada 2014b). Although the overall reliability of this estimate is considered to be low for this species (Environment Canada 2014b), a long-term decrease of >50% is almost certain (probability = 0.999).

Over the short term, for the latest decade for which data are available (2002-2012, Figure 4, Table 1), the index for Canada shows a trend of -6.94% per year (95% CI: -13.8, 6.16, n=30), which is a decline over that period of 51% (Environment Canada 2014b). The overall reliability of this estimate is considered to be low, however. The probability of a decrease of >50% is 0.47, and the probabilities of a decrease of >25% and of any decrease at all are 0.77 and 0.88 (Environment Canada 2014b). Depicted another way, rolling 10-year trends for 1980-2014 show that estimated trends are below -30% for all years, and that about half of them are below the 50% mark (see Figure 5). Given statistical uncertainties of the 10-year estimate, the Canadian population has likely declined by at least 30% over the past decade.

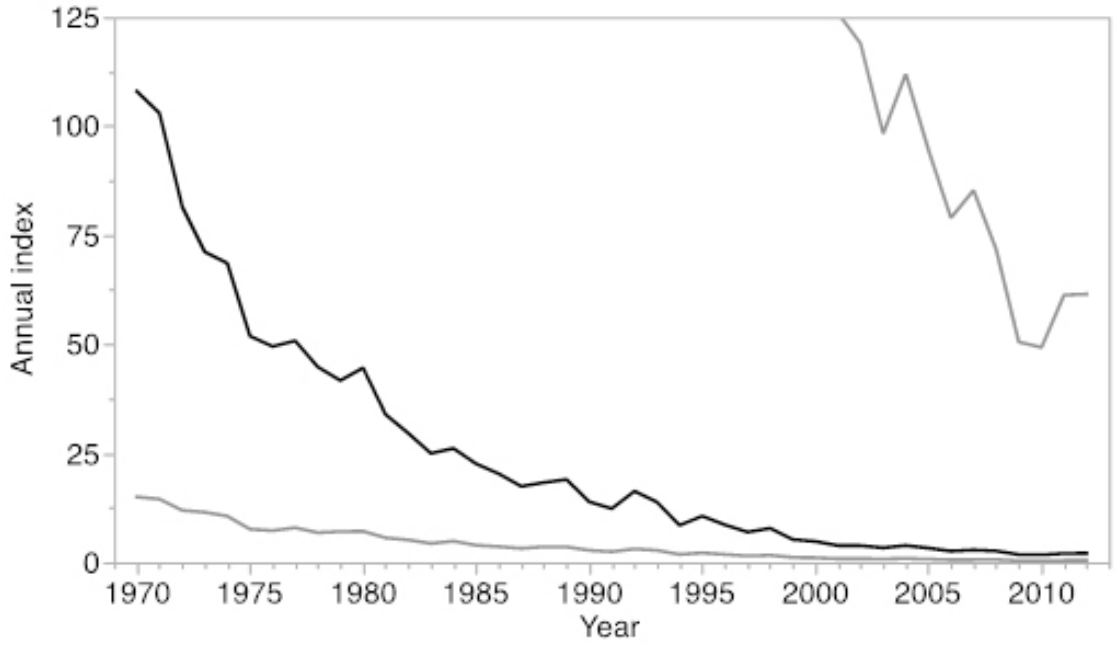

Figure 3. Breeding Bird Survey annual index of abundance for McCown's Longspur in Canada over the long term (1970-2012, black line) with 95% credible intervals (grey lines; based on Environment Canada 2014b).

Table 1. Breeding Bird Survey trends for McCown's Longspur (percent change per year, with 95% credible intervals in parentheses and sample size in number of survey routes). Long-term trend is from 1970-2012 for Canada, and 1968-2012 for the US and North America. Short-term trends are 2002-2012 for all regions. Sources: Environment Canada 2014b (Canada), Sauer *et al.* 2014 (other regions).

Region	Long-term trend	Short-term trend
Canada	-9.0% (-13.8, -4.6), N=38	-6.9% (-13.8, 6.2), N=30
United States	-1.0% (-3.7, 2.1), N=67	2.4% (-2.0, 9.4), N=67
North America	-4.2% (-7.1, -1.2), N=105	1.1% (-3.4, 6.8), N=105

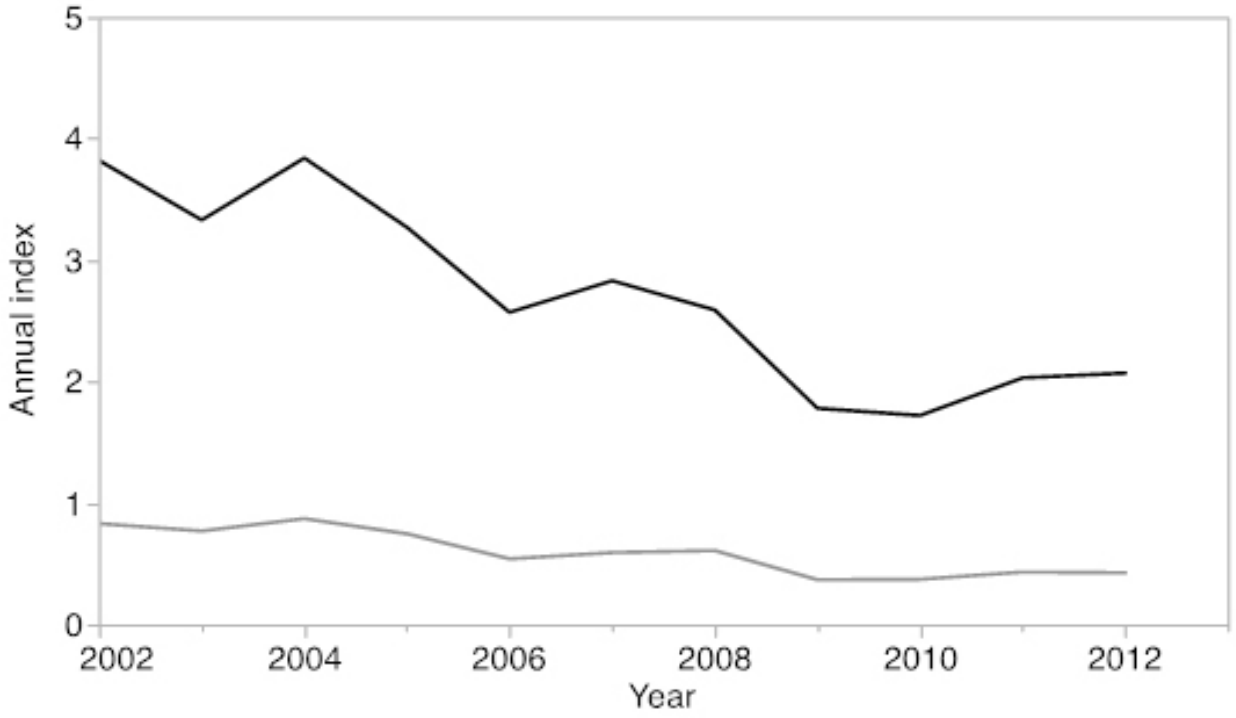

Figure 4. Breeding Bird Survey annual index of abundance for McCown's Longspur in Canada over the latest decade for which analyses were available (2002-2012, black line) with 95% credible intervals (grey line, lower limit only; for upper limit, see Figure 1; Environment Canada 2014b).

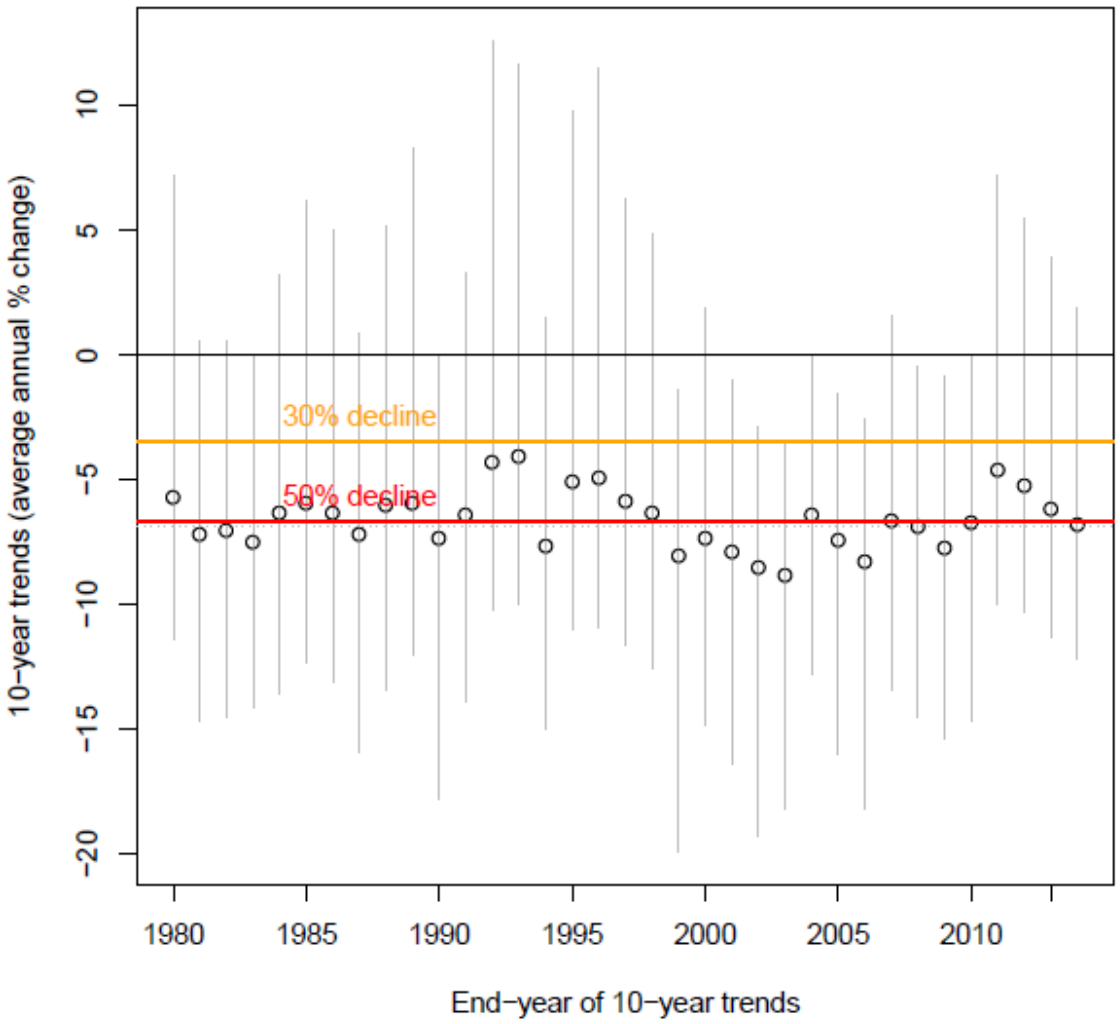

Figure 5. Rolling 10-year trends for McCown's Longspur in Canada from 1980 to 2014 based on the Breeding Bird Survey (courtesy of Adam Smith, Environment Canada). Horizontal lines mark cumulative 10-year trends of zero, -30% and -50%. Whiskers indicate 95% credible intervals. Note that all trend estimates fall below the 30% mark, and that about half of them fall below 50%.

For North America as a whole, long-term BBS data (1968 to 2012) show a trend of -4.24% (Figure 6, Table 1), which is a decline of 86%. More recently (2002-2012), however, the continental trend has shown wide credible intervals, rendering it indistinguishable from stable (Table 1).

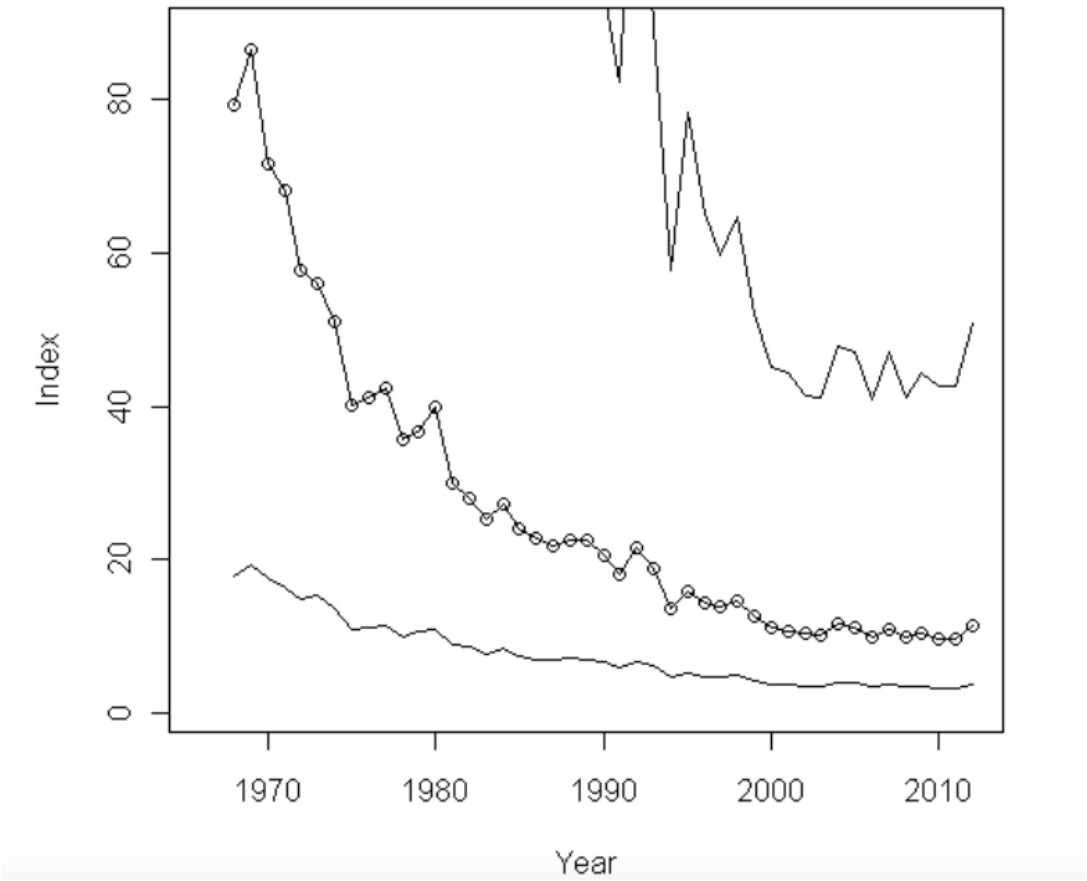

Figure 6. Breeding Bird Survey annual index of abundance for McCown's Longspur in North America over the long term (1968-2012), showing 95% credible intervals (outer lines), from Sauer *et al.* 2014.

CBC counts for this species, coarsely controlled for effort (by dividing by how many parties searched and for how long), are low and vary erratically from year to year (Figure 7). McCown's Longspurs are typically recorded on fewer than 20 CBC count circles each winter. The best available analyses of these trends, which account for variation in data quality among counts (details in Sauer *et al.* 2004), show that the long- and short-term CBC trends are indistinguishable from zero (mean percent change per year, with 95% credible intervals: 1970-2013: -1.9% (-7.8, 3.7); 2004-2013: 0.4% (-2.2, 3.9); Candan Soykan, pers. comm.). The reliability of these estimates is poor, however, as they are based on few detections of the species (Candan Soykan, pers. comm.).

The Alberta breeding bird atlas did not detect any change in distribution between 1987-1992 and 2000-2005 (Federation of Alberta Naturalists 2007). The species was found on only about 25 10x10 km squares in each atlas.

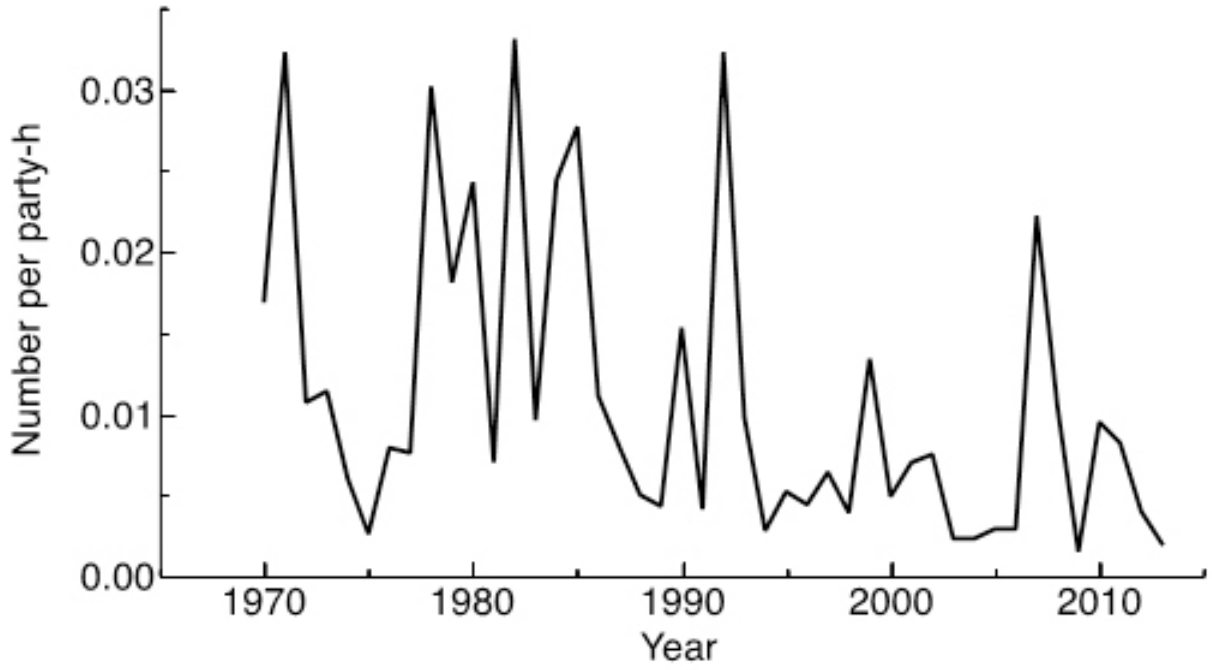

Figure 7. Number of McCown's Longspurs recorded per party-hour on Christmas Bird Counts in the US and Mexico, 1970-2013 (National Audubon Society 2014b).

Rescue Effect

The northern range of this species in the US is continuous with the Canadian range, and although dispersal has not been studied in this species, its natural history suggests that it is highly dispersive (see Population Spatial Structure and Variability, above). Recent trends across the United States appear to be more stable than in Canada, so potential immigrants to Canada should be available. Overall, rescue through immigration from US populations is possible, but judged unlikely. This is because substantial immigration would be needed to rescue a population that has been in such strong decline, and because there is ongoing loss of habitat in both Canada and the US.

THREATS

The threats to McCown's Longspur have not been studied in detail, and, because of the species' distinctive habitat requirements, may differ from those facing better-known grassland songbirds. In particular, whether natural system modifications and pesticides are having a current impact, as they are on other grassland songbirds, is uncertain. Nevertheless, because these impacts might be high, this section starts with these two threats, before proceeding to threats that are more certain, but whose impact is medium to negligible. Overall, threats were scored as having high to moderate impacts. For more information on how threats were assessed, see Appendix A.

Natural System Modifications

Several natural systems that maintained this species' habitat continue to be disrupted, some locally and some range-wide. Historically, these disruptions had a major impact on the species, but the current impact of these disruptions is unknown. Before European settlement, the habitat this species required was maintained by periodic grazing and fire locally, and by drought regionally. Now, grazing by native species, such as prairie dogs (*Cynomys* spp.), Bison (*Bison bison*), and Pronghorns (*Antilocapra americana*), has been largely replaced by cattle grazing, which tends to be less cyclical in a given area (Sedgwick 2004; Askins *et al.* 2007; Toombs and Roberts 2009). Patterns of fire and drought over space and time have also been disrupted, because of fire suppression, groundwater depletion, draining, and climate change (CEC and TNC 2005; Tsai *et al.* 2012).

Grasslands throughout the species' range are being invaded by exotic species that degrade the native prairie preferred by McCown's Longspur. Crested Wheatgrass (*Agropyon cristatum*) and Leafy Spurge (*Euphorbia esula*) have been singled out as particularly severe threats to breeding habitat in Canada (Canadian Prairie Partners in Flight 2004). Both breeding and, especially, wintering habitat are threatened by a wide range of invasive species (Sedgwick 2004; Pool *et al.* 2014), although the effects of these species on McCown's Longspurs have not been studied.

Agricultural Effluents

The impact of pesticides, including pesticides from runoff and from spraying, may be low or high. The threat is pervasive, because birds are no doubt exposed to a range of pesticides during their lifetime (including outside the breeding season), but the severity of the threat is uncertain.

Insecticide formulations characterized as being highly lethal to birds (carbamates, organophosphates, and organochlorides) are not known to have been used in recent years in Canada, but might still be used elsewhere in the species' range. Several studies have shown poisoning and/or reduced reproductive success of grassland songbirds, including McCown's Longspur, in response to application of insecticides. Specifically, application of toxaphene (an organochloride) has fatally poisoned nestling McCown's Longspurs (McEwen and Ells 1975), and application of carbofuran (a carbamate) has depressed neurotransmitters in nestling Chestnut-collared Longspurs (Martin *et al.* 2000) and killed arctic-nesting Lapland Longspurs on migratory stopover (Mineau *et al.* 2005). Analyses of grassland bird declines across the US suggested they were particularly severe in regions with heavier use of pesticides (Mineau *et al.* 2005; Mineau and Whiteside 2013), although this pattern has not been tested for McCown's Longspur specifically.

In recent years, the lethal insecticide formulations implicated in these studies are not known to have been used in Canada. Also, re-analysis of grassland bird trends across the US showed their relationship with insecticide use is uncertain, and that a far stronger correlate with population declines is habitat loss and degradation (Hill *et al.* 2014).

The latest information thus suggests that the threat posed by pesticides to longspurs when they are in Canada is low. Nonetheless, lethal pesticides might still be used on a restricted basis outside Canada, particularly in Mexico, where about 40% of the North American population winters (Environment Canada 2014a). Given the potential for Canadian breeders to be exposed to such pesticides, the threat might be high.

Oil & Gas Drilling

Habitat loss because of energy development is a threat with a low to medium impact on this species. The threat is low to moderate in severity, but is continuing and increasing throughout the species' range (CEC and TNC 2005; Roch and Jaeger 2014). The number of gas wells on grasslands has nearly tripled in the past 20 years in Canada (Linnen 2008; Davies and Hanley 2010) and doubled in the past 30 years in the US (Copeland *et al.* 2009; Naugle *et al.* 2010). In one study, abundance of McCown's Longspur was higher in areas with higher densities of gas wells. However, breeding density was lower near the wells, even when changes to vegetation were factored out, suggesting that birds were avoiding some other disturbance associated with the wells, such as noise produced by generators (Bogard and Davis 2014).

Annual and Perennial Non-timber Crops

An ongoing threat that can be serious locally is the conversion of habitat to agricultural uses. In both the breeding and wintering ranges, native grassland is still being destroyed or degraded by conversion to cropland and tame pasture (Sutter *et al.* 2000; CEC and TNC 2005; Askins *et al.* 2007; Dale *et al.* 2009). Habitat loss and degradation through crop production are projected to continue in both Canada and the US (CEC and TNC 2005; Stubbs 2007), and to continue and likely increase in Mexico (Pool and Panjabi 2011; Pool *et al.* 2014).

Crop production can also threaten habitat in other ways. Specifically, the McCown's Longspur's preference for short-cropped grassland with bare patches can lead birds to preferentially settle in more intensely tilled areas (Martin and Forsyth 2003), where their reproductive success might be lower. Also, agricultural runoff is filling in the playas that the species uses on its US migrating and wintering grounds (Burris and Skagen 2013). Finally, use of cropland may increase the species' exposure to pesticides (see above) and to certain agricultural operations that destroy nests (Environment Canada 2014a).

Renewable Energy

Locally, a threat that may have some impact is renewable energy development. Wind energy development is accelerating in the Prairie Provinces (CANWEA 2010, 2014) and US prairie states (AWEA 2014). The breeding range of McCown's Longspur has been identified as having the highest potential in Alberta for wind energy development (CANWEA 2014), and the northern portion of the wintering range, the Texas panhandle, accounts for 57% of current wind farm construction in the US (AWEA 2014). However, there is little definitive information on the effects of renewable energy (including wind and solar development) on McCown's Longspurs.

Transportation and Service Corridors

Locally, transportation and service corridors associated with some of the developments discussed above are a slight but continuing threat expected to have low impact overall. Specifically, crop development not only destroys habitat, but also, along with the shelterbelts and roadways associated with it, fragments habitat. Similarly, the increases in energy development noted above will also increase the trails, pipelines, and seismic lines associated with petroleum development, and the roads and transmission lines associated with wind turbine development (Leddy *et al.* 1999; Pruett *et al.* 2009).

The effects of fragmentation have not been studied in this species, but breeding density is lower near roads (Wellicome *et al.* 2014), and habitat fragmentation, while not known to be a threat in itself, breaks up the large areas required for territory settlement (see Physiology and Adaptability, above), and might increase access for predators, for example by providing perches for avian predators.

Residential & Commercial Development

Development projects, such as housing or campground developments, destroy habitat and thus are severe threats. However, they are so local as to have negligible impact on the overall population.

War, Civil Unrest & Military Exercises

Military exercises at Canadian Forces Base Suffield in Alberta occur regularly, but with unknown effect on the longspurs that breed there. There would be negligible impact on the overall population.

Climate Change

Climate change is a pervasive threat of unknown severity. Whatever impact it may have falls beyond the timeframe of this assessment. The northern Great Plains became warmer and drier during the 20th century, especially in the McCown's Longspur's Canadian range (Millett *et al.* 2009; Werner *et al.* 2013), with direct effects on the region's vegetation (Piwowar 2010). Some analyses predict this trend will continue for the next century (Sauchyn *et al.* 2009), and will result in an increase in the extent of wintering habitat, but with a concomitant decline in the species' breeding habitat by 2080 (Price 1995; National Audubon Society 2014a). Another analysis projected that habitat loss by 2100 could be anywhere from 0 to 100%, depending on which global climate model was used (Nixon *et al.* 2015).

Number of Locations

The number of locations, in the sense of distinct areas vulnerable to particular threats, cannot be calculated for this species, given its broad range and the variety of threats it faces. It is almost certainly >10.

PROTECTION, STATUS AND RANKS

Legal Protection and Status

The species is protected under the *Migratory Birds Convention Act* of 1994, which protects the birds and their eggs and nests. Since December 2007 it has been listed as Special Concern under Schedule 1 of the *Species at Risk Act*, which requires development of a management plan for the species. A management plan has been posted on the Species at Risk Registry (Environment Canada 2014a), and lists several actions already completed or currently underway. The species is not specifically protected under provincial legislation in Alberta or Saskatchewan.

Non-Legal Status and Ranks

In the US, the species is not listed under the *Endangered Species Act*, but is among the "Birds of Conservation Concern", which makes it a candidate for eventual consideration under the Act (USFWS 2008). Partners in Flight considers it a "Continental Stewardship Species", which makes it a priority for monitoring and conservation efforts (RMBO 2012).

At the global level, the species is ranked as Apparently Secure (G4), but this has not been updated since 2003. It is ranked as Vulnerable (S3) or Apparently Secure (S4) in Alberta (S3S4) and Saskatchewan (S3S4B). Rankings in the United States range from Imperilled (S2) to Apparently Secure (S4), except where the species is extirpated or its status is uncertain (Table 2).

Table 2. NatureServe Status Ranks for McCown's Longspur (NatureServe 2014).

Jurisdiction	Status*
Global	G4
Canada	N4B
Alberta	S3S4
Saskatchewan	S3S4B
United States	N4B, N4N
Arizona	S2
California	SNRN
Colorado	S2
Kansas	S3
Minnesota	SXB, SNRM
Montana	S3
Nebraska	S3
New Mexico	S3
North Dakota	S2
South Dakota	SUB
Texas	S4
Wyoming	S2

*N (at start of rank) National, S Subnational, B Breeding, N (at end of rank) Nonbreeding, 1 Critically Imperilled, 2 Imperilled, 3 Vulnerable, 4 Apparently Secure, 5 Secure, X Extirpated, NR Not Ranked, U Unrankable (due to lack of information or conflicting information).

Habitat Protection and Ownership

In Alberta, 56% of native grassland is on Crown land and is used mainly for grazing leases and community pastures, although only 2% is officially protected (Nernburg and Ingstrup 2005). In Saskatchewan, 32% of native grassland is protected by government or non-government organizations in various ways. This includes parks, lands where the *Wildlife Habitat Protection Act* applies, community pastures, and properties held by the Nature Conservancy of Canada. However, this amounts to only 9.4% of the Saskatchewan Prairie Ecozone (Gauthier *et al.* 2002).

Formally protected lands that have McCown's Longspurs include Grasslands National Park (907 km^2), Suffield National Wildlife Area (459 km^2), Onefour Heritage Rangeland Natural Area (92 km^2), and Twin River Heritage Rangeland Natural Area (150 km^2; COSEWIC 2006).

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Andrew Gregg Horn earned his B.Sc. in Biological Sciences at Cornell University and his Ph.D. in Zoology at University of Toronto, where he studied the singing behaviour of Western Meadowlarks. Now he is a Research Adjunct at Dalhousie University, researching acoustic communication by birds and teaching courses in behavioural ecology. He also undertakes various projects in avian monitoring and assessment, and has written several status and recovery documents, including update status reports for two other grassland birds, Baird's Sparrow and Ipswich Sparrow.

Appendix A. Results of Threat Calculator Teleconference (17 Feb 2015).

Species or Ecosystem Scientific Name	McCown's Longspur *Rhynchophanes mccownii*
Assessor(s):	Jon McCracken, Dwayne Lepitzki, Andrew Horn, Ruben Boles, Julie Perrault, Patricia Rosa, Stephen Davis, Brandy Downey
References:	telecon 17 Feb 2015

Overall Threat Impact Calculation Help:		**Level 1 Threat Impact Counts**	
	Threat Impact	**high range**	**low range**
	A Very High	0	0
	B High	1	0
	C Medium	1	0
	D Low	2	4
Calculated Overall Threat Impact:		High	Medium

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development		Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)	
1.1	Housing & urban areas		Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)	
1.2	Commercial & industrial areas						
1.3	Tourism & recreation areas						There is a campground planned in east block of Grasslands NP, where there are few birds (most are in the west block).
2	Agriculture & aquaculture	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	
2.1	Annual & perennial non-timber crops	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	Conversion of pastures depends on whether it is economically viable. The severity depends on the agricultural practices used.
2.2	Wood & pulp plantations						
2.3	Livestock farming & ranching		Not a Threat	Pervasive (71-100%)	Neutral or Potential Benefit	High (Continuing)	Moderate, heterogeneous grazing is beneficial, but heavy, homogeneous grazing is detrimental.
2.4	Marine & freshwater aquaculture						
3	Energy production & mining	CD	Medium - Low	Large (31-70%)	Moderate - Slight (1-30%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
3.1	Oil & gas drilling	CD	Medium - Low	Large (31-70%)	Moderate - Slight (1-30%)	High (Continuing)	Includes the pads, etc., but not the roads and pipelines, which are instead dealt with below. Oil drilling has bigger vegetation and noise disturbance footprint than gas. Development of gas is declining, but of oil is increasing. The severity depends very much on the site-specific implementation.
3.2	Mining & quarrying						There's a small potential of gravel mining in Alberta that may affect some habitat.
3.3	Renewable energy	D	Low	Restricted - Small (1-30%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)	There's potential for both wind and solar projects, e.g., in Alberta, but the time between approval and implementation is quite variable. There's much uncertainty over the effect of renewable energy on this species. E.g., mortality at wind turbines may be low, but avoidance may be high; there's little information on this.
4	Transportation & service corridors	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	
4.1	Roads & railroads	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	May increase predation from increased perches for avian predators.
4.2	Utility & service lines		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	This category includes oil and gas pipelines
4.3	Shipping lanes						
4.4	Flight paths						
5	Biological resource use						
5.1	Hunting & collecting terrestrial animals						
5.2	Gathering terrestrial plants						
5.3	Logging & wood harvesting						
5.4	Fishing & harvesting aquatic resources						
6	Human intrusions & disturbance		Negligible	Negligible (<1%)	Unknown	High (Continuing)	
6.1	Recreational activities						
6.2	War, civil unrest & military exercises		Negligible	Negligible (<1%)	Unknown	High (Continuing)	Refers to military exercises at Suffield.
6.3	Work & other activities						This is a very understudied species, so the impact of any research activities is negligible.
7	Natural system modifications		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
7.1	Fire & fire suppression		Unknown	Pervasive (71-100%)	Unknown	High (Continuing)	This is a historical threat to the species. The major impact has already occurred to this species.
7.2	Dams & water management/use						Groundwater depletion is a threat to wintering habitat, but its threat to breeding habitat is unknown.
7.3	Other ecosystem modifications		Unknown	Large - Small (1-70%)	Unknown	High (Continuing)	Includes effects of non-native species that change habitat. Non-native species are widespread, but their impact on the species is largely unknown.
8	Invasive & other problematic species & genes						
8.1	Invasive non-native/alien species						
8.2	Problematic native species						
8.3	Introduced genetic material						
9	Pollution	BD	High - Low	Pervasive (71-100%)	Serious - Slight (1-70%)	High (Continuing)	
9.1	Household sewage & urban waste water						
9.2	Industrial & military effluents						
9.3	Agricultural & forestry effluents	BD	High - Low	Pervasive (71-100%)	Serious - Slight (1-70%)	High (Continuing)	This category includes agricultural pesticides from runoff, but also sprayed pesticides (which other threats calculators might include under 9.5). Although pesticide use might be low within the Canadian breeding range, bird's that breed in Canada will certainly be exposed within their lifetimes. Forestry effluents not an issue here.
9.4	Garbage & solid waste						
9.5	Air-borne pollutants						
9.6	Excess energy						
10	Geological events						
10.1	Volcanoes						
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						
11	Climate change & severe weather		Not Calculated (outside assessment timeframe)	Pervasive (71-100%)	Unknown	Low (Possibly in the long term, >10 yrs)	Categories 11.1-11.4 were considered individually and in combination, and concluded to all have the same scope, severity, and timing.
11.1	Habitat shifting & alteration						
11.2	Droughts						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.3	Temperature extremes						
11.4	Storms & flooding						