

Management Plan for the Spotted Bat (*Euderma maculatum*) in Canada

Spotted Bat



2014

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For copies of the management plan, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

Cover illustration: Michael Proctor

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MANAGEMENT PLAN FOR THE SPOTTED BAT (*Euderma maculatum*) IN CANADA

2014

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the Government of British Columbia has given permission to the Government of Canada to adopt the “Management Plan for the Spotted Bat (*Euderma maculatum*) in British Columbia” (Part 2) under section 69 of the *Species at Risk Act* (SARA). Environment Canada has included an addition which completes the SARA requirements for this management plan.

The federal management plan for the Spotted Bat (*Euderma maculatum*) in Canada consists of two parts:

Part 1 - Federal Addition to the “Management Plan for the Spotted Bat (*Euderma maculatum*) in British Columbia”, prepared by Environment Canada.

Part 2 - “Management Plan for the Spotted Bat (*Euderma maculatum*) in British Columbia”, prepared by the B.C. Ministry of Environment.

TABLE OF CONTENTS

Part 1 - Federal Addition to the “Management Plan for the Spotted Bat (<i>Euderma maculatum</i>) in British Columbia”, prepared by Environment Canada.....	I
PREFACE	II
ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT	III
Species Status Information.....	III
Effects on the Environment and Other Species	III
 Part 2 - “Management Plan for the Spotted Bat (<i>Euderma maculatum</i>) in British Columbia”, prepared by the B.C. Ministry of Environment	

Part 1 - Federal Addition to the “Management Plan for the
Spotted Bat (*Euderma maculatum*) in British Columbia”,
prepared by Environment Canada

PREFACE

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

SARA section 65 requires the competent Minister, which is the federal Minister of the Environment in this case, to prepare a management plan for all listed special concern species. SARA section 69 allows the Minister to adopt all or part of an existing plan for the species if the Minister is of the opinion that an existing plan relating to a wildlife species includes adequate measures for the conservation of the species.

The attached provincial management plan (Part 2 of this document) for the species was provided as science advice to the jurisdictions responsible for managing the species in British Columbia. Environment Canada has prepared this federal addition to meet the requirements of SARA.

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

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

ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT

The following sections have been included to address specific requirements of SARA that are either not addressed in the “Management Plan for the Spotted Bat (*Euderma maculatum*) in British Columbia” (see Part 2 of this document, referred to hereafter as the “provincial document”) and/or to provide additional information.

Species Status Information

This section augments “Species Status Information” (section 2) in the provincial document.

It is estimated that the percent of the global range of this species in Canada is less than 5%.

Effects on the Environment and Other Species

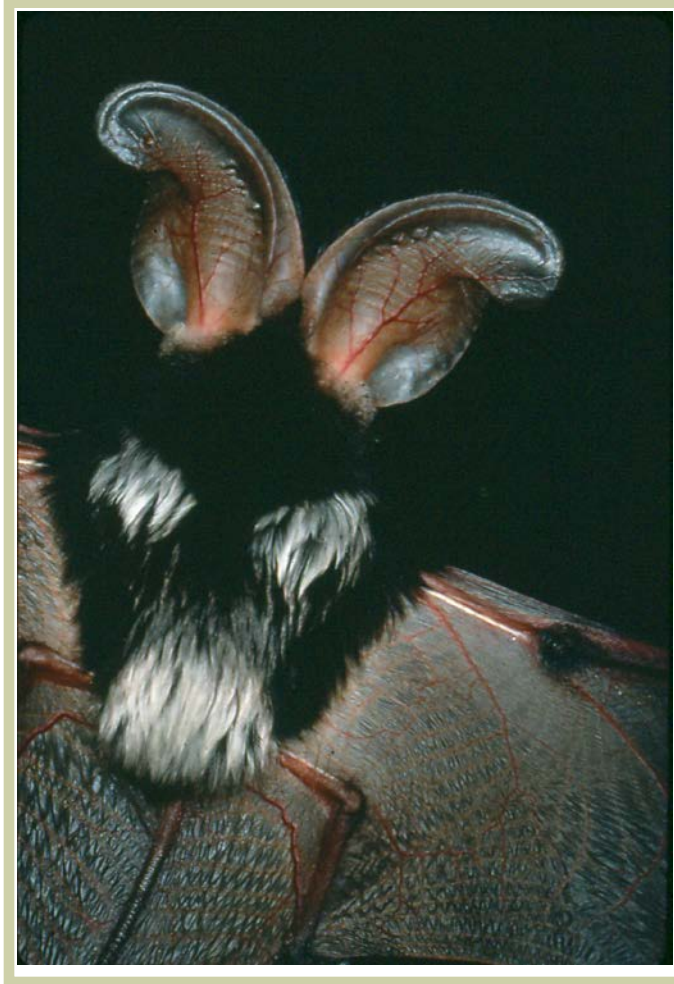
A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

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

Negative effects on other species are not foreseen; however, management and protection of the Spotted Bat could prove beneficial for other species with overlapping habitat. Species that may benefit from efforts to protect Spotted Bat roosting habitat include other cliff-roosting bat species (Pallid Bat [*Antrozous pallidus*] – Threatened, and Little Brown Myotis - Endangered) and cliff-nesting birds (e.g., Peregrine Falcon [*Falco peregrinus anatum/tundrius* subspecies] - Special Concern). Efforts to maintain open forest and marsh foraging habitat for Spotted Bats will benefit a large suite of SARA-listed species that also rely on these habitat types (e.g., open forest: White-headed Woodpecker [*Picoides albolarvatus*] – Endangered, and Lewis's Woodpecker [*Melanerpes lewis*] – Threatened).

Part 2 - "Management Plan for the Spotted Bat (*Euderma maculatum*) in British Columbia", prepared by the B.C. Ministry of Environment.

Management Plan for the Spotted Bat (*Euderma maculatum*) in British Columbia



Prepared by B.C. Ministry of Environment



Ministry of
Environment

March 2013

About the British Columbia Management Plan Series

This series presents the management plans that are prepared as advice to the Province of British Columbia. Management plans are prepared in accordance with the priorities and management actions assigned under the British Columbia Conservation Framework. The Province prepares management plans for species that may be at risk of becoming endangered or threatened due to sensitivity to human activities or natural events.

What is a management plan?

A management plan identifies a set of coordinated conservation activities and land use measures needed to ensure, at a minimum, that the target species does not become threatened or endangered. A management plan summarizes the best available science-based information on biology and threats to inform the development of a management framework. Management plans set goals and objectives, and recommend approaches appropriate for species or ecosystem conservation.

What's next?

Direction set in the management plan provides valuable information on threats and direction on conservation measures that may be used by individuals, communities, land users, conservationists, academics, and governments interested in species and ecosystem conservation.

For more information

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

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

**Management Plan for the Spotted Bat
(*Euderma maculatum*) in British Columbia**

Prepared by the B.C. Ministry of Environment

March 2013

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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 management plan has been prepared by the B.C. Ministry of Environment, as advice to the responsible jurisdictions and organizations that may be involved in managing the species.

This document identifies the management actions that are deemed necessary, based on the best available scientific and traditional information, to prevent Spotted Bat populations in British Columbia from becoming endangered or threatened. Management 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 management approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions 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.

Success in the conservation 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 management plan. The B.C. Ministry of Environment encourages all British Columbians to participate in the conservation of Spotted Bat.

ACKNOWLEDGEMENTS

A preliminary draft of this management plan was prepared by Glorianna Anderson (Environment Canada – Canadian Wildlife Service) with input from Megan Harrison (Environment Canada – Canadian Wildlife Service) and Francis Iredale (B.C. Ministry of Forests, Lands and Natural Resource Operations). Orville Dyer (B.C. Ministry of Forests, Lands and Natural Resource Operations) revised this document for publication with the help of additional review provided by Mike Sarell (Ophiuchus Consulting) and Leah Westereng (B.C. Ministry of Environment). Orville Dyer, John Surgenor (B.C. Ministry of Forests, Lands and Natural Resource Operations), Mike Sarell, and Megan Harrison completed the threats assessment for Spotted Bat. We thank the B.C. Ministry of Environment for funding an external review.

EXECUTIVE SUMMARY

The Spotted Bat (*Euderma maculatum*) is listed as Special Concern in Canada under Schedule 1 of the *Species at Risk Act* (SARA). It was designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), primarily because of a small population size, although loss of prey and foraging sites and disturbance of roosting sites are also concerns. The Spotted Bat is ranked S3S4 (vulnerable to apparently secure) in British Columbia (B.C.) and is on the provincial Blue list. Globally the Spotted Bat is ranked G4 (apparently secure) by NatureServe. The B.C. Conservation Framework ranks the Spotted Bat as a priority 2 under goal 1 (contribute to global efforts for species and ecosystem conservation) and goal 3 (maintain the diversity of native species and ecosystems). It is protected from capture and killing under the B.C. *Wildlife Act*. It also is listed in the category of species at risk under the *Forest and Range Practices Act*, which enables habitat management tools as per the Identified Wildlife Management Strategy.

The Spotted Bat is a medium-sized cliff roosting bat. It is easily distinguishable from other bats by its black fur, which contrasts with three distinct white patches on the back. However, and, unlike other bat species in B.C., its echolocation call is audible to the unaided human ear.

Within B.C., the Spotted Bat is located in the Bunchgrass, Ponderosa Pine and Interior Douglas-fir biogeoclimatic zones. It uses these regions for both roosting (within crevices in steep cliff faces) and foraging. The Spotted Bat has a relatively large North American distribution; however, the total population within B.C. is believed to be stable with fewer than 1000 adults (as of 2004 COSEWIC assessment).

Threats to the Spotted Bat include loss of habitat from urban development, from land conversion for agricultural purposes, and to a lesser extent from mining exploration and roads. Recreational rock climbing can cause disturbances that can lead to roost abandonment and increase the risk of offspring mortality. As well, wind turbines may kill bats through direct impact by blades or, more often, barotraumas. Other threats such as light and noise pollution, pesticide use, and the impacts of fire require more investigation. Spotted Bats in North America have not yet been exposed to White-nose Syndrome so it is unknown if it will affect Spotted Bat populations.

The management goal is to maintain a stable or increasing population of the Spotted Bat distributed throughout the species' present range in B.C.

1. Protect¹ and manage important habitat for Spotted Bat in B.C.
2. Clarify population numbers, the distribution of roosting and foraging habitat, and trends for Spotted Bat populations and habitat in B.C.
3. Address knowledge gaps relating to wintering habitat use and foraging habitat use quantification, for the Spotted Bat.

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

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	iii
EXECUTIVE SUMMARY.....	iv
1 COSEWIC* SPECIES ASSESSMENT INFORMATION.....	1
2 SPECIES STATUS INFORMATION.....	1
3 SPECIES INFORMATION.....	2
3.1 Species Description.....	2
3.2 Populations and Distribution.....	2
3.3 Needs of the Spotted Bat.....	4
3.3.1 Habitat and Biological Needs.....	4
3.3.2 Limiting Factors.....	6
4 THREATS.....	6
4.1 Threat Assessment.....	7
4.2 Description of Threats.....	9
5 MANAGEMENT GOAL AND OBJECTIVES.....	13
5.1 Management Goal.....	13
5.2 Rationale for the Management Goal.....	13
5.3 Management Objectives.....	13
6 APPROACHES TO MEET OBJECTIVES.....	13
6.1 Actions Already Completed or Underway.....	13
6.2 Recommended Management Actions.....	15
6.2.1 Narrative to Support Management Actions Table.....	16
6.2.2 Habitat Protection.....	16
6.2.3 Monitor Trends.....	16
6.2.4 Species and Population Management.....	16
7 MEASURING PROGRESS.....	16
8 EFFECTS ON OTHER SPECIES.....	17
9 REFERENCES.....	18

LIST OF TABLES

Table 1. Threat classification table for the Spotted Bat in British Columbia.....	8
Table 2. Recommended management actions and suggested implementation schedule for the Spotted Bat in British Columbia.....	15

LIST OF FIGURES

Figure 1. Spotted Bat distribution in North America (modified from COSEWIC 2004).....	3
Figure 2. Spotted Bat distribution in British Columbia (Environment Canada, 2012, unpubl. data).	4

1 COSEWIC* SPECIES ASSESSMENT INFORMATION

<p>Date of Assessment: May 2004</p> <p>Common Name (population): Spotted Bat</p> <p>Scientific Name: <i>Euderma maculatum</i></p> <p>COSEWIC Status: Special concern</p> <p>Reason for Designation: In Canada, this species occurs in the intermontane grasslands of southern British Columbia. It is a distinctively coloured bat that is unmistakable to identify. Unlike any other Canadian species of bat, its echolocation call is within the range of human hearing. It roosts in crevices in large cliff faces. It is considered the easiest and best censused species of bat in Canada. Population estimates, based on relatively good census effort, suggests that there are fewer than 1000 adults. At this time, numbers appear to be stable, and there are relatively few threats to populations or habitats. Perhaps the biggest threat to this species is its small population size. Use of pesticides on its prey, loss of foraging habitat, and disturbance at roosting sites by rock climbers are potential threats. Rescue may be possible from neighbouring populations in the United States, however, movements of individuals between Canadian and US populations are not documented.</p> <p>Canadian Occurrence: British Columbia</p> <p>COSEWIC Status History: Designated special concern in April 1988 and in May 2004. Last assessment based on updated status report.</p>

* Committee on the Status of Endangered Wildlife in Canada.

2 SPECIES STATUS INFORMATION

Spotted Bat^a	
Legal Designation	
FRPA: ^b Species at Risk	B.C. Wildlife Act: ^c Schedule A SARA Schedule: 1-Special Concern (2005)
OGAA: ^b Species at Risk	
Conservation Status^d	
B.C. List: Blue	B.C. Rank: S3S4 (2006) National Rank: N3 (2011) Global Rank: G4 (2012)
Subnational Ranks: ^e Arizona: S1S2, California: S2S3, Colorado: S2, Idaho: S3, Montana: S2, Navajo Nation: S4, Nevada: S2, New Mexico: S3, Oregon: S2, Texas: S2, Utah: S2S3, Washington: S3, Wyoming: S3	
B.C. Conservation Framework^f	
Goal 1: Contribute to global efforts for species and ecosystem conservation.	Priority: ^g 2 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.	Priority: 5 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.	Priority: 2 (2009)
Action Groups: Compile Status Report; Monitor Trends; Send to COSEWIC; Habitat Protection; Private Land Stewardship; Species and Population Management	

^a Data source: B.C. Conservation Data Centre (2013) unless otherwise noted.

^b Species at Risk = a listed species that requires special management attention to address the impacts of forest and range activities under the FRPA (Province of British Columbia 2002) and/or the impacts of oil and gas activities under the OGAA (Province of British Columbia 2008) on crown land (as described in the Identified Wildlife Management Strategy; Province of British Columbia 2004).

^c 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).

^d S = subnational; N = national; G = global; 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; NR = unranked; U = unrankable.

^e Data source: NatureServe (2012).

^f Data source: B.C. Ministry of Environment (2010).

^g Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Species Description

The Spotted Bat is a medium-sized bat of the order Chiroptera with an average body mass of 17.9 g (Nagorsen 2002). The Spotted Bat is easily distinguishable from other bat species due to its unique markings and physical characteristics. It has black fur with three distinct white patches; one on the rump and one on each shoulder, in addition to two smaller white patches at the base of the ears (van Zyll de Jong 1985). These spots are believed to aid in camouflage (Easterla 1965) and or communication using visual signaling (van Zyll de Jong 1985). The undersides of the Spotted Bat are white with black under fur. A striking feature of this bat species is the large pink-grey ears. Echolocations range from 6 to 16 kilohertz so can be heard with unaided human ears (Nagorsen and Brigham 1993).

3.2 Populations and Distribution

The Spotted Bat has a patchy distribution throughout its North American range (Fenton *et al.* 1987; Pierson and Rainey 1998). It ranges from central Mexico and the western United States including Arizona, New Mexico, Nevada, Texas, California, Oregon, Utah, Colorado, Wyoming, Montana, Idaho, and Washington up to southern B.C. (COSEWIC 2004; Figure 1).

Within Canada this species is only located in the dry interior grasslands of southern B.C. (Nagorsen and Brigham 1993; Figure 2). The extent of occurrence of the Spotted Bat population in B.C. is approximately 10,590 km², which is less than 5% of the species' global range (COSEWIC 2004). The area of occupancy is unknown (COSEWIC 2004). The Spotted Bat was first detected in Canada in 1979 (Woodsworth *et al.* 1981) and further surveys (Collard *et al.* 1990; Roberts and Roberts 1992, 1993; Holroyd *et al.* 1994; Sarell and Haney 2000) found occurrences in the Okanagan, Similkameen, Thompson, Fraser, and Chilcotin River valleys. In 2010, range expansion was noted based on a single detection at Carpenter Lake, B.C.; this location is the furthest westward location known to date (Sarell *et al.* 2010). The Spotted Bat is typically located below 900 m elevation (Nagorsen and Brigham 1993).

As of 2004, there were 80 records (roosting and foraging); however, surveying was not systematic and there was relatively little surveying done in the north Okanagan valley or the Fraser River valley (COSEWIC 2004). Surveys in the southern Okanagan and Similkameen only included areas that had high habitat potential for roosting (Sarell and Haney 2000).

The Spotted Bat population in B.C. is believed to be stable with less than a 1000 mature individuals (COSEWIC 2004). Sarell and Haney (2000) estimated that the total number of Spotted Bats in the southern Okanagan was 100–200 mature individuals. Assuming that the Cariboo- Chilcotin and Thompson regions support similar numbers, an estimate of less than 1000 individuals appears realistic for B.C. (COSEWIC 2004). However, as no standard methodology was used, unequal sampling efforts were made, multiple counts could have occurred, and there was bias towards surveying high quality roosting sites. These data need to be regarded with caution (COSEWIC 2004).



Figure 1. Spotted Bat distribution in North America (modified from COSEWIC 2004).

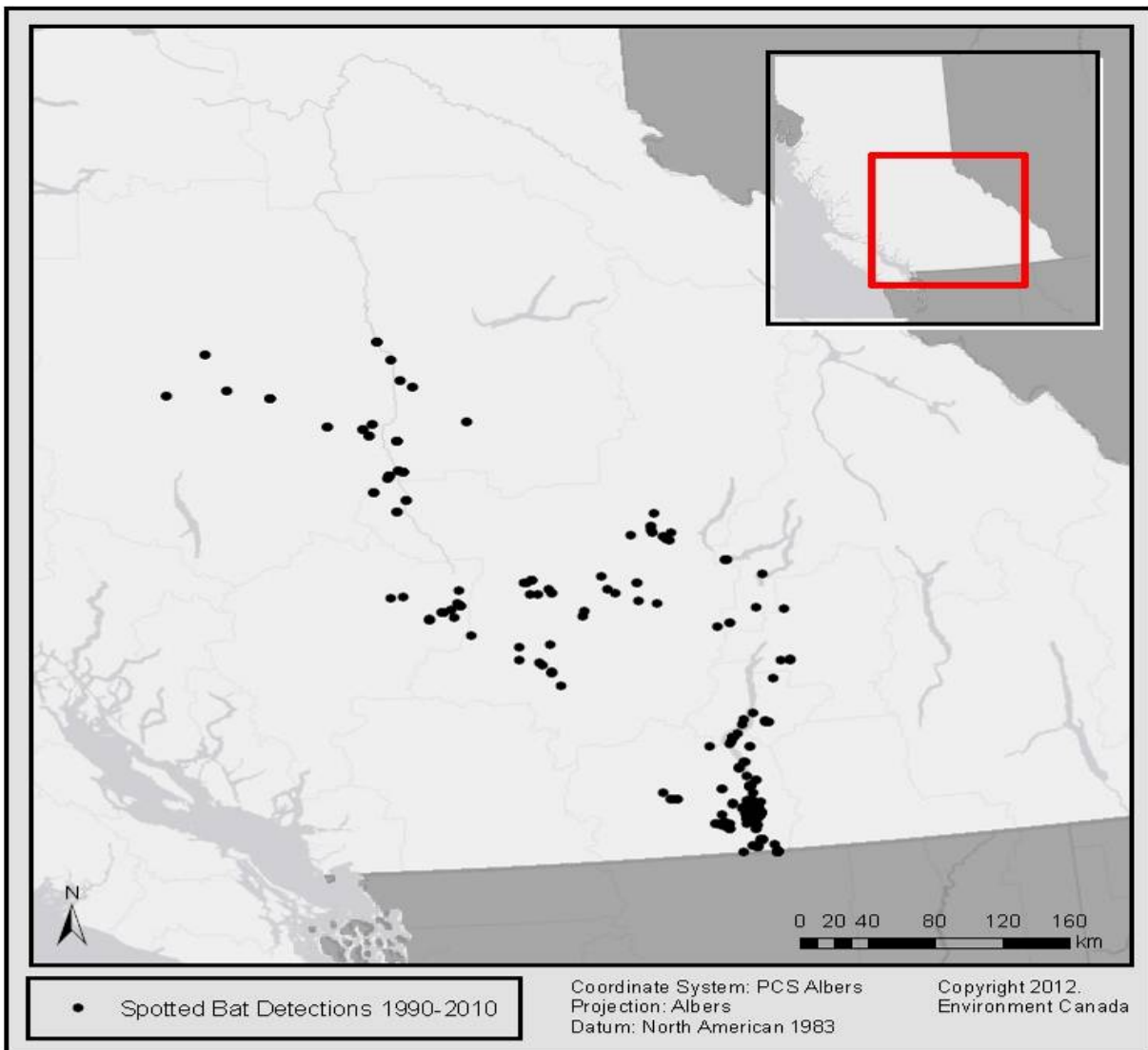


Figure 2. Spotted Bat distribution in British Columbia (Environment Canada, 2012, unpubl. data).

3.3 Needs of the Spotted Bat

3.3.1 Habitat and Biological Needs

In Canada, the majority of Spotted Bat observations have been between elevations of 300 and 900 m in grassland (Nagorsen and Brigham 1993) shrub-steppe, ponderosa pine (*Pinus ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*) forest habitats (Meidinger and Pojar 1991). Most records are in the Bunchgrass (BG), Ponderosa Pine (PP), and Interior Douglas-fir (IDF) biogeoclimatic zones. In the United States, the Spotted Bat has been observed at altitudes ranging from sea level to 3230 m above sea level (Watkins 1977; Reynolds 1981) where they occupy habitats from desert to coniferous forest.

Despite the broad geographic range, the biology of the Spotted Bat is poorly understood because of patchy distribution and low capture rates (Fenton *et al.* 1987). Information regarding Spotted

Bat reproduction is minimal; however, it is believed that most Spotted Bats in B.C. mate in the fall (Nagorsen and Brigham 1993). Easterla (1973) speculated that they are solitary breeders and that fertilization is delayed until the following spring. Female Spotted Bats give birth to a single young (Watkins 1977). In the United States, births occur during May or June and nursing individuals have been observed from June to August (Watkins 1977). In B.C., births are believed to occur slightly later; at the end of June or early July (Nagorsen and Brigham 1993). The age of sexual maturity is unknown.

There are no records regarding the life span of this species; however, it is believed to be similar to other temperate region bats (20–40 years).

Due to their wide geographic distribution, Spotted Bats have adapted to withstand variations in temperatures. Ambient temperatures typically range from 4.4 to 18.3°C during the time bats forage at night (Leonard and Fenton 1983).

The Spotted Bat is an aerial insectivore and feeds primarily on moths, specifically those between 2 and 5 mm in length (Easterla 1965; Ross 1967; Poché 1981; Wai-Ping and Fenton 1989). Like other bat species, the Spotted Bat uses echolocation calls to locate and track the movements of prey. The cordilleran ecozone of B.C. sustains a diverse population of moth species, many of which (approximately 350) overlap with the Spotted Bat distribution within the Okanagan Valley (Wai-Ping and Fenton 1989). Additionally the Spotted Bat has a unique echolocation call, which allows it to be extremely effective in capturing moths. Unlike most bats, this species has a low frequency call (dominant frequency 9–12 kHz), which is within the human hearing range (Fullard and Dawson 1997). This low frequency call is effective for capturing tympanate moths, which can hear echolocations only at the higher frequencies (e.g., 30 to 75 kHz) that are used by other bat species and sometimes avoid capture (Fullard *et al.* 1983).

The Spotted Bat typically forages in open areas at altitudes of 5–30 m above ground in 200–300 m elliptical paths (Easterla 1965; Ross 1967; Poché 1981; Wai-Ping and Fenton 1989). The Spotted Bat has been reported as a solitary species, both roosting alone and maintaining exclusive foraging areas (Leonard and Fenton 1983). The species may be territorial (Leonard and Fenton 1983; Storz 1995).

Day Roosts

Spotted Bats require roost sites during the day. These roosts serve as secure resting sites during the day but also as maternity roosts for females who give birth during the months of June and July (Nagorsen and Brigham 1993). While other more widespread species such as the Little Brown Myotis (*Myotis lucifugus*) use a broader suite of roosts (e.g., buildings, trees), Spotted Bat roosts are specialized as they are typically in cracks and crevices (2.0–5.5 cm wide) on faces of cliffs (Poché 1981; Leonard and Fenton 1983; Sarell and Haney 2000). Within B.C. there appears to be variation in height, length, and aspect of cliffs selected (Wai-Ping and Fenton 1987); however, a general measure showed that cliffs selected have vertical faces of up to 400 m and warm aspects (Roberts and Roberts 1993; Sarell and Haney 2000). The minimum height of roosting cliffs may also be important. Most Spotted Bat roosting cliffs are above 40 m in height (M. Sarell, pers. comm., 2012). Even though numerous observations have been made, it is

difficult to measure the specific physical features for which the Spotted Bats may be selecting as the height of the cliffs make them inaccessible.

Winter Roosts

Little is known about Spotted Bat winter roosting habitats. Nagorsen and Brigham (1993) reported no winter records for this species in B.C. and speculate that Spotted Bats may winter in cliffs or crevices either in B.C. or outside of the province.

Foraging Habitat

The primary foraging habitats for the Spotted Bat in B.C. are marshes, riparian areas, open fields, and clearings in forests (Leonard and Fenton 1983; Wai-Ping and Fenton 1989; Holroyd *et al.* 1994). In the southern Okanagan, open ponderosa pine forest and marshy areas were most frequently used (Wai-Ping and Fenton 1989). However, Leonard and Fenton (1983) recorded no feeding buzzes over ponderosa pine forest and assumed bats flying over this habitat were in transit. Native habitats that were converted to hay fields were used by Spotted Bats for foraging, based on feeding buzzes observed by Leonard and Fenton (1983). However, habitat converted to orchard was not used (Leonard and Fenton 1983). A forested habitat that was altered by fire also was not used when monitored 10 years after the event (Leonard and Fenton 1983). A common and important feature to most Spotted Bat foraging habitat is the close proximity to a water source (Collard *et al.* 1990). Although some long distance movements have been recorded in both Canada and the United States, the distance travelled from roosts by three Spotted Bats to reach their foraging habitats in the Okanagan was between 6 and 10 km (Wai-Ping and Fenton 1989).

3.3.2 Limiting Factors

Female Spotted Bats only produce a single offspring per year (Watkins 1977). Although the B.C. population currently appears to be stable, a low reproductive rate could limit population recovery if other threats become more prevalent. The small population size within B.C. may limit the population's ability to recover from stochastic events. Mating interactions also may be limited as individual roosting sites are often spatially isolated and patchily dispersed within the region because of the Spotted Bat's specialized habitat needs.

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 considered². Threats presented here do not include biological features of the species or population such as inbreeding depression, small population size, and genetic isolation; or likelihood of regeneration or re-colonization for ecosystems, which are considered limiting factors.³

² 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).

³ It is important to distinguish between limiting factors and threats. Limiting factors are generally not human induced and include characteristics that make the species or ecosystem less likely to respond to recovery/conservation efforts.

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) so that this type of event would have a disproportionately large effect on the population/ecosystem compared to the effect they would have had historically.

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 Spotted Bat were assessed for the entire province of B.C. (Table 1).

Table 1. Threat classification table for the Spotted Bat in British Columbia.

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d
1	Residential & commercial development	Low	Small	Serious	High
1.1	Housing & urban areas	Low	Small	Serious	High
2	Agriculture & aquaculture	Low	Small	Serious	High
2.1	Annual & perennial non-timber crops	Low	Small	Serious	High
2.3	Livestock, Farming and Ranching	Unknown	Large	Unknown	High
3	Energy production & mining	Low	Small	Extreme	Moderate
3.2	Mining & quarrying	Low	Small	Extreme	Moderate
3.3	Renewable Energy	Low	Small	Extreme	Moderate
4	Transportation & Service Corridors	Low	Small	Serious	High
4.1	Roads & railroads	Low	Small	Serious	High
5	Biological resource use	Negligible	Negligible	Unknown	High
5.3	Logging & wood harvesting	Negligible	Negligible	Unknown	High
6	Human intrusions & disturbance	Low	Small	Extreme	High
6.1	Recreational activities	Low	Small	Extreme	High
7	Natural system modifications	Unknown	Restricted	Unknown	High
7.1	Fire & fire suppression	Unknown	Small	Unknown	High
7.3	Other ecosystem modifications	Unknown	Restricted	Unknown	High
8	Invasive & other problematic species & genes	Unknown	Pervasive	Unknown	Moderate
8.1	Invasive non-native/alien species	Unknown	Pervasive	Unknown	Moderate
9	Pollution	Low	Large	Slight	High
9.6	Excess energy	Low	Large	Slight	High
11	Climate change & severe weather	Unknown	Restricted	Unknown	High
11.1	Droughts	Unknown	Restricted	Unknown	High

^a **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.

^b **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%).

^c **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%).

^d **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 Medium.⁴ This overall threat considers the cumulative impacts of multiple threats. This includes 6 Low Impact threats: urban development, land conversion for agricultural purposes, roads, and mining exploration, as well as renewable energy (e.g., wind turbines), recreational activities (e.g., rock climbing) and light and noise pollution (Table 1). Details are discussed below listed under Threat Level 1 and 2 headings.

IUCN #1. Residential and commercial development

1.1 Housing and Urban areas

Within the next 10 years, urban development is predicted to increase by 5% and 7% in the Okanagan-Similkameen and Thompson Nicola Regional Districts, respectively, between 2012 and 2022 (Province of British Columbia 2011). Most development will occur in the low-elevation areas occupied by Spotted Bats. Spotted Bat roosting habitat (in inaccessible cliff faces) is unlikely to be directly impacted. However, construction activity produces noise, which could cause roost-site abandonment if in close proximity (Garcia *et al.* 1995). This species commutes approximately 6 to 10 km from roosts to foraging sites, which are more likely to be impacted by development than roost sites. Over 90% of Spotted Bat range occurs outside of protected areas (COSEWIC 2004) and may be at risk of loss due to development. Natural foraging habitats are likely to be destroyed by urban development, by severely reducing moth (prey) habitat and productivity, although bats may continue to fly over it.

IUCN #2. Agriculture and aquaculture

2.1 Annual and perennial non-timber crops

Orchards and/or vineyards are common in the Okanagan and Thompson valleys. Within the Okanagan-Similkameen region alone, where the majority (>80%) of Spotted Bat detections have occurred, 5965 ha are devoted to fruit, berry, and nut orchards (B.C. Ministry of Agriculture and Lands 2006). The total area of land devoted to agriculture has increased steadily in the Okanagan-Similkameen region since 1996 (B.C. Ministry of Agriculture and Lands 2006). It is expected that this trend will continue and Spotted Bat foraging habitat will continue to be converted for crop production. Further land conversion and increased crop production could threaten the Spotted Bat, depending on the type of crop. No foraging activity has been recorded in orchards (Leonard and Fenton 1983), suggesting that these areas are not preferred foraging habitats for the Spotted Bat. Natural foraging habitats are likely to be destroyed by agricultural development, by severely reducing moth (prey) habitat and productivity.

⁴ The overall threat impact was calculated following Master *et al.* (2009) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate. This includes 0 Very High, 0 High, 0 Medium, 6 Low, and 3 Unknown (Table 1). The overall threat considers the cumulative impacts of multiple threats.

2.3 Livestock farming and ranching

The impact of livestock farming and ranching is not well understood. Garcia *et al.* (1995) stated “grazing and agricultural practices may cause habitat loss, produce less suitable foraging conditions, or affect the prey base.” As a result, the range measures outlined in the Identified Wildlife Management Strategy recommend avoiding placement of livestock attractants, managing for proper riparian function and maintaining foraging habitat and prey abundance in Spotted Bat Wildlife Habitat Areas (WHAs).

IUCN #3. Energy Production and mining

3.2 Mining and quarrying

There has been a recent surge in mining activity in B.C. In 2010, the mine evaluation stage doubled from 2009 levels within the Thompson- Okanagan-Cariboo region and mining activities saw substantial increases from 2009 to 2010 (Madu 2010). This type of activity could destroy roosting and foraging habitat. Quarrying of talus or other rock associated with roosts may also impact some sites. Additionally, Spotted Bats are believed to be sensitive to noise disturbance (Garcia *et al.* 1995). Exploration and mining activities could cause substantial noise, which may lead to roost abandonment. The current scope of mining activity is estimated to impact about 1% of roosts and associated foraging area.

3.3 Renewable energy

Wind turbines may kill bats through direct impact by blades or, more often, barotrauma, which is internal hemorrhaging caused by rapid air pressure changes near the blades (Baerwald *et al.* 2008). The scope of this threat is estimated to be about 1% of roosts and associated foraging area but is expected to increase in the next 10 years.

IUCN #4. Transportation and Service Corridors

4.1 Roads and Railroads

Roads likely destroy prey (moth) production through direct habitat loss, similar to urban development. Direct mortality is not known but thought to be low since Spotted Bats generally fly relatively high (5–15 m) from the ground (Wai Ping and Fenton 1989).

IUCN #5. Biological resource use

5.3 Logging and wood harvesting

Impacts of logging on Spotted Bats are not clear. Spotted bats use open ponderosa pine forest and often forage within 20 m of a forest edge (Garcia *et al.* 1995). Leonard and Fenton (1983) recorded no feeding buzzes over ponderosa pine forest and assumed bats flying over this habitat were in transit. Wai-Ping and Fenton (1989) reported Spotted Bats feeding in transit but concentrating on marshes and very open ponderosa pine forest. Some logging in dense ponderosa pine forest therefore may be beneficial for this species. Spotted Bats are dependent on moths but data on moth ecology, production, and density in relation to forest habitats and harvesting was not available. Forest harvesting is limited in ponderosa pine forests at this time due to limited market interests and pine beetle impacts drawing harvesting to other tree species and as such logging and wood harvesting are thought to have a negligible impact at this time.

IUCN #6. Human intrusions and disturbance

6.1 Recreational activities

Spotted Bat cliff roosting habitat may be disturbed by recreational activities such as rock climbing (COSEWIC 2004). This potential threat is not well understood and requires additional research for clarification. The scope of potential rock climbing includes about 1% of known roosting areas, specifically at Skaha Bluffs Provincial Park. Peak rock climbing activity coincides with the time when Spotted Bats are birthing and raising their young. Easterala (1973) reports roost abandonment as a result of noise. Prolonged and continuous disturbance could potentially lead to roost abandonment and increase risk of offspring mortality. Potential Spotted Bat roosting cliffs that host climbing routes at Skaha Bluffs Provincial Park are not occupied by Spotted Bats, suggesting that climbers may be excluding them (M. Sarell, pers. comm., 2012). Due to the height of the roost sites, the overall threat of rock climbing appears low.

IUCN #7. Natural system modifications

7.1 Fire and fire suppression

Fire impacts on Spotted Bats are poorly understood and require additional research.

Forest fires are a common occurrence during the dry summer months in the southern Okanagan and Thompson valley regions. Human-caused wildfires are prevalent in B.C. According to the B.C. Ministry of Forests and Range (2010), 41% of fires recorded between 2000 and 2010 were human-caused. Because of anthropogenic fire suppression, there is an increased probability of catastrophic (i.e., stand replacing) fires (Noss *et al.* 2006), which may result in longer-term loss of Spotted Bat foraging habitat than the lower severity fires that would naturally occur in dry interior forests. Leonard and Fenton (1983) did not detect feeding buzzes in a burned ponderosa pine forest, 10 years after a stand-replacing fire. A catastrophic fire could potentially reduce populations of Spotted Bat prey and temporarily alter foraging habitat therefore reducing prey abundance and capture success. However, Spotted Bats prefer open forests and habitats for foraging, so some burns may provide improved foraging habitat in the longer term if they maintain suitable structure and moth production. Wai-Ping and Fenton (1989) observed high foraging activity over very open ponderosa pine forest woodland. Fire suppression often influences canopy and understory composition. If the forest and understory become denser, decreasing the openness of the forest, foraging habitat may be less used. Fire suppression may be worse for Spotted Bats than having regular fires, but little direct observation of fire impacts have been made.

7.3 Other ecosystem modifications

COSEWIC (2004) states pesticide impacts on Spotted Bat are unknown but orchard spraying may reduce prey abundance. The use of pesticides in crop production is a common practice in the Okanagan and Thompson. No foraging activity was observed in orchards (Leonard and

Fenton 1983) suggesting that they are not preferred foraging areas for the Spotted Bat and may not contribute to prey production. Aerial spraying of *Bacillus thuringiensis* var. *kurstaki* (Btk) for Spruce budworm (*Choristoneura occidentalis*), Douglas-fir Tussock Moth (*Orgyia pseudotsugata*), or other forest pests may also reduce prey density. However, this spraying is limited in extent of overlap with Spotted Bat habitat and seldom applied to the same area more than once in 10 or 20 years (L. MacLauchlan, pers. comm., 2011) so likely has little impact, especially in the long term. This is a knowledge gap that requires investigation.

IUCN #8. Invasive and other problematic species and genes

White-nose Syndrome is a new and rapidly spreading disease that has been linked with extremely high mortality in some hibernating bat species in North America (U.S. Fish and Wildlife Service 2012). It is caused by a fungus (*Geomyces destructans*) (U.S. Fish and Wildlife Service 2012). It has not yet reached B.C. and Spotted Bats are not known to be affected at this time (U.S. Fish and Wildlife Service 2012). However, exposure to the fungus may not have occurred yet. It is not known if Spotted Bats will be exposed to the fungus or if they will be susceptible to infection since their hibernating behaviour is not understood. White-nose Syndrome is an emerging, potential threat that requires close monitoring.

IUCN #9. Pollution

9.6 Excess energy

Road use by vehicles appears to cause temporary avoidance of the airspace above the road (M. Sarell, pers. comm., 2012). Cars passing at night may interrupt foraging behavior (Sarell 2004). Spotted Bats move away when vehicles come, but then return (M. Sarell, pers. comm., 2012). This may increase the energy Spotted Bats expend on foraging. Anecdotal evidence suggests that Spotted Bats may respond to noise and light by excluding habitat up to 100 m from the source (M. Sarell, pers. comm., 2012). It is not clear whether this response is due to light, noise, or other factors. COSEWIC (2004) refers to reports of Spotted Bat intolerance to noise but suggests these reports are anecdotal. More research is required.

IUCN #11. Climate change and severe weather

11.2 Droughts

The potential impacts of climate change on Spotted Bats are not clear. Climate models predict an increase in the amount of grassland beyond the current limits of the Bunchgrass Zone (Wilson and Hebda 2008), which may increase potential Spotted Bat habitat including sagebrush and antelope-brush communities. Climate models also predict increased temperature, from 2.5 to 4.8°C by 2080, and decreased precipitation in the summer (Austin *et al.* 2008). Increased summer temperatures may not impact the species directly, since it thrives in hotter climates to the south. Drought could alter foraging habitat (drying out, decreased plant survival, etc.), which could decrease prey populations but this is speculative. Drought is likely to result in drying of wetlands, which may impact the species foraging habitat. Most foraging takes place over moist to wet habitats such as wetlands, riparian areas and hayfields (COSEWIC 2004).

5 MANAGEMENT GOAL AND OBJECTIVES

5.1 Management Goal

To maintain a stable or increasing population of Spotted Bat distributed throughout the species' present range in B.C.

5.2 Rationale for the Management Goal

As of 2004, there were 80 known occurrences and the estimated population size was fewer than 1000 mature individuals (COSEWIC 2004). The Spotted Bat is likely to remain designated as Special Concern by COSEWIC (i.e., unlikely to be removed from Schedule 1) due to the natural scarcity of its specialized roosting habitats and its limited range in southern B.C. However, the Spotted Bat population within B.C. is thought to be stable and it should be possible to prevent the species from becoming threatened or endangered by maintaining the current distribution and numbers and minimizing threats. Emerging potential threats related to White-nose Syndrome, which is currently unknown in Spotted Bats, may require a change in approach. Quantifying population and habitat targets is not feasible at this time due to limited baseline information. To better quantify population and habitat targets, addressing knowledge gaps should be a priority.

5.3 Management Objectives

1. Protect⁵ and manage important habitat for Spotted Bat in B.C.
2. Clarify population numbers, the distribution of roosting and foraging habitat, and trends for Spotted Bat populations and habitat in B.C.
3. Address knowledge gaps relating to wintering habitat use and foraging habitat use quantification, for the Spotted Bat.

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

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

⁵ Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation covenants, sale by willing vendors on private lands, land use designations, and protected areas

Compile Status Report (complete)

- COSEWIC report completed (COSEWIC 2004). Update due 2014.

Send to COSEWIC (complete)

- Spotted Bat designated Special Concern (COSEWIC 2004). Re-assessment due 2014.

Monitor Trends (in progress)

- Limited monitoring of site occupancy has been done: 1981 (Leonard and Fenton 1983); 1986 (Fenton *et al.* 1987); 1987 (Wai-Ping and Fenton 1987); 1989 (Collard *et al.* 1990); 1991 (Chapman and McGuiness, unpubl. data); 1992 (Roberts and Roberts 1992; Holroyd *et al.* 1994); 1993 (Roberts and Roberts 1993); 2000 (Sarell and Haney 2000); 2007 (Iredale and Ferguson 2007).

Planning (complete)

- Management Plan for the Spotted Bat (*Euderma maculatum*) in B.C. completed (this document, 2013).

Habitat Protection and Land Stewardship (in progress)

- Acoustic inventories have been conducted to identify some sites for habitat protection and stewardship, although this action is incomplete: 1981 (Leonard and Fenton 1983); 1986 (Fenton *et al.* 1987); 1987 (Wai-Ping and Fenton 1987); 1989 (Collard *et al.* 1990); 1991 (Chapman and McGuiness, unpubl. data); 1992 (Roberts and Roberts 1992; Holroyd *et al.* 1994); 1993 (Roberts and Roberts 1993); 2000 (Sarell and Haney 2000); 2007 (Iredale and Ferguson 2007).
- Bat assessment in 2010 in Bridge River (Sarell *et al.* 2010).
- 5% of Spotted Bat potential habitat in B.C. is in conservation lands (COSEWIC 2004). Some examples include South Okanagan Grasslands and White Lake Grasslands Protected Areas, which are protected through the legal provisions of the provincial *Parks Act*, and the Vaseux-Bighorn National Wildlife Area, which is protected under the *Canada Wildlife Act*.
- It is listed as a species at risk under the *Forest and Range Practice Act*, which enables habitat management tools as per the Identified Wildlife Management Strategy (Province of British Columbia 2004). One WHA has been approved at Criss Creek near Kamloops to manage forestry and range activities for Spotted Bats.

Species and Population Management (in progress)

- Protected from killing under the provincial *Wildlife Act*.

6.2 Recommended Management Actions

Table 2. Recommended management actions and suggested implementation schedule for the Spotted Bat in British Columbia.

Objective	Conservation Framework action group	Recommended management action	Threat or concern addressed	Priority	Time-line
1	Habitat Protection	Identify important roosting, wintering and foraging habitats for protection through inventory and GIS models. Assess and record threats at each important site to clarify protection needs.	All threats; Knowledge gaps	Essential	2013 to 2018
		Protect/ manage important habitat using WHAs, parks and protected areas, best management practices (BMPs), outreach, stewardship agreements, and other effective measures	1.1, 2.1, 3.2, 3.3, 4.1, 6.1, 9.6; Knowledge gaps	Essential	2013 to 2018
2	Monitor Trends	Develop standardized methods for inventory and monitoring to obtain population counts and trends at representative sites	Knowledge Gaps	Necessary	2013 to 2014
		Implement the above standard methods to establish population trends	Knowledge Gaps	Necessary	2013 to 2014
		Develop standardized methods for monitoring trends for important habitats	Knowledge Gaps	Necessary	2014 to 2018
		Implement the above standard methods to establish habitat trends	Knowledge Gaps	Necessary	2014 to 2018
3	Species and Population Management	Coordinate with universities in Canada and the U.S. to prioritize and conduct research to address knowledge gaps including wintering habitat; quantification of foraging habitat preferences and prey (moth) densities; and potential threats from noise, light, wind farms, White-nose Syndrome, and rock climbing.	Knowledge Gaps; 3.3, 6.1, 8.1, 9.6	Beneficial	2013 to 2018

^a Threat numbers according to the IUCN-CMP classification (see Table 1 for details).

^b 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).

6.2.1 Narrative to Support Management Actions Table

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

6.2.2 Habitat Protection

Habitat protection and management are essential for maintaining existing Spotted Bat locations. Spotted Bat roosting habitat is generally in inaccessible cliff faces but still may be subject to disturbance and may require management to reduce threats. Hibernating sites have not been located. However, they are important and potentially limiting habitats that require protection, if identified. Foraging sites include wetlands and riparian areas that have been impacted by development (Lea 2008) and need protection to ensure that unsustainable losses do not continue.

6.2.3 Monitor Trends

Monitoring of strategically selected locations is required to assess the effectiveness of protection and threat abatement measures.

6.2.4 Species and Population Management

There are many knowledge gaps for the Spotted Bat. These knowledge gaps must be prioritized and addressed to ensure threat abatement measures are effective and targeted at the threats with the greatest impact on the species.

7 MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution goal and recovery objectives. If monitoring activities indicate that the Spotted Bat population is stable or increasing throughout its B.C. range, then the management goal has been met. Performance measures are listed below for each objective.

Objective 1

- Important roosting, wintering and foraging habitats at a minimum of 10 locations throughout the species range have been identified by 2015 and protection measures have been initiated at these 10 locations by 2018.

Objective 2

- A standardized monitoring strategy for selected locations/habitats has been developed by 2014 and implemented by 2015 to clarify population and habitat trends.

Objective 3

- Research topics have been prioritized and universities have been contacted and encouraged to conduct research into knowledge gaps by 2015.

8 EFFECTS ON OTHER SPECIES

Negative effects on other species are not foreseen; however, management and protection of the Spotted Bat could prove beneficial for other species with overlapping habitat. Species that may benefit from efforts to protect Spotted Bat roosting habitat include other cliff-roosting bat species (Pallid Bat [*Antrozous pallidus*] - Threatened and Little Brown Myotis - Endangered) and cliff-nesting birds (e.g., Peregrine Falcon [*Falco peregrinus anatum/tundrius* subspecies] - Special Concern). Efforts to maintain open forest and marsh foraging habitat for Spotted Bats will benefit a large suite of SARA-listed species that also rely on these habitat types (e.g., open forest: White-headed Woodpecker [*Picoides albolarvatus*] – Endangered, and Lewis’s Woodpecker [*Melanerpes lewis*] – Threatened).

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