

# Recovery Plan for the Barn Owl (*Tyto alba*) in British Columbia



Prepared by the B.C. Ministry of Environment



March 2014

## **About the British Columbia Recovery Strategy Series**

This series presents the recovery documents that are prepared as advice to the Province of British Columbia on the general approach required to recover species at risk. The Province prepares recovery documents to ensure coordinated conservation actions and to meet its commitments to recover species at risk under the *Accord for the Protection of Species at Risk in Canada* and the *Canada–British Columbia Agreement on Species at Risk*.

### **What is recovery?**

Species at risk 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 a species' persistence in the wild.

### **What is a provincial recovery document?**

Recovery documents summarize the best available scientific and traditional information of a species or ecosystem to identify goals, objectives, and strategic approaches that provide a coordinated direction for recovery. These documents outline what is and what is not known about a species or ecosystem, identify threats to the species or ecosystem, and explain what should be done to mitigate those threats, as well as provide information on habitat needed for survival and recovery of the species. This information may be summarized in a recovery strategy followed by one or more action plans. The purpose of an action plan is to offer more detailed information to guide implementation of the recovery of a species or ecosystem. When sufficient information to guide implementation can be included from the onset, all of the information is presented together in a recovery plan.

Information in provincial recovery documents may be adopted by Environment Canada for inclusion in federal recovery documents that the federal agencies prepare to meet their commitments to recover species at risk under the *Species at Risk Act*.

### **What's next?**

The Province of British Columbia accepts the information in these documents as advice to inform implementation of recovery measures, including decisions regarding measures to protect habitat for the species.

Success in the recovery of a species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this document. All British Columbians are encouraged to participate in these efforts.

### **For more information**

To learn more about species at risk recovery in British Columbia, please visit the B.C. Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

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## **Cover illustration/photograph**

Christopher Martin Photography ©  
Barn Owl hunting at Boundary Bay, Delta, BC

## **Additional copies**

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>>

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## Disclaimer

This recovery plan has been prepared by the British Columbia Ministry of Environment, as advice to the responsible jurisdictions and organizations that may be involved in recovering the species. The B.C. Ministry of Environment has received this advice as part of fulfilling its commitments under the *Accord for the Protection of Species at Risk in Canada*, and the *Canada–British Columbia Agreement on Species at Risk*.

This document identifies the recovery strategies and actions that are deemed necessary, based on the best available scientific and traditional information, to recover Barn Owl population in British Columbia. Recovery actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and recovery approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions and all members of the recovery team have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals on the recovery team.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this plan. The B.C. Ministry of Environment encourages all British Columbians to participate in the recovery of Barn Owl.

## **ACKNOWLEDGEMENTS**

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## EXECUTIVE SUMMARY

The Barn Owl (*Tyto alba*) is a medium-sized owl with a distinctive heart-shaped facial disc and blackish eyes. Its upper body colour ranges from deep grey and buff, to golden, to almost white, with grey and black markings.

The Barn Owl was designated as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in November 2010. The main reasons for uplisting the Barn Owl population to Threatened was the ongoing loss and degradation of grassland and old field habitat, loss of nest sites as old farms structures are demolished, and increasing road mortality due to major road development and increased traffic volume on the existing road network. It is listed as Special Concern in Canada under Schedule 1 of the *Species at Risk Act* (SARA). In British Columbia, the Barn Owl is ranked S3 (Special Concern, 2009) by the Conservation Data Centre, and is on the provincial Blue list. It is protected from capture and killing under the B.C. *Wildlife Act*. Recovery is considered to be biologically and technically feasible.

The Barn Owl predominantly inhabits lower-elevation grassland/farmland habitats in southwestern British Columbia. It is a small mammal specialist and cavity nester, known to use a variety of man-made structures for nesting.

Main threats to the Barn Owl include:

- residential and commercial development (direct loss of grassland habitats as land is converted to housing, commercial, and industrial buildings; loss of nest sites as old trees and farm buildings are demolished);
- changes in agricultural practices (loss of habitat as grassland-associated agriculture is transformed to vegetable, berry, and greenhouse production; loss of nest sites as old barns and silos are either demolished or sealed up); and
- transportation and service corridors (increased road mortality).

The following is the recovery (population and distribution) goal for Barn Owl:

To arrest the decline of the Barn Owl population and distribution, such that population size does not fall below current levels, and such that the species persists throughout its existing range in British Columbia.

The following are the recovery objectives:

1. Prevent additional habitat degradation and/or loss by either protecting<sup>1</sup> or enhancing available habitat within the Barn Owl's range in B.C.
2. Assess and mitigate current threats within the Barn Owl's range in B.C. (e.g., road mortality and risk of rodenticide poisoning, nest site loss).
3. Establish and implement a B.C. monitoring program so that trends in occupancy and habitat availability can be established throughout the Barn Owl's range.
4. Address knowledge gaps to further understand impacts of threats (e.g., determine minimum habitat requirements; evaluate effects of secondary rodenticide exposure).

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<sup>1</sup> Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, sale of private lands by willing vendors, land use designations, and protected areas.

## RECOVERY FEASIBILITY SUMMARY

Recovery of the Barn Owl in British Columbia is considered technically and biologically feasible based on the criteria outlined by the Government of Canada (2009):

- 1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.**  
Yes. COSEWIC (2010) estimates a population of 250–1000 mature individuals; however, it suggests that the current population size is likely to be in the low to mid-range of this estimate. Nonetheless, the Barn Owl has high recovery and management potential for several reasons: they are capable of high reproductive output, they may have two broods within one season, they take readily to nest boxes, they reach sexual maturity at one year of age, and they are typically non territorial. When prey abundance is high, all of the aforementioned characteristics provide mechanisms for rapid population increase and expansion into suitable habitat (Taylor 1994; Marti *et al.* 2005). In addition, the population in Washington State (where the Barn Owl is considered secure: S4) likely provides dispersing individuals, which could increase genetic variation.
- 2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.**  
Yes. Sufficient habitat is currently available to support the Barn Owl population; however, planned urban development and road expansion will result in further habitat loss and range contraction. To reduce net loss and continued fragmentation of habitat, there is a need to protect, restore, and enhance existing habitat.
- 3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.**  
Yes. The main threats to Barn Owls are urban and highway developments and changes in agricultural practices, resulting in loss and degradation of habitat and increased road mortality. This can be mitigated and strategic partnerships can be created, with the most important mechanisms being protection and enhancement of remaining habitat and enhancing opportunities for adaptation in modified landscapes. This is particularly important for Barn Owls in the Lower Mainland and the Fraser Valley, where the greatest abundance of Barn Owls is combined with the fastest growing cities in B.C. (Ip and Grundlingh 2013). Losses due to highway mortality can be addressed by conducting surveys and identifying high risk locations and implementing appropriate mitigation measures.
- 4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.**  
Yes. Habitat conservation, enhancement and restoration, in conjunction with mitigation measures to reduce road mortality, will be suitable recovery techniques to achieve population and distribution objectives.

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## 1 COSEWIC\* SPECIES ASSESSMENT INFORMATION

<p><b>Assessment Summary:</b> November 2010</p> <p><b>Common Name:**</b> Barn Owl – Western population</p> <p><b>Scientific Name:**</b> <i>Tyto alba</i></p> <p><b>Status:</b> Threatened</p> <p><b>Reason for Designation:</b> Western Canada supports a small fraction of the global population of this charismatic nocturnal raptor that preys on small rodents. Owing to its intolerance of cold climates and deep snow cover, populations in Canada are restricted to parts of southern British Columbia and southwestern Ontario. The Western population in British Columbia is small and threatened by ongoing loss and degradation of grassland and old field habitat to intensive agriculture and urbanization, and by the conversion of old wooden barns and other rural buildings to more modern structures. This owl is also exposed to increasing levels of road-kill mortality owing to expansion of the road network and increases in traffic volume.</p> <p><b>Occurrence:</b> British Columbia</p> <p><b>Status History:</b> The species was considered a single unit and designated Special Concern in April 1984. In April 1999, the Western and Eastern populations were assessed separately. The Western population was designated Special Concern. Status re-examined and confirmed in November 2001. Status re-examined and designated Threatened in November 2010.</p>
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\* Committee on the Status of Endangered Wildlife in Canada.

\*\* Common and scientific names reported in this recovery plan follow the naming conventions of the British Columbia Conservation Data Centre, which may be different from names reported by COSEWIC.

## 2 SPECIES STATUS INFORMATION

<b>Barn Owl<sup>a</sup></b>	
<b>Legal Designation:</b>	
<a href="#">FRPA:</a> <sup>b</sup> No	B.C. <i>Wildlife Act:</i> <sup>c</sup> Schedule A <a href="#">SARA:</a> <sup>d</sup> <a href="#">Schedule 1</a> – Special Concern (2003)
<a href="#">OGAA:</a> <sup>b</sup> No	
<b>Conservation Status<sup>e</sup></b>	
B.C. List: Blue	B.C. Rank: S3 (2009) <a href="#">National Rank:</a> N3 (2005)    Global Rank: G5 (1996)
Other <a href="#">Subnational Ranks:</a> <sup>f</sup> S1: IL, ON, NY, VT, RI, IA, DC, MI;	S2: MA, AR, WV, SD, CT, IN, OH, WY
	S3: GA, VI, PA, NC, NJ, DE, AL, KS, KY, MD, MS, MO, NE, OK, TN, UT
	S4: CO, NM, LA, MT, NV, OR, SC, WA    S5: ID, AZ, TX
<b>B.C. Conservation Framework (CF)<sup>g</sup></b>	
<a href="#">CF Action Groups:</a>	Compile Status Report; Monitor Trends; Send to COSEWIC; Habitat Protection; Private Land Stewardship; Species and Population Management; Planning

<sup>a</sup> Data source: B.C. Conservation Data Centre (2013) unless otherwise noted.

<sup>b</sup> No = not listed in one of the categories of wildlife that requires special management attention to address the impacts of forest and range activities on Crown land under the *Forest and Range Practices Act* (FRPA; Province of British Columbia 2002) and/or the impacts of oil and gas activities on Crown land under the *Oil and Gas Activities Act* (OGAA; Province of British Columbia 2008).

<sup>c</sup> Schedule A = designated as wildlife under the B.C. *Wildlife Act*, which offers it protection from direct persecution and mortality (Province of British Columbia 1982).

<sup>d</sup> Schedule 1 = found on the List of Wildlife Species at Risk under the *Species at Risk Act* (SARA).

<sup>e</sup> S = subnational; N = national; G = global; B = breeding; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure.

<sup>f</sup> Data source: NatureServe (2012).

<sup>g</sup> Data source: B.C. Ministry of Environment (2010).

### 3 SPECIES INFORMATION

#### 3.1 Species Description

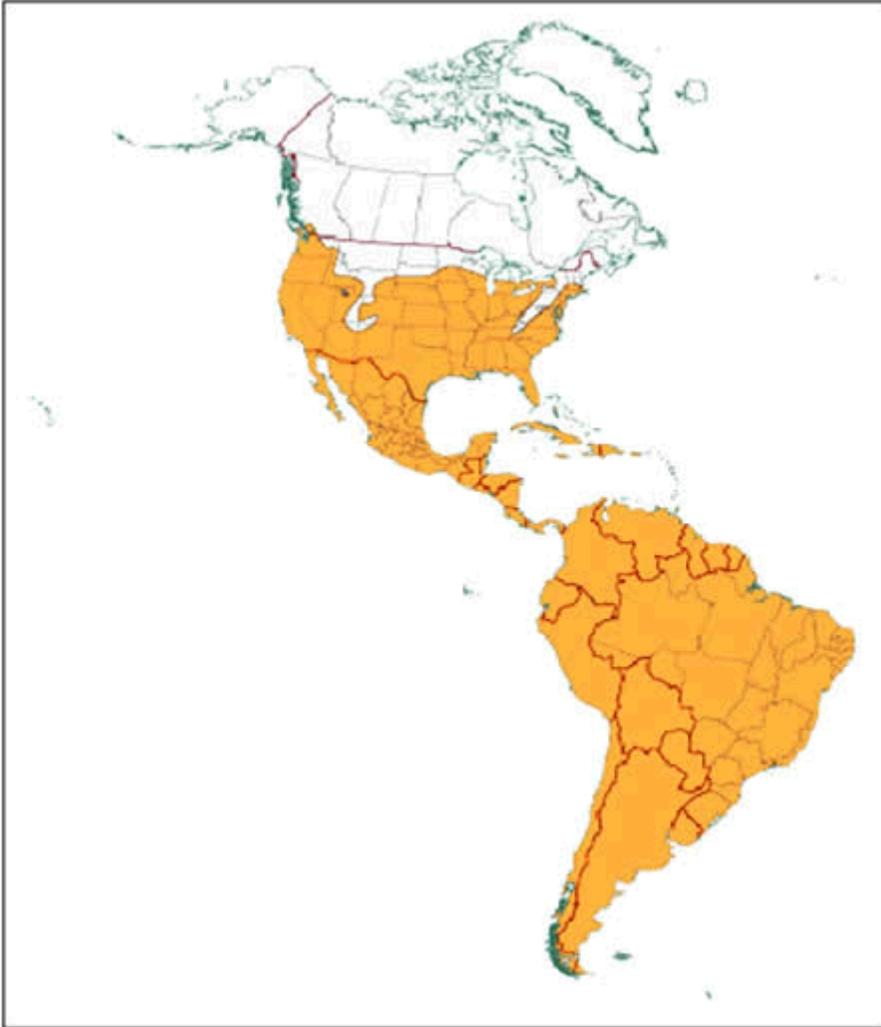
The Barn Owl (*Tyto alba*) is a medium-sized owl with a distinctive heart-shaped facial disc and blackish eyes. Their colouration varies depending on subspecies. In general, their upper body colour ranges from deep grey and buff, to golden, to almost white. All have a degree of white, grey, and black markings. The colour on the under-parts is variable; typically, females are darker and have more and larger brown and black spots and speckles than the males, which can appear completely white on their ventral surface. Barn Owls have noticeably long legs and wings compared to body size; the latter allow for quiet, slow, buoyant flight, and low wing loading (Taylor 1994). In North America (subspecies: *pratincola*), females are significantly larger than males (female length: 33–40 cm, 420–700 g; male length: 32–39 cm, 400–560 g; Marti *et al.* 2005). Barn Owls do not hoot, but make a variety of screams, twitters, and hisses.

#### 3.2 Populations and Distribution

##### 3.2.1 Global Distribution and Abundance

The Barn Owl is one of the most widely distributed of all land birds (Taylor 1994) and there are approximately 30 recognized subspecies (Chandler 2011). Its range includes most of the Americas; the Caribbean islands; Europe; parts of North Africa; most of sub-Saharan Africa; parts of the Arabian Peninsula; Southern Asia; Australasia; and various islands in the Atlantic, Indian, and Pacific oceans, including Madagascar, the Cape Verde, the Galapagos, the Falklands, and Hawaii. Its marginal tolerance for sub-zero temperatures limits its northward distribution. The global rank for the Barn Owl is G5 (secure; NatureServe 2012).

In North America, the Barn Owl is the single representative of the Tytonidae, and there is only one subspecies *Tyto alba pratincola*. In the United States, the Barn Owl is found in Washington, southern Idaho, Montana, South Dakota, Iowa, southern Wisconsin, southern Michigan, New York, southern Vermont, Massachusetts, and South through the remaining states. It is sparsely and patchily distributed across most of its range in the northern U.S. (COSEWIC 2010). It reaches its northern limit in southwestern and south-central British Columbia and southern Ontario.



**Figure 1.** Barn Owl distribution in Canada/Americas (COSEWIC 2010).

### **3.2.2 Canadian Range**

Canada is the northern limit of the Barn Owl's range in North America, and they are only known to breed in southwestern B.C. (Western population) and southern Ontario (Eastern population) (Figure 1; COSEWIC 2010). The species is a year-round resident in southern B.C., with the core population found in the southwestern corner of the province (COSEWIC 2010). Elsewhere in Canada, the Barn Owl is listed as a vagrant or accidental (COSEWIC 2010).

### **3.2.3 British Columbia Distribution**

The Barn Owl inhabits lower elevations in southern B.C. It is most common in the Lower Mainland and in the Fraser Valley east to Hope, where it is best described as uncommon (COSEWIC 2010). The Vancouver Island Inventory Project documented Barn Owls from Sooke to Campbell River, including the Gulf Islands, with most confirmed sightings from the Cowichan Valley (P. Levesque, pers. comm., 2013; Figure 2). Elsewhere in B.C., it is a rare resident in

southern parts of the B.C. Interior with breeding documented in Osoyoos and the Kootenay Valley as far east as Creston (D. Cannings, pers. comm., 2013). The species is accidental in other parts of B.C.

The B.C. Breeding Bird Atlas Survey conducted from 2008 to 2012, recorded Barn Owls in 40 10 x 10 km squares from eight atlas regions in southwestern B.C.: Greater Vancouver (13 squares), Central Fraser Valley (9 squares), Victoria–Southern Gulf Islands (5 squares), Comox Valley–Campbell River (5 squares), Chilliwack–Hope (3 squares), South Okanagan Boundary (2 squares), Nanaimo–Qualicum (2 squares), and Lillooet–Lytton (1 square) (B.C. Breeding Bird Atlas 2013).

Most known nest sites are on private land; for example, 87% of the known nest site locations in Delta, Surrey, Richmond, and Vancouver are on private property (S. Hindmarch, unpubl. data, 2013).

### **3.2.4 Distribution Trends and Population Size in British Columbia**

The first official record of a Barn Owl was documented in Ladner in 1909. It was a female with enlarged ovaries, indicative of breeding (Brooks 1909). Over 30 years passed before the first record of an active nest site was documented in 1941 at Crescent Beach (Cowan 1942).

There are few historical records on the distribution and population size of Barn Owls in B.C. but, as in other areas of North America (Colvin 1985), their numbers and range likely increased during the first half of the 20th century due to the expansion of suitable agricultural habitat (Cowan 1942). This expansion came following European settlement as forests were cleared and replaced with pastures and hay fields, and barns and other structures augmented the availability of nest and roost sites (Solymár and McCracken 2002). Since a large part of the Barn Owls' range would have been floodplain dominated by meadows and low shrub vegetation, in addition to some peripheral riparian habitat (North and Teversham 1984), it is possible that Barn Owls occurred in small numbers in B.C. before the mid-19th century and European settlement.

From the 1970s onwards, the abundance and range of the Barn Owl likely decreased due to changes in agricultural practices and the increase in the human population size, both of which led to the degradation and/or direct loss of habitat. For example, Metro Vancouver and the Fraser Valley have experienced major human population growth, in conjunction with the removal of approximately 12,000 ha (9%) of land from the Agricultural Land Reserve (ALR) since its creation in 1974 (ALC 2009). The loss of agricultural land has happened predominantly in areas that are close to major urban centres and transport corridors; hence, a substantial amount of suitable habitat and range contraction has occurred in South Vancouver (Southlands), North Richmond, south New Westminster, and North Delta over the last 30–40 years. Recent inventories and banding projects have had a regional focus (e.g., Andrusiak 1994; Hindmarch 2010; D. Clegg, pers. comm., 2013; P. Levesque, pers. comm., 2013 [Vancouver Island Barn Owl Inventory Project]). Combined, these studies suggest that the strongest indicator of population decline and range contraction is the rate at which suitable habitat is becoming degraded, fragmented, and lost. For example, Hindmarch (2010) showed that suitable nesting and foraging habitat in Surrey and Delta has been substantially degraded, fragmented, and/or lost

due to urbanization and agricultural intensification since the beginning of the 1990s. Similar habitat degradation and loss are likely occurring in the rest of the Lower Mainland and parts of the Fraser Valley.

Campbell and Campbell (1984) conducted the only long-term province-wide Barn Owl survey. From 1970 to 1981, a total of 2642 barns were surveyed and 232 nest sites and 443 roost sites were documented; the population was estimated at a 1000 mature individuals (including non-breeding birds). Currently, the total number of mature individuals has been estimated at 250 to 1000 individuals, but based upon recent breeding studies and Christmas Bird Count information, the real population size is likely to be at the lower to mid-range of this estimate (COSEWIC 2010).

In general, population trends for Barn Owls in North America have not been well documented, mainly because Barn Owls are nocturnal and secretive, they do not respond to call play-back, and most nest sites are on private property. Consequently, Barn Owls are likely to be under-reported during general bird surveys (e.g., BC Breeding Bird Atlas Project, Christmas Bird Count, and Breeding Bird Survey). The total population for the U.S. and Canada is estimated at 300,000 individuals, which is based on breeding bird survey data from the 1990s (Partners in Flight 2007); this equates to B.C. supporting 0.1 to 0.3% of the population.

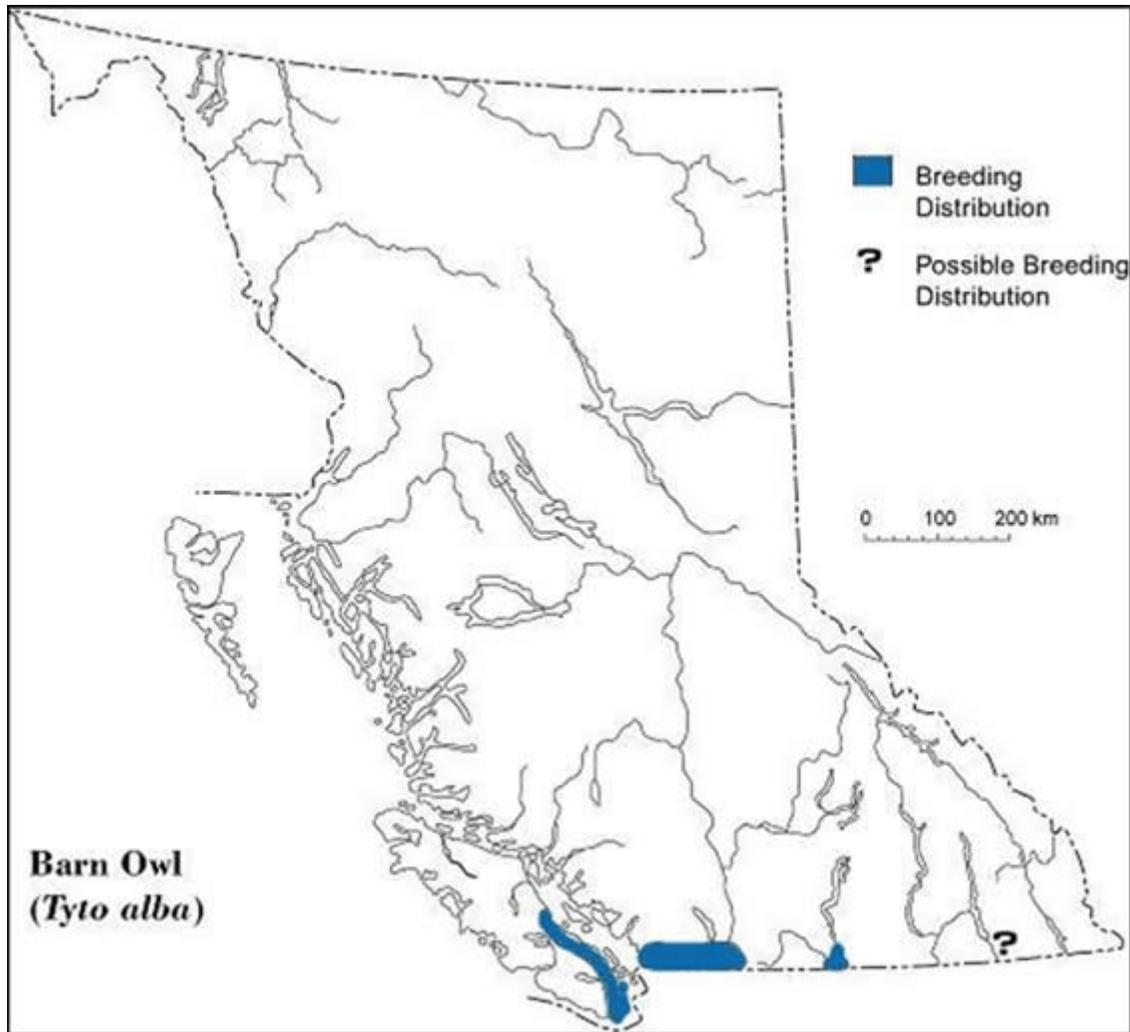


Figure 2. Barn Owl distribution in British Columbia (COSEWIC 2010).

### 3.3 Needs of the Barn Owl

#### General Habitat Requirements

The Barn Owl has adapted to low elevation open habitats such as grasslands, meadows, marshes, desert, and agricultural landscapes (Taylor 1994). The main requirements are that the habitat supports an abundance of accessible small mammal prey and that there are sufficient protected cavities for nesting nearby (Marti *et al.* 2005).

The Barn Owl requires warmer habitats as it has a limited ability to withstand sub-zero temperatures, due to a lack of insulation and fat deposits (Piechocki 1960; Edwards 1987). Further, snow cover impedes its ability to hunt (Marti 1994). This restricts its northward distribution.

### **Foraging Requirements**

The Barn Owl requires an abundance of small mammals that occur in habitats that are accessible to its hunting methods. The Barn Owl's diet is made up mostly of field voles (*Microtus* spp.) but also includes rats, shrews, and mice (Marti 1992).

In B.C., Townsend's Voles (*Microtus townsendii*) are the main constituent in the diet (Cowan 1942: 73%; Doerkson 1969: 76.1%; Dawe *et al.* 1978: 79.9%; Campbell *et al.* 1987: 73%; Hindmarch 2010: 65%). Between 1941 and 1981, Campbell *et al.* (1987) conducted the only long-term diet study ever done in B.C. They documented both seasonal and inter-annual fluctuations in the proportion of voles in the diet, which is thought to reflect the voles' annual cyclical abundance, and hence availability. Small mammal abundance has also been shown to be correlated with annual Barn Owl productivity and population size (Otnen *et al.* 1972; Gubanyi *et al.* 1992; Taylor 1994). Grassy set-asides that are > 2 years old have shown to have the greatest density of field voles, and would therefore be considered the most important foraging habitat for Barn Owls in B.C. (Merkens 2004).

Barn Owls are nocturnal hunters. Venturing out during daylight puts them at risk of being harassed by crows (*Corvus* spp.) and diurnal raptors, and they only seem to do this when food abundance is low, mainly during winter (S. Hindmarch, pers. comm., 2013).

### **Nesting and Roosting Requirements**

Barn Owls nest and roost in a wide variety of natural and artificial nest structures. The following nest/roost sites have been documented in B.C.: cavities in live and dead trees; elevated platforms in barn lofts, silos, hangars, water towers, bridges/overpasses, and attics; crevices between stacked hay bales; and behind insulation in buildings (Campbell and Campbell 1984; Andrusiak 1994; S. Hindmarch, pers. comm., 2013). In B.C., Barn Owls predominantly nest/roost in human-made structures (> 95%), and they have been shown to take readily to nest boxes (Marti *et al.* 1979). Out of 30 nest boxes placed in Delta in 1992, 17 (57%) had been used for nesting by Barn Owls a year later (Andrusiak 1994). Similarly, a more recent ongoing nest box program by the Delta Farmland and Wildlife Trust (DFWT) documented nesting in 10 of 13 installed boxes, within a year following installation (C. Terpsma, pers. comm., 2013).

Nests in natural tree cavities have been located in the following tree species in B.C.: live and dead black cottonwood (*Populus balsamifera*), live and dead Douglas-fir (*Pseudotsuga menziesii*), live bigleaf maple (*Acer macrophyllum*), and dead western redcedar (*Thuja plicata*) (Andrusiak 1994). Trees suitable for nesting/roosting are often older with large cavities, making them vulnerable to rotting and/or waterlogging, and therefore short lived as nest sites (Taylor 1994; Hindmarch *et al.* 2012).

### **Home Range**

In general, Barn Owl pairs are non-migratory and stay year-round within their home range, with only slight seasonal variation in home range size. In B.C., documented Barn Owl home range sizes have varied from 60 ha to as large as 1767 ha (S. Hindmarch and J. Elliott, unpubl. data, 2013). However, they typically vary around 300 ha, which equates to about a 1-km radius around the nest/roost site (Byrd 1982; Taylor 1994).

Barn Owls have been known to fly 5–8 km from their nest/roost site to take advantage of more profitable feeding patches in both rural (Colvin 1984; Hegdal and Blaskiewicz 1984) and fragmented urban landscapes (S. Hindmarch and J. Elliott, unpubl. data, 2013). Home ranges often overlap between breeding pairs (Taylor 1994), and nests by different pairs have been located in the same structure (Smith *et al.* 1974; Andrusiak 1994; Hindmarch 2010).

### 3.4 Ecological Role

In southwestern B.C., the Barn Owl is one of the top predators in open field habitats, be it native meadows or fields associated with agricultural production. Their main prey item, the Townsend's Vole, is an important prey item for many diurnal/crepuscular raptors, as well as other species such as the Great Blue Heron (*Ardea herodias*). The presence of a productive Barn Owl population is therefore indicative of a healthy small mammal population.

The Barn Owl's role as a rodent predator, combined with its non-territorial behaviour, makes it a good candidate for being part of an integrated pest management program. It could be particularly economically beneficial to agriculturalists such as berry farmers who lose significant parts of their crops to rodents.

Barn Owls can also provide prey opportunities for other animals. Predators of Barn Owls include larger raptors, such as the Bald Eagle (*Haliaeetus leucocephalus*) and the Great Horned Owl (*Bubo virginianus*) (Rudolph 1978; Knight and Jackman 1984; Millsap and Millsap 1987; S. Hindmarch, pers. obs., 2013). In Terra Nova Park, Richmond, B.C., a Great Horned Owl preyed on eight Barn Owls during the 2012 breeding season, two of which were banded young of the year (R. Kenny, pers. comm., 2013).

Crows (*Corvus* spp.) will mob Barn Owls aggressively, which can lead to mortality if young birds are kept grounded, because they are then susceptible to opportunistic terrestrial predators, such as Coyotes (*Canis latrans*) and Raccoons (*Procyon lotor*) (S. Hindmarch, pers. obs., 2013).

### 3.5 Limiting Factors<sup>2</sup>

#### Ecological Suitable Range in British Columbia

The Barn Owl's range is limited by cold winters as it is poorly adapted to sub-zero temperatures and is unable to hunt when there is more than 30cm of snow cover on the ground (Marti and Wagner 1985). Severe winters and unusually cold springs have been known to increase mortality and nest abandonment (Stewart 1952; Marti and Wagner 1985; D. Clegg, pers. comm., 2013). In addition, the Barn Owl requires open lowland foraging habitat and cavity nesting opportunities, which effectively limit the Barn Owl's ecological suitable range in B.C. to the southwestern

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<sup>2</sup> Limiting factors are generally not human induced and include characteristics that make the species or ecosystem less likely to respond to recovery/conservation efforts (e.g., inbreeding depression, small population size, and genetic isolation; or likelihood of regeneration or recolonization for ecosystems).

corner of the province, though a few breeding records exist for the B.C. Interior close to the U.S. border.

### **Small Population Size**

Small population size can become a limiting factor for a species through issues such as isolation, inbreeding depression, and demographic stochasticity. Isolation can become limiting when populations become so small and remaining individuals become so widely separated that some single birds are not able to find mates, thereby creating a situation where the effective population size is smaller than the actual population size (SOPET 1997). Inbreeding depression occurs when populations are so small that individuals have few genetically diverse mate choices and the negative effects of inbreeding plays a role in significantly reducing fitness. Once a population is reduced to below a certain threshold, random genetic drift will result in some alleles being lost by chance in the transfer of genetic material from one generation to the next (Caughley and Gunn 1995). The lost alleles may be related to adaptation to certain conditions and their loss could therefore increase the species' risk of extinction or extirpation. Small populations are disproportionately vulnerable to various stochastic events and influences. Demographic stochasticity in small populations means that changes in population size from one year to the next are more related to pure chance than age-specific survival and reproduction. That is, population size varies between years, but when the population is small, this variation has more chance of causing extirpation (Chutter *et al.* 2004).

## **4 THREATS**

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (Salafsky *et al.* 2008). For purposes of threat assessment, only present and future threats are considered.<sup>3</sup>

For the most part, threats are related to human activities, but they can be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., invasive species introduction). Effects of natural phenomena (e.g., fire, hurricane, flooding) may be especially important when the species or ecosystem is concentrated in one location or has few occurrences, which may be a result of human activity (Master *et al.* 2009). As such, natural phenomena are included in the definition of a threat, though should be applied cautiously. These stochastic events should only be considered a threat if a species or habitat is damaged from other threats and has lost its resilience, and is thus vulnerable to the disturbance (Salafsky *et al.* 2008) such that this type of event would have a disproportionately large effect on the population/ecosystem compared to the effect they would have had historically.

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<sup>3</sup> Past threats may be recorded but are not used in the calculation of Threat Impact. Effects of past threats (if not continuing) are taken into consideration when determining long-term and/or short-term trend factors (Master *et al.* 2009).

## 4.1 Threat Assessment

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For a detailed description of the threat classification system, see the [CMP website](#) (CMP 2010).

Threats may be observed, inferred, or projected to occur in the near term. Threats are characterized here in terms of scope, severity, and timing. Threat “impact” is calculated from scope and severity. For information on how the values are assigned, see [Master \*et al.\* \(2009\)](#) and table footnotes for details. Threats for the Barn Owl were assessed for the entire province (Table 1).

**Table 1.** Threat classification table for the Barn Owl in British Columbia.

Threat # <sup>a</sup>	Threat description	Impact <sup>b</sup>	Scope <sup>c</sup>	Severity <sup>d</sup>	Timing <sup>e</sup>
1	Residential & commercial development	Medium	Large	Moderate	High
1.1	Housing & urban areas	Medium	Large	Moderate	High
1.2	Commercial & industrial areas	Medium	Restricted	Serious	High
1.3	Tourism & recreation areas	Negligible	Negligible	Moderate	Moderate
2	Agriculture & aquaculture	Medium	Large	Moderate	High
2.1	Annual & perennial non-timber crops	Medium	Large	Moderate	High
2.3	Livestock farming & ranching	Low	Small	Slight	High
4	Transportation & service corridors	Medium	Large	Moderate	High
4.1	Roads & railroads	Medium	Large	Moderate	High
4.4	Flight paths	Negligible	Small	Negligible	High
5	Biological resource use	Negligible	Negligible	Negligible	High
5.3	Logging & wood harvesting	Negligible	Negligible	Negligible	High
6	Human intrusions & disturbance	Negligible	Negligible	Negligible	High
6.1	Recreational activities	Negligible	Negligible	Negligible	High
7	Natural system modifications	Negligible	Negligible	Slight	High
7.3	Other ecosystem modifications	Negligible	Negligible	Slight	High
8	Invasive & other problematic species & genes	Negligible	Negligible	Unknown	High
8.1	Invasive non-native/alien species	Negligible	Negligible	Unknown	High
9	Pollution	Low	Pervasive	Slight	High
9.3	Agriculture & forestry effluents	Low	Pervasive	Unknown	High
11	Climate change & severe weather	Not Calculated	Restricted	Unknown	Low
11.2	Droughts	Not Calculated	Unknown	Unknown	Low
11.4	Storms & flooding	Negligible	Negligible	Unknown	Low

<sup>a</sup> Threat numbers are provided for Level 1 threats (i.e., whole numbers) and Level 2 threats (i.e., numbers with decimals).

<sup>b</sup> **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on severity and scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

<sup>c</sup> **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species’ population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

<sup>d</sup> **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or 3-generation timeframe. Usually measured as the degree of reduction of the species’ population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

<sup>e</sup> **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [ $< 10$  years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

## 4.2 Description of Threats

The overall province-wide Threat Impact for this species is High.<sup>4</sup> This overall threat considers the cumulative impacts of multiple threats. The greatest threats for the Barn Owl are commercial and residential development, road mortality and changes in agriculture land use and practices (Table 1). Details are discussed below under the IUCN Threat Level 1 and 2 headings.

### 4.2.1 Medium- and Low-impact Threats

#### IUCN-CMP Threat 1. Residential & commercial development

##### 1.1 Housing & urban areas; 1.2 Commercial & industrial

The greatest threat currently facing Barn Owls in B.C. is the expansion of residential and commercial development into areas of suitable foraging habitats and active nest/roost sites. This has led to significant and ongoing habitat and nest site loss, especially in municipalities that are close to major cities (COSEWIC 2010). Remaining lowland field habitats close to major urban centres in the Lower Mainland and Fraser Valley are faced with immense developmental pressure, as projected human population is expected to almost double by 2036 (Ip and Grundlingh 2013). Hindmarch *et al.* (2012) showed that all measures of development in Delta and Surrey increased within a 1-km radius of each potential Barn Owl site between the 1990s and 2007/2008. The area of urban cover<sup>5</sup> increased by 133%, the length of secondary roads increased by 18%, and corresponding grass cover around sites decreased by 53%. Similar patterns of nest site and habitat loss have been observed in Abbotsford, Chilliwack, and Agassiz over the same period (D. Clegg, pers. comm., 2013; G. Powers, pers. comm., 2013). The human population in the Lower Mainland and the Fraser Valley is expected to almost double by 2036; hence the conversion of farmland (e.g., proposed Tsawwassen First Nation development is projected to remove 207 ha of farmland from the ALR [Aboriginal Affairs and Northern Development Canada 2010; B.C. Ministry of Transportation and Infrastructure 2013]) and larger acreage properties into high density residential and commercial buildings is predicted to continue at a steady rate (BC Stats 2011). This is of particular concern as (1) the ecological suitable range of the Barn Owl is limited to the southwestern portion of B.C., and (2) the Lower Mainland and the Fraser Valley are considered the geographical stronghold of the B.C. population (COSEWIC 2010; B.C. Breeding Bird Atlas 2013).

#### IUCN-CMP Threat 2. Agriculture and aquaculture

##### 2.1 Annual and perennial non-timber crops

Agricultural intensification has led to the conversion of old wooden barns into inaccessible steel barns. Old tower silos are now obsolete, and even though retaining old trees is part of the biodiversity program within the Environmental Farm Project (K. Sutherland, pers. comm., 2013),

<sup>4</sup> The overall threat impact was calculated following Master *et al.* (2009) using the number of Level 1 Threats assigned where timing = High or Moderate, which included 3 Medium and 1 Low (Table 1).

<sup>5</sup> This calculation of “urban cover” includes some forms of development that are not included under the IUCN-CMP Threat 1 category (e.g., greenhouses); however, it is provided here as an indication of this threat.

old trees have been removed as part of field enlargement programs, resulting in the loss of Barn Owl nesting/roosting sites (Taylor 1994; Ramsden 1998; Solymár and McCracken 2002). As old structures deteriorate, they are replaced by modern structures, which for most types of animals and for crop and machine storage are generally designed to exclude birds (K. Sutherland, pers. comm., 2013). In Delta and Surrey, B.C., Hindmarch (2010) found that almost one-third of occupied nesting/roosting sites in the 1990s were no longer available to owls in 2007/08.

Most greenhouse operations are concentrated in the lowland portions of southwestern British Columbia. Although the 2011 data indicate that the greenhouse footprint has more than doubled since 1996 (Statistics Canada 2011), this represents a small portion (0.4%) of the total area farmed in the Metro Vancouver and the Fraser Valley Regional District (approximately 462 ha). The DFWT has successfully offset some of the loss of tall grass habitat through farmer participation in their grassland set-aside program.

In addition, overall intensification of agriculture has put a premium on agriculture land. The price of agricultural land in the Lower Mainland is high and there has been a shift in land use with more land being converted to berry and field vegetable crops for economic reasons. A decline in grass acreage from 1996 to 2011 (BC Stats 2011) is due in part to the decline in the beef industry, and the movement of dairy farms from the Lower Mainland to the B.C. Interior (K. Zimmermann, pers. comm., 2013). A comparison of the 1996 and 2011 census data shows a significant decrease in the number of cattle and calves, milk cows, and beef cows. A decrease in animal agriculture in favour of horticulture crops has also been seen in the Comox Valley (J. Hatfield, pers. comm., 2013). There is now less land in pasture and non-intensive forage production. As pasture and non-intensive forage production is prime habitat for voles, the population of voles has decreased.

### 2.3 Livestock farming and ranching

Some changes to livestock farming are not beneficial to Barn Owls. Food health and safety regulations have rendered many types of actively used barns inaccessible to any forms of wildlife (Canadian Food Inspection Agency 2010). Poultry barns have to be completely sealed and dairy barns often place nets in the ceiling so that European Starlings (*Sturnus vulgaris*) and other birds are unable to roost inside the barns. Most grass fields are cut up to 3–4 times per year for hay and silage production instead of being used as pasture for livestock. Such intensively cut grass fields are considered low quality habitat for field voles, the main prey item of the Barn Owl (Edge *et al.* 1995; Tattersall *et al.* 2000).

Most poultry and dairy farms in B.C. are situated in the Lower Mainland and the Fraser Valley (B.C. Ministry of Agriculture 2011). The number of poultry birds has increased over the past 15 years, but the total number of cattle and calves has decreased (K. Zimmermann, pers. comm., 2013); however, the production of both has remained relatively stable since 2008 (Statistics Canada 2011).

## **IUCN-CMP Threat 4. Transportation & service corridors**

### 4.1 Roads & railroads

The Barn Owl has evolved to fly low (1–2 m above ground) and at slow speeds when foraging. This behaviour makes them particularly vulnerable to being hit by vehicles when either crossing roads and/or hunting along grassy roadside verges or interchanges, particularly along major highways (Preston and Powers 2006; Boves and Belthoff 2012). Accumulating research from North America and Europe is showing that vehicle collisions are a major cause of Barn Owl mortality (Newton *et al.* 1991; Baudvin 1997; Fajardo 2001; Lodé 2000; Preston and Powers 2006; Boves and Belthoff 2012). Mortality rates are particularly high on highways that are elevated compared to the rest of the surrounding landscape (Baudvin 1997; Lodé 2000). Boves and Belthoff (2012) conducted a 2-year road survey on a 248-km stretch of Interstate 84 in southern Idaho, and estimated a mortality rate of 1.6 owls per kilometre per year. After adjusting for search and removal bias, the mortality rate estimate was as high as 6.0 owls per kilometre per year, and predominately sub-adults and females were affected. In B.C., vehicle collisions are known to kill and injure a large number of owls. Andrusiak (1994) reported that 63% (n = 341) of Barn Owls found dead in the Fraser Valley were killed by vehicle collisions. Similarly, Preston and Powers (2006) found Barn Owls to be the most frequently found dead owl along highways in the Fraser Valley, representing 57% (n = 542 Barn Owls) of the road killed owls (n = 10 species) found in 1987 and 1995–2005.

Urbanization of the landscape also means expansion and upgrading of existing road networks (Hindmarch *et al.* 2012). Hindmarch *et al.* (2012) investigated how changes to landscape attributes in Delta and Surrey over time have affected Barn Owl site occupancy. Their findings indicate that Barn Owls had a greater tendency to persist at sites with lower increases in traffic exposure and that current occupancy was negatively influenced by the length of highway within a 1-km radius. Arguably, there is no evidence to demonstrate a direct link between changes in site occupancy and road mortality, but the lower occupancy at suitable sites close to highways suggests a higher turnover at these sites. In B.C., road mortality is likely to intensify and impact a larger proportion of the Barn Owl population as major new highways are currently being built, such as the South Fraser Perimeter Road (South Fraser Perimeter Road 2013), which has removed 90 ha from the ALR. Existing highways are also being expanded such as Highway 1 and the George Massey Tunnel (B.C. Ministry of Transportation and Infrastructure 2013). For example, the Trans-Canada Highway #1 has experienced major widening and expansion between 2008 and 2013, including the construction of the new Port Mann Bridge and corresponding approach and corridor from the bridge to the Langley/Abbotsford area. The George Massey Tunnel planned expansion includes areas through Richmond (north side) and into Delta (south side) along Highway 97, which runs through low-elevation farmland and owl foraging habitat (J. Heron, pers. comm., 2013). Conversion of Barn Owl habitat to roadways results in permanent loss of habitat.

Further, road mortality rates are likely to be correlated with the loss and fragmentation of foraging habitat resulting from residential and commercial development within an area. Increasing patchiness and limited habitat may increase the frequency at which Barn Owls cross major highways and/or lead to more foraging along grassy road side verges; both activities increase the risk of vehicle collisions.

## **IUCN-CMP Threat 9. Pollution**

### 9.3 Agriculture and forestry effluents

Anticoagulant rodenticides are commonly used to suppress rodent populations, and subsequent direct or secondary poisoning of non-target species has been documented worldwide (Newton *et al.* 1990; Eason *et al.* 2002; Stone *et al.* 2003). In B.C., work by Albert *et al.* (2010) found that 62% (n = 78) of the Barn Owl carcasses collected throughout the province, between 1988 and 2003, tested positive for one or more anticoagulant rodenticide. In most instances, Barn Owls were testing positive for second-generation anticoagulant rodenticides. These compounds are found to be more toxic and persistent in the tissues of animals, thus posing a greater risk to non-target species than the more commonly known first-generation products such as warfarin. Interestingly, secondary rodenticide poisoning was only diagnosed as the primary cause of death in two Barn Owls (3%) (Albert *et al.* 2010). However, more recent residue data from 2006 to 2011 showed the exposure rate in Barn Owls had increased to 75% (n = 16), and three failed Barn Owl clutches were confirmed to have died outright from rodenticide poisoning (J. Elliott *et al.*, unpubl. data, 2013). The high presence of residues in Barn Owls warrants more research to determine the risk of sub-lethal effects on the population, such as reduced productivity and/or foraging capabilities.

As farmers are required by mandatory food safety programs to control rats and other rodents, and anticoagulant rodenticides are currently the most effective tool at their disposal (K. Zimmermann, pers. comm., 2013), this will likely remain an issue until better alternatives are developed.

## **4.2.2 Other Threats Considered**

The following threats have a negligible Threat Impact or could not be scored as the threat was unlikely to occur within the timeframe for assessment (Table 2). They are mentioned here for completeness.

## **IUCN-CMP Threat 1. Residential & commercial development**

### 1.3 Tourism & recreation areas

The short monoculture grass associated with golf courses is unsuitable for most species of wildlife. In 1988, Agricultural Land Commission (ALC) lost its authority to allow or refuse golf courses on ALR land. Consequently, a major spike in golf course developments took place between 1988 and 1991. In total 89 proposals, primarily on farmland close to urban areas, were allowed to proceed before a moratorium on golf course development in the ALR land took effect in 1991 (Quayle 1998).

Golf courses are still being built within the Barn Owl's range in B.C. (e.g., the Tsawwassen Golf and Country Club housing development has been approved and is currently being built; Corporation of Delta 2008), but these conversions are occurring at a much slower rate.

## **IUCN-CMP Threat 4. Transportation & service corridors**

### 4.4 Flight paths

Since 2009, Vancouver International Airport (YVR) has reported an average of nine Barn Owls struck by aircraft per year. Bird strike data before 2009 are less reliable, as it was not until then that YVR adopted Transport Canada's more rigorous definition of a bird strike; however, data from 2003 to 2008 still indicate an average of 6 strikes per year with a peak of 14 recorded in 2005 (D. Bradbeer, pers. comm., 2013). The Airport Authority is trying to reduce strikes by relocating raptors and managing the airfield habitats to reduce vole abundance (D. Bradbeer, pers. comm., 2013).

## **IUCN-CMP Threat 5. Biological resource use**

### 5.3 Logging and wood harvesting

As trees in urban areas (including parks) get older, they begin to decay and can acquire various types of disease that can cause them to become unstable and in danger of falling. When this happens they present a potential danger to humans and/or structures, and when assessed and deemed dangerous by an arborist, they have to be selectively removed as a precautionary measure. Unfortunately, such trees are also more likely to provide potential nesting cavities for Barn Owl than younger healthier trees, so removing them can unintentionally result in reduced nesting opportunities.

## **IUCN-CMP Threat 6. Recreation activities**

### 6.1 Recreational activities

The Barn Owl habituates easily to most routine human disturbances. However, unpredictable disturbance by people during the day at quieter roost/nest sites might surprise and flush the Barn Owl, which puts it at risk of being harassed by crows and day-time raptors. Continued disturbance by humans (e.g., wildlife viewing, nest inspections, pellet collection) during the early phases of breeding (eggs or young chicks) can lead to nest abandonment (COSEWIC 2010).

## **IUCN-CMP Threat 7. Natural system modifications**

### 7.3 Other ecosystem modifications

Grassy habitats in parks and along greenways are often intensively managed and kept short at all times to accommodate sport activities and reduce littering. As intensively mowed grass habitat is unable to support vole populations (Edge *et al.* 1995; Tattersall *et al.* 2000), it is of little value as foraging habitat for Barn Owls. In Terra Nova Park, Richmond, B.C., park managers have tried to offset this trend by purposely leaving areas of the park unmowed, mimicking old field habitat, in conjunction with installing three Barn Owl nest boxes. Combined with public outreach, the program has been very successful: two out of three boxes were occupied by Barn Owls and had successful breeding within a year. To try to offset the loss of valuable grassy habitats in the city,

Richmond Parks is trying to implement the same concept in smaller parks and green spaces (R. Kenny, pers. comm., 2013). As urban development becomes increasingly dense, adopting a more ecologically friendly aesthetic in urban park zones and along roadsides, etc., may help mitigate negative impacts towards Barn Owls.

## **IUCN-CMP Threat 8. Invasive and other problematic species and genes**

### 8.1 Invasive non-native/alien species

In many areas, especially along the south coast, grassy habitats will eventually, become covered with a dense cover of blackberry bushes (*Rubus fruticosus*) if not actively managed, which will impede the Barn Owl's ability to hunt.

Further, reed canarygrass (*Phalaris arundinacea*) has the ability to invade grass and marshlands and outcompete native grass species. Reed canarygrass is of little value for field voles, and hence reduces the quality of the grassland as foraging habitat for Barn Owls (Taitt 2006).

## **IUCN-CMP Threat 11. Climate change and severe weather**

### 11.2 Droughts; 11.4 Storms and flooding

It is unknown how climate change could potentially impact the Barn Owl's range and abundance in B.C. over the next 10–20 years. Historical climate data suggest that southern B.C. is already experiencing the impacts of climate change, with an average annual temperature increase of 0.6°C and an increase in precipitation of 2–4% per year. Predictions for the 21st century estimate an annual average temperature increase of 1–4°C for B.C. (B.C. Ministry of Environment 2002). Milder winters with less snow cover would be beneficial to Barn Owls, and might even lead to range expansion. Conversely, more winter precipitation and extreme weather would negatively impact Barn Owls. Increased rainfall would impair the owl's hunting efficiency, especially as heavy rains are often associated with strong winds, which would make it harder for the owls to detect prey using auditory cues. In addition, rainfall during winter, when temperatures are close to zero, has been shown to reduce vole activity (Baumler 1975; Lehmann and Sommersberg 1980). Increased precipitation would also increase the risk of flooding, especially in lowland areas of the Lower Mainland and the Fraser Valley, thereby reducing available foraging habitat.

At the other extreme, prolonged summer droughts will affect the growth of the vegetation and hence the voles' food supply, which can result in reduced summer and autumn vole densities (Ostfeld and Canham 1995). The late summer/early fall is a critical time period for newly fledged, dispersing Barn Owls to learn how to hunt efficiently and to find new territories, thus a smaller food supply might reduce the recruitment of individuals to the population.

## **5 RECOVERY GOAL AND OBJECTIVES**

### **5.1 Recovery (Population and Distribution) Goal**

The following is the recovery (population and distribution) goal for Barn Owl:

To arrest the decline of the Barn Owl population and distribution, such that population size does not fall below current levels, and such that the species persists throughout its existing range in B.C.

### **5.2 Rationale for the Recovery (Population and Distribution) Goal**

Historical records suggest that Barn Owls have been present in B.C. at some level from at least the beginning of the 20th century, and the species may have occurred in low numbers in suitable habitat before that. It is generally accepted that Barn Owls became more common following European settlement as forests were cleared and replaced with pastures and hay fields; barns and other structures augmented the availability of nest and roost sites (Solymár and McCracken 2002). This is a logical assumption as the first Barn Owl record occurred in 1909 (Brooks 1909) and nesting was not documented until 1941 (Cowan 1942). However, the population is now inferred to be declining based on documented habitat loss (COSEWIC 2010); current numbers appear to be less than in recent decades.

There is uncertainty around the actual current number of mature individuals, as well as the number of mature individuals required for the persistence of the population. The current population estimate ranges from at least 250 individuals, up to 1000 mature individuals (COSEWIC 2010). More recent surveys and studies suggest that the actual figure is likely closer to the lower to mid-range of this estimate; however, a great amount of uncertainty still remains. Further, there is uncertainty around the current distribution of the species. Survey information is mainly from the Lower Mainland and Fraser Valley of southwestern B.C. To date, very few surveys have been conducted on Vancouver Island or in the Gulf Islands, Maple Ridge, Mission, Pitt Meadows, the Thompson-Okanagan, or the Kootenays (i.e., additional areas where Barn Owl has been found and/or may be expected to occur in higher numbers than currently known).

Owing to the above-mentioned uncertainty in both historic and current population size and distribution, the population and distribution goal is not explicitly quantified and/or qualified at this time. As these knowledge gaps are filled, the population and distribution goal should be quantified and revised if required. In the interim, a goal of arresting any further declines and maintaining the current population size and distribution (based on best available estimates as described above) should ensure that the Barn Owl does not become designated as Endangered by COSEWIC.

The Lower Mainland and Fraser Valley of southwestern B.C. are currently understood to be the geographical strongholds of the provincial population (COSEWIC 2010; B.C. Breeding Bird Atlas 2013). A diverse array of developments are either underway or being proposed in both the Lower Mainland and parts of the Fraser Valley. With very few exceptions, the known breeding

population is restricted to this area, therefore any habitat loss and subsequent range contraction within the Lower Mainland and Fraser Valley could have significant impacts on the entire B.C. population. It is crucial to limit further habitat loss, and to augment remaining habitat both in semi-urban and agricultural landscapes to maintain existing levels of occupancy.

### 5.3 Recovery Objectives

The suggested timeframe to accomplish the following objectives towards meeting the population and distribution goal is 5 years. The recovery objectives should be re-evaluated and updated as new information becomes available.

1. Prevent additional habitat degradation and/or loss by either protecting<sup>6</sup> or enhancing available habitat within the Barn Owl's range in B.C.
2. Assess and mitigate current threats within the Barn Owl's range in B.C. (e.g., road mortality and risk of rodenticide poisoning, nest site loss).
3. Determine trends in occupancy and habitat availability throughout the Barn Owl's range.
4. Address knowledge gaps to further understand impacts of threats in B.C. (e.g., minimum habitat requirements, evaluate effects of secondary rodenticide exposure).

## 6 APPROACHES TO MEET RECOVERY OBJECTIVES

### 6.1 Actions Already Completed or Underway

The following actions have been categorized by the action groups of the B.C. Conservation Framework (B.C. Ministry of Environment 2010). Status of the action group for this species is given in parentheses.

#### **Compile Status Report (complete)**

- COSEWIC report completed (COSEWIC 2010).

#### **Send to COSEWIC (complete)**

- Barn Owl (Western population) designated as Threatened (COSEWIC 2010).

#### **Planning (in progress)**

- British Columbia Recovery Plan completed (this document, 2014).
- Federal Recovery Strategy (in progress).

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<sup>6</sup> Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, sale of habitat on private lands by willing vendors, land use designations, and protected areas.

**Monitor Trends (in progress)**

- 2007 – ongoing: monitoring of Barn Owl nest sites in Delta and Surrey. Expanded in 2011 to include Richmond and New Westminster (S. Hindmarch, pers. comm., 2013).
- Ongoing (since approximately 1995) monitoring of Barn Owl nest sites in Chilliwack and Agassiz (D. Clegg, pers. comm., 2013).
- Ongoing (since early 1990s) collection of Barn Owl carcasses, to monitor rodenticide residues (Albert *et al.* 2010).

**Habitat Protection and Private Land Stewardship (in progress)**

- DFWT Grassland Set-Aside Program (~550 ha/yr).
- 2011 – ongoing: DFWT nest box program; 13 boxes installed to date.
- The ALR as a designated land base contributes significantly to the protection of Barn Owl habitat.
- Some habitat protection is provided by national, regional, and municipal protected areas (Table 2). Protection generally addresses the threat of urban or commercial development (IUCN-CMP Threats 1.1 and 1.2) and in some cases threats from agriculture (IUCN-CMP Threat 2.1).

**Table 2.** Parks, protected areas, and wildlife areas/sanctuaries that afford some level of habitat protection for the Barn Owl.

<b>Area name</b>	<b>Approximate area of habitat supported (ha)</b>
<b>National Parks</b>	
Gulf Islands National Park	28.0
Pacific Rim National Park	30.0
<b>Provincial Parks, Protected Areas, and Ecological Reserves</b>	
Ruckle Provincial Park	12.4
<b>Migratory Bird Sanctuaries (MBSs)</b>	
George C. Reifel MBS	203.2
Shoal Harbour MBS	2.5
<b>National Wildlife Areas (NWAs) / CWS Protected Areas</b>	
Alaksen NWA	283.2
Alaksen NWA (Albion Island)	11.0
Coast Guard Transmitter Property	17.9
Ewen Slough	6.6
Harlock Island	1.9
Robertson Farm	30.4
Robertson Slough	13.7
Sea Island Conservation Area	107.3
<b>Wildlife Management Areas (WMAs)</b>	
Boundary Bay WMA	592.1
Coquitlam River WMA	8.0
South Arm Marshes WMA	173.4
Sturgeon Bank WMA	127.0
<b>Regional Parks</b>	
Aldergrove Lake	28.9
Boundary Bay - Boundary Bay Dyke	29.9
Boundary Bay - Centennial Beach	43.6
Boundary Bay - Delta Heritage AirPark	5.6
Brae Island	33.5
Burns Bog	2.5

<b>Area name</b>	<b>Approximate area of habitat supported (ha)</b>
Campbell Valley	354.6
Colony Farm	158.8
Deas Island	91.2
Derby Reach	225.9
Dyke Road	0.6
Elk/Beaver Lake Regional Park	3.4
Glen Valley	13.5
Glen Valley - West Creek	3.1
Iona Beach	15.1
Kanaka Creek	15.0
Matsqui Trail	3.1
Minnekhada	117.7

Note: Assessment based on known occurrences and species needs as described in Section 3.3; note that current survey information is mainly restricted to the Lower Mainland and Fraser Valley of southwestern B.C.

### **Habitat Restoration and Private Land Stewardship (in progress)**

- 2011 – ongoing: City of Richmond old field habitat enhancement program at Terra Nova Park, which includes the restoration and enhancement of old field and the installation of eight nest boxes on municipal land.

### **Species and Population Management (in progress)**

- 2007 – ongoing: The B.C. Ministry of Transportation and Infrastructure is conducting Barn Owl nest and roost site monitoring (presence and productivity) surveys in a portion of southwest Delta. This work is associated with an adaptive management and monitoring program to assess the efficacy of mitigations for the South Fraser Perimeter Road, which is currently under construction (Hemmera 2013).
- 2010 – ongoing: Inventory for any evidence of Barn Owls nesting/roosting in more industrialized areas in the Lower Mainland as part of assessing the risk of secondary rodenticide poisoning to urban owls (S. Hindmarch, pers. comm., 2013).

## 6.2 Recovery Planning Table

**Table 3.** Recovery planning table for the Barn Owl.

Objective	CF action group <sup>a</sup>	Actions to meet objectives	Performance measures	Threat <sup>b</sup> or concern addressed	Priority <sup>c</sup>
1	HP, PLS	Determine land use zoning and ownership within suitable habitat.	<ul style="list-style-type: none"> <li>Land ownership determined.</li> </ul>	Knowledge Gap	Essential
	HP, PLS	Identify and protect important breeding habitat throughout the Barn Owl's range. Prioritize the Lower Mainland and the Fraser Valley (Barn Owl population stronghold) and high urban development pressure in these regions.	<ul style="list-style-type: none"> <li>Important habitat identified and mapped.</li> <li>Conservation options explored (e.g., set-asides, private land stewardship, Development Permit Area, ALR).</li> </ul>	Knowledge Gap; 1.1, 1.2, 2.1	Essential
	HP, HR, PLS	Restore or enhance habitat on private land, in parks, and in urban settings to increase suitable habitat and promote connectivity in highly fragmented landscapes.	<ul style="list-style-type: none"> <li>Identify habitat that can be enhanced.</li> <li>Outreach to farmers, private landowners, and municipalities on optimal grassland management.</li> </ul>	Knowledge Gap; 1.1, 1.2, 2.1	Necessary
	HP, PLS	Identify and describe surrounding habitat of nest site.	<ul style="list-style-type: none"> <li>Nest sites identified and habitat described.</li> </ul>	Knowledge Gap; 1.1, 1.2, 2.1	Necessary
	HP, PLS	Promote habitat stewardship of nest site and surrounding habitat and protect nests sites throughout the Barn Owl's range (including: private and Crown land, recreational parks, and urban settings).	<ul style="list-style-type: none"> <li>Outreach material developed and distributed to landowners.</li> <li>Location data distributed to municipalities, which can use environmental protection tools (e.g., B.C. <i>Wildlife Act</i>, Riparian Areas Regulation, and Development Permit Area) to protect nest/roost sites.</li> </ul>	Knowledge Gap; 1.1, 1.2, 2.1	Essential
2	HP, HR, PLS	Nest box installation throughout the Barn Owl's range.	<ul style="list-style-type: none"> <li>Nest box program initiated.</li> </ul>	1.1, 1.2, 2.1	Beneficial
	SPM	Monitor and compile existing data on road mortality to identify high risk areas and present options for mitigation. Avoid nest box installation in high risk areas.	<ul style="list-style-type: none"> <li>Implement monitoring program.</li> <li>Existing data compiled and high risk areas identified.</li> <li>Implement mitigation measures in high risk areas.</li> </ul>	Knowledge Gap	Necessary
	SPM, PLS	Increase awareness among farmers and private landowners about the benefits of having a predator	<ul style="list-style-type: none"> <li>Outreach material developed and presented.</li> <li>Reduced usage and misuse of chemical rodent</li> </ul>	9.3	Necessary

Objective	CF action group <sup>a</sup>	Actions to meet objectives	Performance measures	Threat <sup>b</sup> or concern addressed	Priority <sup>c</sup>
		of rodents, and increase the awareness about the risks of secondary rodenticide poisoning of wildlife.	control. <ul style="list-style-type: none"> <li>• Project pilots initiated with commodity groups (e.g., blueberry growers), aimed at increasing Barn Owls and reducing rodent populations for farmers.</li> </ul>		
3	MT, SPM	Establish and implement a province-wide, long-term monitoring program, prioritizing regions that have very little to no inventory data.	<ul style="list-style-type: none"> <li>• Current occupancy and distribution mapped.</li> <li>• Improved understanding of occupancy at potential sites, nest site turn-over, reproductive success, and local threats.</li> </ul>	Knowledge Gap	Necessary
	MT	Based on inventories, create habitat suitability models to further describe available habitat within the Barn Owl's range.	<ul style="list-style-type: none"> <li>• Population and habitat trends estimated and mapped for the entire range.</li> </ul>	Knowledge Gap	Essential
4	HP, SPM	Assess habitat requirements and home range sizes for Barn Owls with differing degrees of urbanization and habitat fragmentation surrounding their nest/roost sites.	<ul style="list-style-type: none"> <li>• Home range size and suitable habitat analysis used to determine minimum habitat requirements needed.</li> <li>• Increased understanding of how habitat degradation and loss can affect population abundance, survival, productivity, and foraging behaviour</li> </ul>	Knowledge Gap	Necessary
	SPM	Monitor and quantify rodenticide residues in the livers of deceased Barn Owls and combine these data with Barn Owl productivity, mortality, and rodenticide usage data.	<ul style="list-style-type: none"> <li>• Increased understanding of the potential sub-lethal effects of carrying a low-level body burden of rodenticides.</li> <li>• Identification of rodenticide products and user-group(s) that pose the greatest threat to the Barn Owl population.</li> <li>• Effectiveness of the new rodenticide regulations (Pesticide and Management Regulatory Agency 2013) evaluated.</li> </ul>	Knowledge Gap; 9.3	Necessary

<sup>a</sup> CF = Conservation Framework Action Group; HP = Habitat Protection; HR = Habitat Restoration; PLS = Private Land Stewardship; SPM = Species and Population Management; MT = Monitoring Trends.

<sup>b</sup> Threat numbers according to the IUCN-CMP classification (see Table 1 for details).

<sup>c</sup> Essential (urgent and important, needs to start immediately); Necessary (important but not urgent, action can start in 2–5 years); or Beneficial (action is beneficial and could start at any time that was feasible).

### 6.3 Narrative to Support Recovery Planning Table

Recommended actions have been categorized by the action groups of the B.C. Conservation Framework.

If appropriate, recovery implementations should be considered on a landscape scale and should, wherever possible, incorporate objectives from other species at risk using the same area. In the case of the Barn Owl, this may include Short-eared Owl (*Asio flammeus*), Great Blue Heron, and the Georgia Depression population of the Western Meadowlark (*Sturnella neglecta* pop. 1).

However, certain recovery objectives are very specific to the ecological and biological needs of the Barn Owl; even though the recovery actions might benefit other species, a single-species approach needs to be the focus when implementing such recovery actions. Where possible, all recovery activities should be conducted as experiments using an adaptive management model to determine their effect and efficacy in reaching the desired recovery objectives and to improve subsequent recovery actions.

#### 6.3.1 Monitor Trends

There is currently a limited amount of long-term monitoring data for the Barn Owl in B.C. Search-intensive locally focused studies have been conducted in the past, and are on-going in parts of the Fraser Valley and the Lower Mainland (e.g., Andrusiak 1994; Hindmarch 2010; D. Clegg, pers. comm., 2013; G. Powers, pers. comm., 2013). Local population sizes and trends can be gleaned from these data. However, to accurately assess the population size and corresponding trends for the entire B.C. population, it would be necessary to implement systematic long-term surveys on Vancouver Island and the Gulf Islands; at Pitt Meadows, Maple Ridge, and Mission; and in the Thompson-Okanagan and Kootenay.

#### 6.3.2 Habitat Protection, Restoration, and Private Land Stewardship

Stewardship involves the voluntary cooperation of landowners and managers to protect species at risk and the ecosystems they rely on. Private land stewardship is a priority for Barn Owls, as close to 95% of known nests are situated on private properties.

The stewardship approach could cover many different kinds of activities, including where feasible: following guidelines or best management practices to protect and support species at risk; voluntarily protecting important areas of habitat; establishing conservation covenants on property titles; eco-gifting of property (in whole or in part) to protect certain ecosystems or species at risk; and/or selling of property for conservation.

Making nest site location information available to municipalities would facilitate “case by case” discretion when assessing demolition permit applications from landowners.

## 7 INFORMATION ON HABITAT NEEDED TO MEET RECOVERY GOAL

Threats to Barn Owl habitat have been identified. Currently there is enough suitable habitat to meet the species' population and distribution goal; however, this habitat is under intense pressure and is likely to become limiting in the future. Therefore, it is necessary to describe and model the key habitat attributes needed for survival and recovery. In addition, landscape-level habitat mapping will further help identify areas where habitat protection and/or restoration would be beneficial to increase connectivity and help mitigate current and future habitat threats.

### 7.1 Description of Survival/Recovery Habitat

The biophysical attributes of survival/recovery habitat that are needed by Barn Owl to successfully complete its life history stages (i.e., breeding, roosting, and foraging) are described in Section 3.3, "Needs of the Barn Owl." Studies that are required for a more complete understanding of survival/recovery habitat are included in the Recovery Planning Table (Section 6.2).

## 8 MEASURING PROGRESS

Performance indicators provide a way to define and measure progress toward achieving the recovery (population and distribution) goal. This will be determined primarily through monitoring the provincial population and habitat trends. If monitoring indicates that the known population is stable or increasing, the amount of known suitable habitat is likely stable. Individual recovery actions will be evaluated using performance measures (see Table 3).

## 9 EFFECTS ON OTHER SPECIES

The protection and enhancement of open grassy habitats would greatly benefit several species that depend on such habitat for nesting/and or foraging (e.g., Short-eared Owl, Great Blue Heron, Western Meadowlark, Northern Harrier [*Circus cyaneus*], Red-tailed Hawk [*Buteo jamaicensis*], and Rough-legged Hawk (*Buteo lagopus*).

Barn Owls have the highest rate of road mortality among raptors in southern B.C. (Preston and Powers 2006). Any mitigative measures that reduce road mortality for Barn Owls would likely also benefit other species that forage along grassy verges.

In addition, reducing the use and misuse of rodenticides would help mitigate the overall risk of non-target poisoning of any wildlife, particularly other raptors and generalist scavengers.

It is unlikely that recovery activities will have any adverse effects on other species at risk. However, it is unknown what effect an increase in Barn Owls and other predatory bird species may have on local prey species including species at risk such Southern Red-backed Vole (*Myodes gapperi*), Townsend's Mole (*Scapanus townsendii*), Pacific Water Shrew (*Sorex*

*bendirii*), Olympic Shrew (*Sorex rohweri*), Trowbridge's Shrew (*Sorex trowbridgii*), bats, and amphibians.

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