COSEWIC
Assessment and Update Status Report

on the

Fringed Bat
Myotis thysanodes

in Canada

DATA DEFICIENT
2004

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

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

COSEWIC 2004. COSEWIC assessment and update status report on the fringed bat *Myotis thysanodes* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 26 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Previous report:

Balcombe, J.P. 1988. COSEWIC status report on the fringed myotis *Myotis thysanodes* in Canada. Committee on the Status of Endangered Wildlife in Canada. 14 pp.

Production notes:

1. COSEWIC acknowledges David Nagorsen for writing the update status report on the fringed bat *Myotis thysanodes* in Canada. The report was overseen and edited by Brock Fenton, COSEWIC Terrestrial Mammals Species Specialist Subcommittee co-chair.
2. Fringed Bat *Myotis thysanodes* was previously listed by COSEWIC as the Fringed myotis *Myotis thysanodes.*

For additional copies contact:

COSEWIC Secretariat
c/o Canadian Wildlife Service
Environment Canada
Ottawa, ON
K1A 0H3

Tel.: (819) 997-4991 / (819) 953-3215
Fax: (819) 994-3684
E-mail: COSEWIC/COSEPAC@ec.gc.ca
http://www.cosewic.gc.ca

Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le chauve-souris à queue frangée (*Myotis thysanodes*) au Canada – Mise à jour.

Cover illustration:
Fringed bat — Illustration by Michael Hames, from Bats of British Columbia by D.W. Nagorsen and R.M. Brigham (UBC Press/RBCM) 1993, copyright Royal British Columbia Museum, reprinted with permission.

Catalogue No. CW69-14/396-2004E-PDF
ISBN 0-662-37365-0
HTML: CW69-14/396-2004E-HTML
0-662-37366-9


Recycled paper

COSEWIC
Assessment Summary

Assessment Summary – May 2004

Common name
Fringed bat

Scientific name
Myotis thysanodes

Status
Data Deficient

Reason for designation
This species is rarely reported in its Canadian range. There are, however, a few sites in the Okanagan Valley where they regularly can be captured during the summer. There is a lack of data about the extent of its Canadian range and the habitat that is important for foraging and roosting. We also do not know the population size or trends, nor any key demographic characteristics, such as population structure, reproduction or survival rates. It is not known if this species overwinters in Canada or migrates south for the winter; however, there are maternal colonies recorded in Canada.

Occurrence
British Columbia

Status history
Designated Special Concern in April 1988. Status re-examined in May 2004 and designated Data Deficient. Last assessment based on an update status report.

COSEWIC
Executive Summary

Fringed Bat
Myotis thysanodes

Species information

The largest (mean forearm length= 42.3 mm, mean body mass 7.1 g) *Myotis* species in Canada, the Fringed Bat (*Myotis thysanodes*) has pale brown dorsal fur, blackish wing and tail membranes, and long black ears. The most distinctive feature of this species is a fringe of stiff hairs located on the trailing edge of the interfemoral membrane. *M. thysanodes* belongs to the Order Chiroptera, Family Vespertilionidae. Among the North American long-eared *Myotis* species, *M. thysanodes* is the most morphologically distinct but it shares a close affinity with the Western Long-eared Myotis (*Myotis evotis*) and Miller's Myotis (*Myotis milleri*) in allozyme and chromosomal traits. Recent mtDNA analyses have shown that *M. thysanodes* is most closely related to *M. evotis* and in some regions there has been mitochondrial introgression between these two species. Although four subspecies are recognized, the subspecies taxonomy is not supported by mtDNA analysis.

Distribution

The Fringed Bat ranges throughout western North America from Chiapas and Veracruz, Mexico, across much of the western United States to southern British Columbia. A disjunct population inhabits the Black Hills of South Dakota and Wyoming. In Canada, this bat is restricted to the Okanagan, Similkameen, north and south Thompson, Fraser and Chilcotin River valleys of southern British Columbia. A specimen from Olympic National Park on the Olympic Peninsula identified as the Fringed Bat suggests that this species could inhabit coastal British Columbia. The 33 distributional records in Canada represent about 18 element occurrences. The area of occupancy is unknown; the extent of occurrence in Canada is about 8,650 km^2. This represents < 5% of the species' global range.

Habitat

In the United States, this species uses a variety of roosting sites for day and night roosts—buildings, caves, tunnels, mines, and rock crevices. In Canada where no radio-tracking studies have done, what little is known about the roosting biology of the Fringed Bat is derived from opportunistic finds or inferences from captures. The two confirmed

maternity colonies in Canada were in the attics of buildings. *M*. *thysanodes* may also roost in cliff crevices and trees but this has not been confirmed. Night roosts are in buildings and abandoned mines. Little is known about its foraging habitat in Canada but anecdotal evidence suggests it may use forage in riparian habitats.

Biology

What is known about the biology of the species is based largely on studies done in the United States. Mating occurs sometime after this species leaves its maternity roost in late summer. Females arriving at the maternity colony in early April are carrying sperm in their uteri, but ovulation and fertilization occurs nearly a month later. Females give birth to a single young and produce only one litter in the breeding season. Females presumably breed in their first year, but males evidently do not breed until their second year.

When exposed to ambient temperatures $\leq 24^{o}$C, breeding females will use torpor or regulate their body temperature by increasing their metabolic rate. Energy demands are greatest for this species during lactation. Fringed Bats have been found hibernating in Oregon and North Dakota, but winter surveys of 18 caves and mines within the Canadian range found no hibernating Fringed Bats.

Radio tracking studies have shown that this bat generally occupies a limited area of about 4 km^2. Roosts in permanent structures such as buildings are generally occupied throughout the entire summer. But Fringed Bats roosting in trees and rock crevices frequently switch their roosts, remaining at a roost site for only a few days. They rarely move more than 2 km between roosts. Nothing is known about migratory movements in the Canadian population.

The Fringed Bat eats mostly moths, beetles, flies, lacewings and some flightless invertebrates. The slow manoeuvrable flight and moderate to low intensity, frequency-modulated, echolocation calls suggest that it is adapted for gleaning, i.e., taking prey from surfaces.

The Fringed Bat is colonial. Maternity colonies in buildings may contain up to 1,000 to 1,200 individuals. Maternity colonies in tree or rock crevice roosts, however, are smaller, usually fewer than a few dozen animals. Although it often switches its day roosts, there appears to be some fidelity to a local area; night roosts may be used by the same individuals over a period of years.

Population sizes and trends

There are no population estimates for the Canadian population and no data exist to assess population trends. In various surveys done in British Columbia, the Fringed Bat is rarely captured in mist nets and harp traps in comparison to the 6 other *Myotis* species found within its range. To what extent the few captures can be attributed to rarity or simply this species' ability to avoid capture is unknown.

Limiting factors and threats

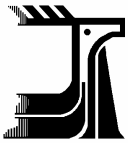
With so little known about this species' biology in Canada, it is difficult to define any threats or limiting factors. Given this species' diverse and flexible roosting habits in the United States, roosting habitat may not be limiting. Most of the threats are generic such as disturbance to maternity colonies in buildings, disturbance of night roosts in mines or other manmade structures, and the impact of pesticides on invertebrate prey.

Special significance of the species

The Fringed Bat is one of three western North American bat species confined to the intermontane grasslands of British Columbia in Canada. It is a member of a diverse temperate bat community of 12 to 14 species and the largest of the 7 *Myotis* species. Its precise niche in this community, however, is virtually unknown.

Existing protection or other status designations

The Fringed Bat was designated Special Concern by COSEWIC in 1988. The global heritage status rank is G4G5 (apparently secure to secure); national ranks are N4N5 (apparently secure to secure) for the United States and N2N3 (imperilled to vulnerable) for Canada. Three states (Idaho, Wyoming, Nebraska) rank the Fringed Bat as S1 or S1? (critically imperilled); two states (Oregon, South Dakota) rank this species as S2 (imperilled). Washington, Montana, Texas, and Utah rank the Fringed Bat as S3 (vulnerable). British Columbia has designated the Fringed Bat as S2S3 (imperilled to vulnerable). In British Columbia, the Fringed Bat is protected from killing under the provincial Wildlife Act, and it is listed as an Identified Wildlife Species under the revised British Columbia Provincial Forest and Range Practices Code. Nonetheless, the Forest and Range Practices Code only applies to provincial crown land; in the southern portion of the Canadian range, for example, nearly 50% of this species' habitat is exempt from the code.



COSEWIC HISTORY

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

COSEWIC MANDATE

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

COSEWIC MEMBERSHIP

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

DEFINITIONS (AFTER MAY 2004)

Species	Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

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

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

*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

Environment Canada | Environnement Canada
Canadian Wildlife Service | Service canadien de la faune

Canada

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

Update
COSEWIC Status Report

on the

Fringed Bat
Myotis thysanodes

in Canada

2004

TABLE OF CONTENTS

SPECIES INFORMATION 4
Name and classification 4
Description 4
DISTRIBUTION 6
Global range 6
Canadian range 6
HABITAT 9
Habitat requirements 9
Trends 11
Protection/ownership 12
BIOLOGY 12
General 12
Reproduction 13
Survival 13
Physiology 13
Movements/dispersal 14
Nutrition and interspecific interactions 14
Behaviour/adaptability 15
POPULATION SIZES AND TRENDS 15
LIMITING FACTORS AND THREATS 16
SPECIAL SIGNIFICANCE OF THE SPECIES 16
EXISTING PROTECTION OR OTHER STATUS 16
SUMMARY OF STATUS REPORT 17
TECHNICAL SUMMARY 18
ACKNOWLEDGEMENTS 20
LITERATURE CITED 20
BIOGRAPHICAL SUMMARY OF THE REPORT WRITER 23
AUTHORITIES CONTACTED 24
COLLECTIONS EXAMINED 24

List of figures

Figure 1. Fringed bat (*Myotis thysanodes*) 5
Figure 2. Global range of the Fringed Bat (*Myotis thysanodes*). 7
Figure 3. Canadian range of the Fringed Bat (*Myotis thysanodes*). 8
Figure 4. Habitat suitability map showing roosting and foraging habitat of the Fringed Bat (*Myotis thysanodes*) in the southern Okanagan and Similkameen valleys of British Columbia 10

List of tables

Table 1. Historical changes in area of natural and anthropogenic habitats in the southern Okanagan-Similkameen valleys of British Columbia 11
Table 2. Land tenure for Fringed Bat (*Myotis thysanodes*) habitat in the southern Similkameen-Okanagan valleys of British Columbia 12

List of appendices

Appendix 1. The occurrence of the Fringed Bat (*Myotis thysanodes*) in coastal Washington. 25

SPECIES INFORMATION

Name and classification

Myotis thysanodes Miller 1897 belongs to the Order Chiroptera, Family Vespertilionidae. A phenetic analysis of morphological traits led Findley (1972) to assign *Myotis thysanodes* to his *Nattereri* group, which included the Palaearctic species *Myotis natteri* and *Myotis pequinus*. A more recent analysis based on mtDNA sequences in 33 species of *Myotis* led Ruedi and Mayer (2001) to conclude that *M. thysanodes* and *M. natteri* evolved in different clades. Morphological similarity among these taxa (notably the distinctive fringe on the trailing edge of the interfemoral membrane) reflects convergence and is a poor predictor of genetic or ancestral similarities. Among the North American long-eared *Myotis* species, *M. thysanodes* is the most morphologically distinct but it shares a close affinity with the Western Long-eared Myotis (*Myotis evotis*) and Miller's Myotis (*Myotis milleri*) in allozyme and chromosomal traits (Reducker et al. 1983). Recent mtDNA analyses by Tanya Dewey (unpubl. data) have shown that *M. thysanodes* is most closely related to *M. evotis* and in some regions there has been mitochondrial introgression between these two species.

Although four subspecies are recognized: *M. t. aztecus*-southern Mexico, *M. t. thysanodes*-most of western North America including British Columbia, *M. t. pahasapensis*-the Black Hills, and *M. t. verspertinus*-coastal Oregon and California (Hall 1981; Manning and Jones 1988), the phylogeographic structure revealed from the mtDNA analysis by Tanya Dewey (unpubl. data) is inconsistent with this subspecies taxonomy.

Another common English name for this species is the Fringed Myotis. The French common name is Vespertilion à queue frangée, or chauve-souris à queue frangée.

Description

The largest *Myotis* species in Canada, the Fringed Bat (Figure 1A) has pale brown dorsal fur, blackish wing and tail membranes, and long black ears. The ventral fur tends to be buffy. The outer edge of the interfemoral membrane has a fringe of stiff hairs visible with the naked eye. The calcar (a cartilaginous spur on the heel bone) is not keeled. The skull has a relatively narrow rostrum and a steep sloping forehead region. The dental formula is: incisors 2/3, canines 1/1, premolars 3/3, and molars 3/3. Representative body measurements (range in parentheses) for adults from the Canadian population are: total length 90 mm (88-93), ear length 19 mm (18-20), tragus length 9 mm (8-11), forearm length 42.3 mm (40.0-44.5), body mass 7.1 g (5.4-8.4) (Nagorsen 2002).

The only other long-eared *Myotis* bat known to occur within its Canadian range is the Western Long-eared Myotis (*M. evotis*). The Fringed Bat is discriminated by its longer forearm (usually >42 mm), and a very prominent fringe of hairs on the outer edge of the tail membrane (Figure 1B) that is visible with the naked eye (van Zyll de Jong 1985; Nagorsen 2003). The skull of *M. thysanodes* has a broader palate (width across upper molars (M^3-$M^{3)}$ >6.2 mm, and longer than maxillary toothrow length).

A

B

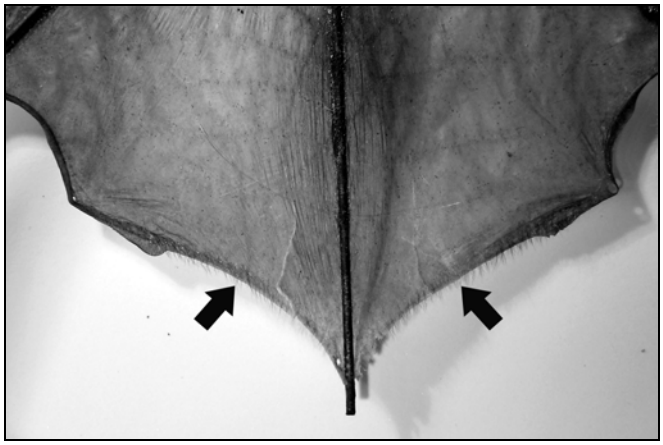


Figure 1. Fringed bat (*Myotis thysanodes*) A: dorsal view, photo from Roger Barbour, B: close up of hair fringe on the edge of the interfemoral membrane (RBCM 2514).

DISTRIBUTION

Global range

The Fringed Bat ranges throughout western North America from Chiapas and Veracruz, Mexico, across much of the western United States to southern British Columbia (Figure 2). A disjunct population inhabits the Black Hills of South Dakota and Wyoming (O'Farrell and Studier 1980). The limits of its distribution in the coastal Northwest are not clear. Most distribution maps (e.g., O'Farrell and Studier 1980) show a coastal population in California and Oregon that reaches its northern limits at the Columbia River. Although Barbour and Davis (1969) and Manning (1993) noted the occurrence of this species in coastal Washington, the Washington records summarized by Johnson and Cassidy (1997) show no coastal occurrences. A specimen from Olympic National Park on the Olympic Peninsula identified as the Fringed Bat by Scheffer (1995) (see Appendix 1) suggests that the coastal range may extend north of the Columbia River.

Canadian range

In Canada (Figure 3), this bat is restricted to southern British Columbia where it is generally found below 800 m in valleys of the dry interior grasslands (Nagorsen and Brigham 1993). This species was first discovered in Canada in 1937 when Maslin (1938) found a nursery colony in a house at Vernon. Subsequent surveys (Fenton et al. 1980; Collard et al. 1990; Roberts and Roberts 1992, 1993; Firman et al. 1994; Holroyd et al. 1994; Sarell and Haney 2000) demonstrated that the Fringed Bat inhabits the Okanagan, Similkameen, north and south Thompson, Fraser and Chilcotin River valleys (Fig. 3). Northernmost occurrences are Grinder Creek near Williams Lake in the Fraser River and the Farwell Canyon in the Chilcotin River. The occurrence of this species in coastal Washington (see Scheffer 1995; Appendix 1) raises the possibility of the Fringed Bat inhabiting coastal areas in south-western British Columbia.

The 33 distributional records in Canada represent about 18 element occurrences[1]. The distributional records in the Cariboo and Fraser river valleys appear to be isolated from those in the Thompson, and southern Okanagan-Similkameen valleys suggesting the existence of two subpopulations. Nevertheless, this disjunct pattern may be largely an artifact of sampling. Little bat inventory has been done the Thompson River valley or the Fraser River valley between Lillooet and Churn Creek.

[1] An element occurrence for small bats is defined by the Heritage Ranking System as sites occupied historically or at present that are separated by 10 km or more.

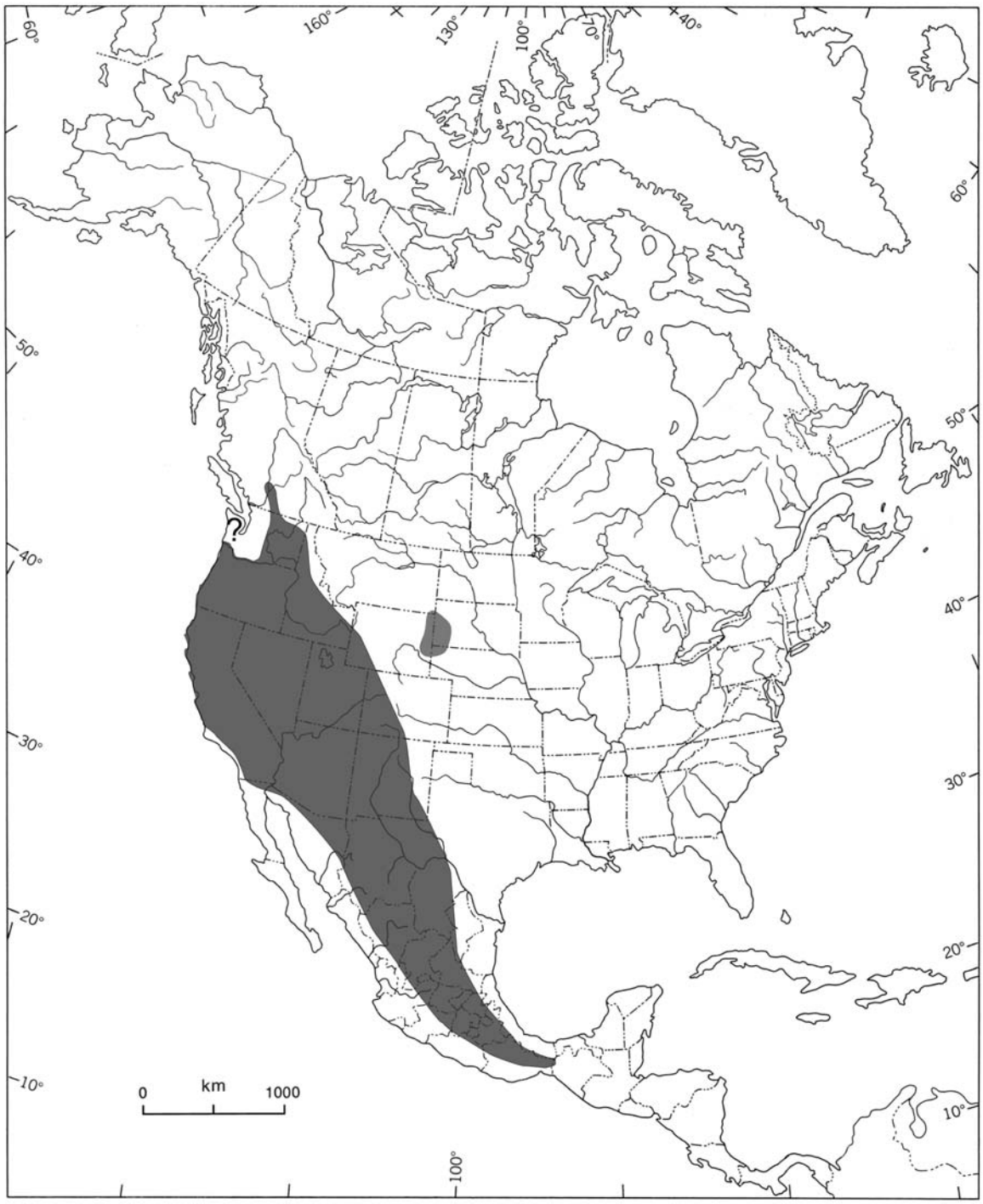


Figure 2. Global range of the Fringed Bat (*Myotis thysanodes*).

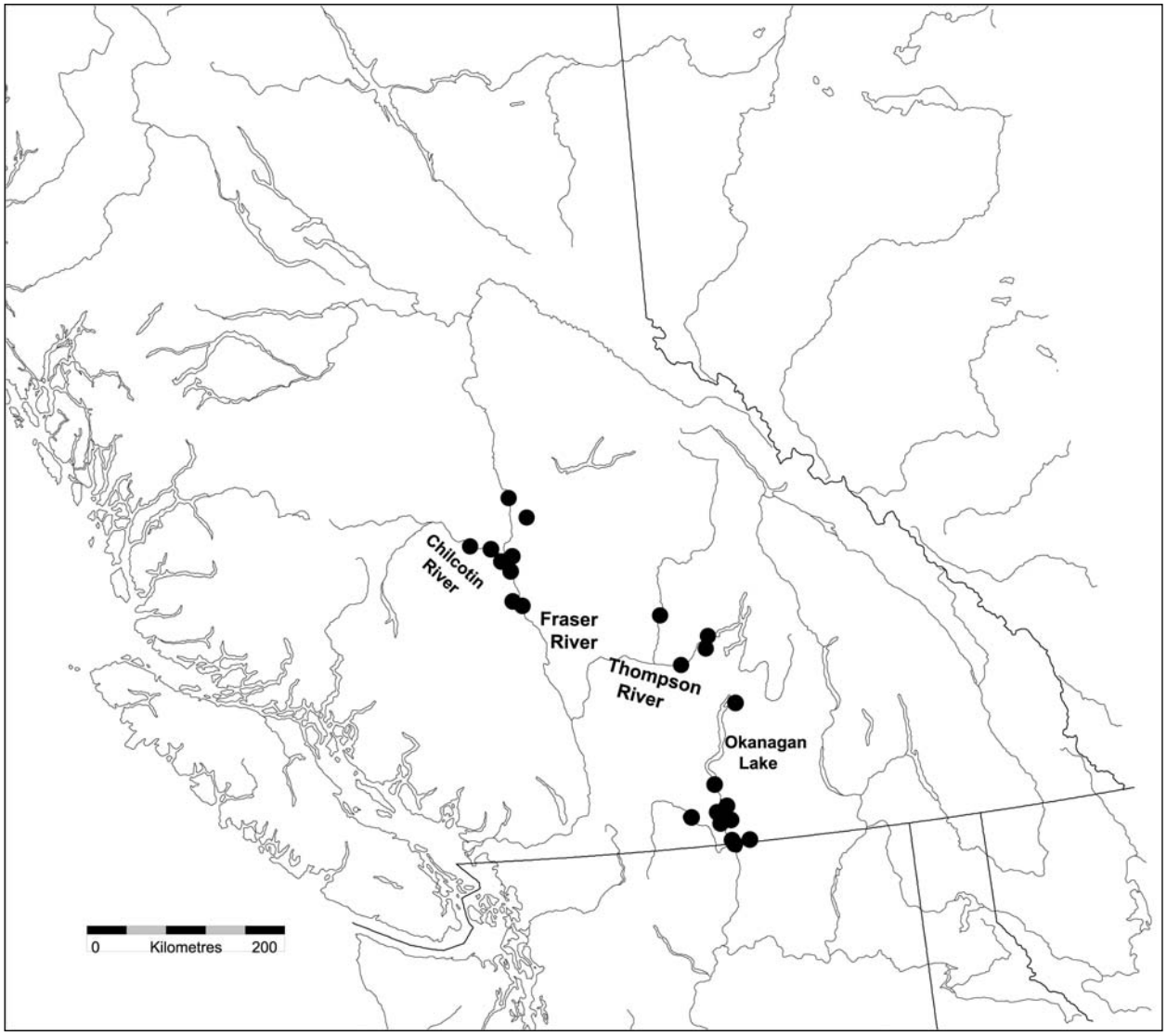


Figure 3. Canadian range of the Fringed Bat (*Myotis thysanodes*).

Historical distributional changes can not be assessed because the Canadian range has only been delimited over the past few decades. The area of occupancy is unknown; the extent of occurrence in Canada is about 8,650 km^2. This represents less than 5% of the species' global range.

HABITAT

Habitat requirements

General

In the United States, the Fringed Bat ranges from sea level to 2,850 m above sea level where it occupies desert, steppe, oak and pinyon woodlands, coastal forest, and montane spruce-fir forest (O'Farrell and Studier 1980). In Canada, this species is restricted to grassland, shrub-steppe and open ponderosa pine forest where most occurrences are from 300 to 800 m elevation in the Bunchgrass, Ponderosa Pine, or Interior Douglas-fir biogeoclimatic zones (Meidinger and Pojar 1991).

Roosting habitat

Throughout most of its range this bat exploits a variety of roosting sites. Day roosts including maternity colonies are located in the attics of buildings, caves, tunnels, mines, and rock crevices (Easterla 1973; O'Farrell and Studier 1980; Cryan et al. 2001). Cryan et al. (2001) observed that cliff roosts tended to be situated on south-facing slopes, but no data have been recorded on the microclimate of caves and mines used as day roosts. Roosts in buildings are usually in dark attics with warm temperatures. Recent studies with radio-tracking in Arizona, California, New Mexico, and South Dakota have revealed that this species also roosts in trees (Chung-MacCoubrey 1996; Rabe et al. 1998; Weller and Zabel 2001; Cryan et al. 2001). It generally roosts under loose bark using large snags in decay classes 2 and 3 (dead trees with broken tops and bark remaining) or in live ponderosa pine (*Pinus ponderosa*) trees with long vertical cracks and loose bark. Night roosts (temporary roosting sites used after nocturnal feeding bouts) are located in buildings, caves, mines and under bridges (Albright 1959; Adam and Hayes 2000). In North Dakota and Oregon this bat has been found hibernating during winter in caves or mine adits (Martin and Hawks 1972; Perkins et al. 1990).

In Canada where no radio-tracking studies have been done, what little is known about the roosting biology of the Fringed Bat is derived from opportunistic finds or inferences from captures. There are only two confirmed maternity colonies—both were in the attics of buildings (Maslin 1938; Sarell and Haney 2000). Sarell and Haney (2000) captured pregnant and post-lactating females in the southern Okanagan Valley and assumed that the maternity colonies were in nearby cliffs. In the Chilcotin-Cariboo region, night roosts have been found in buildings and root cellars (A. Roberts pers. comm.). In the southern Okanagan valley a well-known night roost is located in the Suzie Mine. The mine is only occupied at night (000-300 hrs) by the Fringed Bat.

A habitat suitability map developed for the southern Okanagan and Similkameen valleys (Ministry of Environment, Lands and Parks 1998) indicates that roosting habitat in this region (Figure 4) is widespread. Given the paucity of data on this bat's roosting biology in Canada, the validity of the model (Warman et al. 1998) is dubious. For example, the model includes wildlife trees (dead trees or snags) as a critical habitat

Figure 4. Habitat suitability map showing roosting and foraging habitat of the Fringed Bat (*Myotis thysanodes*) in the southern Okanagan and Similkameen valleys of British Columbia. From *Habitat atlas for wildlife at risk: south Okanagan and lower Similkameen, Ministry of Environment, Lands and Parks, 1998.*

component, but tree roosting has yet to be shown for this species in Canada. The model also fails to incorporate night roosts.

Foraging habitat

Data on the foraging habitat are largely anecdotal. In British Columbia, Collard et al. (1990) tracked 21 Fringed Bats captured at the Suzie Mine that were marked with temporary light tags. Most foraged in riparian habitat from 3 to 10 m above ground after being released. Firman et al. (1994) observed a single light-tagged individual foraging over the forest canopy and along the edge of a lake. Roberts and Roberts (1992, 1993), Holroyd et al. (1994), and Sarell and Haney (2000) all reported captures of the Fringed Bat in mist nets or harp traps set in riparian thickets or at the edge of waterbodies. These captures could reflect foraging or drinking activity.

A habitat suitability map developed for the southern Okanagan and Similkameen valleys (Ministry of Environment, Lands and Parks 1998) demonstrated that foraging habitat in this region is widespread and continuously distributed (Figure 4). According to the map, only urban and agricultural lands in the bottomlands lack suitable foraging habitat. Nevertheless, with so little known about the foraging biology of the Fringed Bat in Canada reliability of the habitat suitability model is unknown.

Trends

The valleys of the interior grasslands of British Columbia have been modified by live-stock grazing, irrigation, and local urban growth. Detailed analyses of habitat trends exist only for the southern Okanagan-Similkameen valleys. Natural communities in this region were first impacted by livestock grazing in the late 1880s, but agricultural development (Table 1) associated with orchards, irrigated hay fields, and vineyards that began in the early 1900s and more recent urban growth have resulted in significant declines in grassland, wetland, and riparian habitats (Cannings et al. 1987; Lea unpublished data; Ministry of Environment, Lands and Parks 1998). According to Redpath (1990) more than 90% of the land in the southern Okanagan-Similkameen has been altered from its 'normal' state.

Table 1. Historical changes in area (hectares) of natural and anthropogenic habitats in the southern Okanagan-Similkameen valleys of British Columbia. Based on unpublished data from Ted Lea, British Columbia Ministry of Water, Air, and Land Protection.

Habitat Type	Year			
	1800s	1939	1995	2001
Antelope-Bush	9607	7046	4279	4093
Big Sagebrush	7243	5567	4369	4369
Riparian[1]	8679	4996	2957	2957
Urban Area	0	368	3567	3567
Cultivated Area	0	11482	18871	19057

[1]water birch, cottonwood communities

With so little known about this species' roosting requirements in Canada, the impacts of agricultural development, urbanization, or forest harvesting on roosting sites is unknown. Riparian or marshy areas have declined in parts of this bat's Canadian range. For example, according to the *Habitat atlas for wildlife at risk: south Okanagan and lower Similkameen* (British Columbia Ministry of Environment, Lands and Parks 1998) about 85% of the valley bottom riparian habitat has disappeared. However, data supporting the Fringed Bat's dependence on riparian habitats for foraging are weak.

Protection/ownership

Quantitative assessment of land tenure for Fringed Bat habitat exists only for the southern Okanagan and Similkameen valleys (Ministry of Environment, Lands and Parks 1998). The 1998 analysis estimated that only 8% of potential Fringed Bat habitat was protected in conservation land (Table 2); a significant portion of habitat was either in Indian Reserve land particularly the Inkaneep and Penticton Reserves or private land holdings. Data in Table 2 were calculated before the establishment of new protected areas (South Okanagan Grasslands, White Lake Grasslands) as part of the Provincial Protected Areas Strategy. These new protected areas support additional Spotted Bat habitat and probably increase the proportion of habitat in conservation land to about 10 to 15%.

Table 2. Land tenure for Fringed Bat (*Myotis thysanodes*) habitat in the southern Similkameen-Okanagan valleys of British Columbia. Taken from *Habitat atlas for wildlife at risk: south Okanagan and lower Similkameen*, Ministry of Environment, Lands and Parks 1998.

Tenure	Area (ha)	% Total Habitat[1]
Conservation Land	12,716	8
Provincial Land	70,204	43
Indian Reserve	37,317	23
Private Land	43,734	26

[1]includes roosting and foraging habitat

BIOLOGY

General

The general biology of the Fringed Bat is similar to that of most temperate region verspertilionid bats. It has the ability to enter torpor to conserve energy, a long life span, and a low reproductive rate. Roosting sites are critical for protection from predators, providing shelter, and suitable physiological conditions. Echolocation is used for orientation in flight and prey detection. Almost all of the data on this species' general biology are derived from studies done in the United States.

Reproduction

Reproductive biology was described by O'Farell and Studier (1972, 1973) for a maternity colony in a building in New Mexico. The precise timing for copulation is unknown, but mating occurs sometime after this species leaves its maternity roost in autumn. Females arriving at the maternity colony in early April were carrying sperm in their uteri. Ovulation and fertilization occurs nearly a month after the females arrive at the maternity colony. Females give birth to a single young and produce only one litter in the breeding season. The gestation period is about 50 to 60 days. The parturition period was synchronized for the New Mexico colony with births from 25 June to 7 July. The young develop rapidly reaching adult size by 3 weeks. By 16.5 days they are capable of limited flight; by 20.5 days they are capable of flight comparable to the adults. Reproductive data for the Canadian population are scanty. A pregnant female was captured 27 June; nursing females have been taken from 9 to 29 July (Roberts and Roberts 1993; Holroyd et al. 1994). The nursery colony at Vernon had young bats 19 July when examined by Maslin (1938). Females may breed in their first year, but males evidently do not breed until their second year.

Survival

Data on survival rates and mortality are few. However, in some temperate bats, first year mortality rate may approach 1%.Tuttle and Stevens (1987) reported a banded Fringed Bat recovered at a mine in Oregon that was a minimum of 18.3 years old. Constantine et al. (1979) described rabies in several Fringed Bats in the United States. There are no reports of predation in the literature.

Physiology

In the south-western United States, Jones (1965) netted Fringed Bats at ambient temperatures of 9 to 25^{o}C. According to Studier and O' Farrell (1972), hyperthermia begins at ambient temperatures of 24^{o}C and this species is fully hyperthermic at ambient temperatures above 28^{o}C. When exposed to ambient temperatures of 24^{o}C or less, breeding females will use torpor or regulate their body temperature by increasing their metabolic rate. Energy demands are greatest for this species during lactation (Studier et al. 1973) and nursing females remaining homeothermic will maintain a body temperature about 2^{o}C lower than that of pregnant or post-lactating females. In maternity roosts, this species undergoes daily movements within the roost to find the ideal temperature regime for thermoregulation.

Studier and O'Farrell (1972) found that Fringed Bats in New Mexico had deposited insufficient fat reserves to hibernate when they abandoned the nursery roost in autumn. They concluded that this bat is periodically active throughout winter. However, Fringed Bats have been found hibernating in Oregon and North Dakota (Martin and Hawks 1972; Perkins et al. 1990). No winter records exist for the Fringed Bat in British Columbia. Winter surveys of 18 caves and mines within the Canadian range found no hibernating Fringed Bats (Nagorsen et al. 1993).

Movements/dispersal

There are no measurements on the distances that this bat commutes from its day roost and nocturnal foraging sites. However, radio tracking studies (Cryan et al. 2001) have shown that it generally occupies a limited area of about 4 km^2. Roosts, particularly maternity colonies, in permanent structures such as buildings are generally occupied throughout the entire summer (O' Farrell and Studier 1975). But Fringed Bats roosting in trees and rock crevices frequently switch their roosts, remaining at a roost site for only a few days (Cryan et al. 2001; Weller et al. 2001). Distances moved between roost sites are short. In north-western California, Weller et al. (2001) found that the mean distance between tree roosts was only 254 m (range 7-641 m). In the Black Hills of South Dakota where both tree and crevice roosts were used, the Fringed Bat never moved more than 2 km between roosts (Cryan et al. 2001). Nursing females will transport their non-volant young when moving to a new roost.

Studier and O'Farrell (1972) speculated that in New Mexico the Fringed Bat migrates in late summer from the summer maternity sites to its winter range. Hoffmeister (1970) documented a shift in occurrence records for summer and winter in Arizona that he attributed to migratory movements. However, there are no specific data on long distance or migratory movements by this bat. Nothing is known about migratory movements in the Canadian population.

Nutrition and interspecific interactions

There are no dietary data for the Canadian population. In New Mexico, Black (1975) found that beetles (Coleoptera) occurred in 73% of the faecal pellets he sampled from this species; moths (Lepidoptera) were found in 36% of the pellet samples. In Oregon moths, lacewings (Neuroptera), and various flightless invertebrates such as spiders (Araneida), crickets (Gyrillidae), and harvestman (Phalangida) were identified in stomach remains (Whitaker et al. 1977, 1981). These diet studies were all based on small sample sizes. An analysis of a large sample (68) of faecal pellets from Arizona revealed that the diet was mostly moths, beetles, flies (Diptera), and lacewings (Warner 1985).

Bell (1980) interpreted the slow manoeuvrable flight and moderate to low intensity, frequency-modulated, echolocation calls of this species as adaptations for a gleaning foraging strategy. Studier and O'Farrell (1980) speculated that the puncture resistant flight membranes of the Fringed Bat are an adaptation for gleaning on the ground or thick thorny vegetation.

With 12 to 14 species including 7 species of *Myotis*, the southern interior grasslands of British Columbia support the most diverse bat community in Canada with some species occurring in high densities (Fenton et al. 1980). Most bats in this region forage opportunistically in the valleys over lakes, marshes and open grassland or open forest. The gleaning strategy of the Fringed Bat may reduce dietary overlap with some of the abundant aerial foragers such as the Little Brown Bat (*Myotis lucifugus*) and Yuma Myotis (*Myotis yumanensis*).

Behaviour/adaptability

The Fringed Bat is colonial. Maternity colonies in buildings may contain up to 1,000 to 1,200 individuals (O'Farrell and Studier 1975). Adult males are rarely found in these large maternity colonies. Maternity colonies in tree or rock crevice roosts are smaller. Cyran et al. (2001), for example, reported a maximum group size of 27 Fringed Bats for tree and crevice roosts. They noted that maternity colonies maintained their group integrity with the same bats associating through roost changes. Although Fringed Bats move frequently between tree or rock crevice roosts, they demonstrate local fidelity returning annually to the same area (Cyran et al. 2001). There may also be some fidelity to night roosts as Collard et al. (1990) recaptured 13 Fringed Bats at the Suzie Mine including 4 individuals banded the previous year at the mine. An individual banded at the Suzie Mine in August 1982 was recaptured at the mine in April 1990 (Nagorsen and Brigham 1993).

According to O'Farrell and Studier (1973), adult female Fringed Bats are easily disturbed in the maternity colony. They are particularly vulnerable to disturbance during late pregnancy before parturition when they become secretive and nearly impossible to approach. The ability to switch roosts coupled with a familiarity of alternate roosting sites, however, may enable the Fringed Bat to relocate to new roosts if roosting habitat is lost.

POPULATION SIZES AND TRENDS

There are no population estimates for the Canadian population and no data exist to assess population trends. Because the ultrasonic echolocation calls of most Canadian *Myotis* species can not be reliably discriminated to species with most bat detectors, inventories of the Fringed Bat are restricted to captures in mist nets or harp traps. In comparison to the 6 other *Myotis* species found within its range in Canada, the Fringed Bat is rarely captured in surveys with mist nets and harp traps. Of 420 bats captured at 22 sites in the southern Okanagan Valley by Fenton et al. (1979), only 6 were Fringed Bats. Of 528 bats captured by Collard et al. (1990) in the southern Okanagan and Similkameen valleys, 38 were Fringed Bats with 34 of these captures from a single night roost. In a survey of 64 sites throughout the grasslands of the British Columbia interior, Holroyd et al. captured 484 bats—only 6 were Fringed Bats. To what extent the few captures can be attributed to rarity or simply this species' ability to avoid capture is unknown.

Although maternity colonies of this bat in buildings can be large with more than a 1,000 individuals, the two maternity colonies found in Canada were small. Maslin (1938) estimated the colony in the attic of a house near Vernon at 30 to 40 animals including young; Sarell and Haney (2000) estimated the colony in the attic of a house at Trout Creek to be about 50 animals including young. There are no data on population trends for these two colonies. According to Sarell (pers. comm.), the colony at Trout Creek has not been censused since it was first discovered in the summer of 2000.

Although the population status of the Fringed Bat in Washington State is unknown, this species has been detected in Okanogan County near the British Columbia border (Sarell and McGuiness 1993; Johnson and Cassidy 1997). Trans-border movements are likely.

LIMITING FACTORS AND THREATS

With so little known about this species' biology in Canada, it is difficult to define any threats or limiting factors. Given this species' diverse and flexible roosting habits in the United States, roosting habitat may not be limiting. Most of the threats are generic such as disturbance to maternity colonies in buildings, disturbance of night roosts in mines or other manmade structures, and the impact of pesticides on invertebrate prey. If the Fringed Bat is dependent on riparian habitats for foraging, then the loss of wetland and riparian ecosystems throughout the grasslands of British Columbia could be a threat. Although disturbance at hibernacula is a major conservation concern for many temperate bats, the location of the Canadian population in winter is unknown.

SPECIAL SIGNIFICANCE OF THE SPECIES

The Fringed Bat is one of three western North American bat species that are confined to the intermontane grasslands of British Columbia in Canada. It is a member of a diverse temperate bat community of 12 to 14 species and the largest of the 7 *Myotis* species. Its precise niche in this community, however, is virtually unknown. In contrast, the biology of rare grassland bats such as the Spotted Bat (*Euderma maculatum*) and Pallid Bat (*Antrozous pallidus*) in Canada has been well studied.

EXISTING PROTECTION OR OTHER STATUS

This species is not listed by the IUCN. It was designated Special Concern by COSEWIC in 1988 (see Balcombe 1988). The global heritage status rank is G4G5 (apparently secure to secure); national ranks are N4N5 (apparently secure to secure) for the United States and N2N3 (imperilled to vulnerable) for Canada. Three states (Idaho, Wyoming, Nebraska) rank the Fringed Bat as S1 or S1? (critically imperilled); two states (Oregon, South Dakota) rank this species as S2 (imperilled). Washington, Montana, Texas, and Utah rank the Fringed Bat as S3 (vulnerable). British Columbia has designated the Fringed Bat as S2S3 (imperilled to vulnerable).

In British Columbia, the Fringed Bat is protected from killing under the provincial Wildlife Act. Although no tree roosts have been documented in British Columbia and it is probably little impacted by rangeland practices, this species is listed as an Identified Wildlife Species under the revised British Columbia Provincial Forest and Range Practices Code. Species listed under the code are considered to be at risk and require

special management by establishing Wildlife Habitat Areas (WHA). Guidelines[2] under the Forest and Range Practices Code specify that WHA's will be established to protect known hibernacula, maternity roosts, and areas with high densities of the Fringed Bat. The WHA will include a 100 m radius core area and a 100 m radius management zone. Various management prescriptions are recommended relating to road development, forest harvesting, gating of caves and mines, pesticide use, and buffers around riparian habitats. To date, no WHA's have been designated for the Fringed Bat. The Forest and Range Practices Code only applies to provincial crown land; in the southern portion of the Canadian range for example nearly 50% of this species' habitat is exempt from the code (Table 2).

SUMMARY OF STATUS REPORT

The Fringed Bat ranges throughout much of western North America. In Canada where it reaches its northern limits, it is known only from the intermontane grasslands of British Columbia, although it could also inhabit coastal areas in south-western British Columbia. Most of our knowledge on this species' general biology including roosting habits, diet, and reproduction is based on studies done in the United States. Known maternity colonies in Canada are in buildings. Maternity colonies are probably also located in crevices of cliffs and possibly trees but this needs to be confirmed with radio-tracking studies. Night roosts are in mines and buildings. No data exist on population size or trends in Canada. The Fringed Bat is rarely captured in surveys with mist nets and harp traps, but it is unknown if this can be attributed to rarity or capture avoidance. Nothing is known about the distribution of the Canadian population in winter. Winter surveys of caves and mines within the Canadian range have not found this species. Limiting factors include disturbance of maternity colonies and night roosts, the loss of riparian habitat and possible impacts of pesticides on its prey. No more than 10% of the Canadian range falls within protected areas and nearly 50% of the range is on private or Indian Reserve lands where habitat is excluded from protection under the British Columbia Forest and Range Practices code.

[2] Guidelines for this species under the Provincial Forest Practices Code are currently in draft stage.

TECHNICAL SUMMARY

Fringed Bat
Myotis thysanodes Chauve-souris à queue frangée
British Columbia

Extent and Area information	
• *extent of occurrence (EO)(km²)*	8, 650 km^2
• *specify trend (decline, stable, increasing, unknown)*	Unknown
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	Unknown
• *area of occupancy (AO) (km²)*	Unknown
• *specify trend (decline, stable, increasing, unknown)*	-
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	-
• *number of extant locations*	33*
• *specify trend in # locations (decline, stable, increasing, unknown)*	Unknown
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	Unknown
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	Unknown
Population information	
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	2
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	Unknown
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	Unknown
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	-
• *are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?*	-
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?*	No
• *list each population and the number of mature individuals in each*	-
• *specify trend in number of populations (decline, stable, increasing, unknown)*	-
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	-
Threats	
-disturbance of maternity colonies and night roosts -loss of riparian habitat -impacts of pesticides on invertebrate prey	

Rescue Effect (immigration from an outside source)	Moderate
• *does species exist elsewhere (in Canada or outside)?*	Yes
• *status of the outside population(s)?*	Uncommon Idaho S1? Montana S3 Washington S3?
• *is immigration known or possible?*	Yes
• *would immigrants be adapted to survive here?*	Yes
• *is there sufficient habitat for immigrants here?*	Yes
Quantitative Analysis	**-**

* 33 occurrences; 18 element occurrences. An element occurrence for small bats is defined by the Heritage Ranking System as sites occupied historically or at present that are separated by 10 km or more.

Other Status
COSEWIC: Special Concern 1988
British Columbia: S2S3

Status and Reasons for Designation

Status: Data Deficient	

Reasons for Designation:

This species is rarely reported in its Canadian range. There are, however, a few sites in the Okanagan Valley where they regularly can be captured during the summer. There is a lack of data about the extent of its Canadian range and the habitat that is important for foraging and roosting. We also do not know the population size or trends, nor any key demographic characteristics, such as population structure, reproduction or survival rates. It is not known if this species overwinters in Canada or migrates south for the winter; however, there are maternity colonies recorded in Canada.

Applicability of Criteria

Criterion A (Declining Total Population)**:**
Population sizes unknown.

Criterion B (Small Distribution, and Decline or Fluctuation)**:**
Extent of distribution unknown.

Criterion C (Small Total Population Size and Decline)**:**
No evidence of population decline.

Criterion D (Very Small Population or Restricted Distribution)**:**
Unknown.

Criterion E (Quantitative Analysis)**:**
Probability of extinction in Canada, unknown.

ACKNOWLEDGEMENTS

I thank Mike Sarell for providing copies of his reports, unpublished location records and a copy of the model used to generate the habitat suitability map. Orville Dyer generously provided various data and a digital copy of the habitat map; Laura Friis provided unpublished reports and the draft species account for the Spotted Bat from the British Columbia Forest and Range Practices Code. Ted Lea provided his unpublished data on historical habitat changes for the south Okanagan. Anna Roberts provided information on night roosts for the Chilcotin-Fraser area. Richard Johnson shared his data on Fringed Bat records from Washington State and the possible location of the Olympic Park specimen. I am grateful to Chris Conroy (MVZ) and Jim Cosgrove (RBCM) for arranging the loan. Tanya Dewey provided unpublished data from her dissertation research on the genetics of long-eared myotis bats. Daphne Nagorsen tracked down and photocopied various references in periodicals at the University of British Columbia library.

Funding for the preparation of this status report was provided by the Canadian Wildlife Service, Environment Canada.

LITERATURE CITED

Adam, M.D., and J.P. Hayes. 2000. Use of bridges as night roosts by bats in the Oregon Coast Range. Journal of Mammalogy 81:402-407.

Albright, R. 1959. Bat banding at Oregon caves. The Murrelet 40:26-27.

Balcombe, J.P. 1988. Status report on the spotted bat (*Euderma maculatum*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. 12 pp.

Barbour, R.W., and W.H. Davis. 1969. Bats of America. The University Press of Kentucky, Lexington. 286 pp.

Bell, G.P. 1980. Habitat use and response to patches of prey by desert insectivorous bats. Canadian Journal of Zoology 58:1876-1883.

Black, H.L. 1974. A north temperate bat community: structure and prey populations. Journal of Mammalogy 55:138-157.

Cannings R.A., Cannings R.J., and Cannings S.G. 1987. Birds of the Okanagan Valley, British Columbia. Royal British Columbia Museum, Victoria. 420 pp.

Cannings S.G., Ramsay L.R., Fraser D.F., and Fraker M.A. 1999. Rare amphibians, reptiles, and mammals of British Columbia. BC Ministry of Environment, Lands and Parks; Wildlife Branch and Resources Inventory Branch, Victoria. 198 pp.

Chung-MacCoubrey, A.L. 1996. Bat species composition and roosts use in pinyon-juniper woodlands of New Mexico. Pp 292. *in*: R.M.R. Barclay, R.M. Brigham, (eds). Bats and forests symposium. October 19-21, 1995, Victoria, British Columbia, Canada. British Columbia Ministry of Forests, Victoria.

Collard, T.S., S.D. Grindal, R.M. Brigham, and R.M.R. Barclay. 1990. Identification of the status and critical habitats of the spotted bat (*Euderma maculatum*), pallid bat (*Antrozous pallidus*), and fringed bat (*Myotis thysanodes*) in the south Okanagan

valley, British Columbia. World Wildlife Fund Canada and British Columbia Ministry of Environment, Toronto. 27 pp.
Constantine, D.G., G.L. Humphrey, and T.B. Herbenick. 1979. Rabies in *Myotis thysanodes*, *Lasiurus ega*, *Euderma maculatum* and *Eumops perotis* in California. Journal of Wildlife Diseases 15:343-346.
Cryan, P.M., M.A. Bogan, and G.M. Yanega. 2001. Roosting habits of four bat species in the Black Hills of South Dakota. Acta Chiropterologica 3:43-52.
Easterla, D.A. 1973. Ecology of 18 species of Chiroptera at Big Bend National Park, Texas. Part I. The Northwest Missouri State University Studies 34:1-53.
Fenton, M.B., C.G. van Zyll de Jong, G.P. Bell, D.B. Campbell, and M. Laplante. 1980. Distribution, parturition dates and feeding of bats in south-central British Columbia. The Canadian Field-Naturalist 94:416-420.
Findley, J.S. 1972. Phenetic relationships among bats of the genus *Myotis*. Systematic Zoology 21:31-52.
Firman, M.C., C. Godwin, and R.M.R. Barclay. 1994. Bat fauna of the west Shuswap and south Thompson River region, British Columbia. British Columbia Ministry of Environment, Lands and Parks, Victoria. 94 pp.
Hall, E.R. 1981. The mammals of North America. John Wiley and Sons, New York. 600+90 pp.
Holroyd, S., R.M.R. Barclay, L.M. Merk, and R.M. Brigham. 1994. A survey of the bat fauna of the dry interior of British Columbia. Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria. 73 pp.
Hoffmeister, D.F. 1970. The seasonal distribution of bats in Arizona: a case for improving mammalian range maps. The Southwestern Naturalist 15:11-22.
Johnson, R.E., and K.M. Cassidy. 1997. Terrestrial mammals of Washington State: Location data and predicted distributions. Pp 304. *in*: K.M. Cassidy, C.E. Grue, M.R. Smith, K.M. Dvornich, (eds). Washington Sate Gap Analysis-Final Report Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle.
Jones, C. 1965. Ecological distribution and activity periods of bats of the Mogollon Mountains area of New Mexico and adjacent Arizona. Tulane Studies in Zoology 12:93-100.
Kuenzi, A.J., G.T. Downard, and M.L. Morrison. 1999. Bat distribution and hibernacula use in west central Nevada. Great Basin Naturalist 59:213-220.
Manning, R.W. 1993. Systematics and evolutionary relationships of the long-eared myotis, *Myotis evotis* (Chiroptera: Vespertilionidae). Texas Tech University, The Museum, Special Publications 37:1-58.
Manning, R.W., and J.K.J. Jones. 1988. A new subspecies of fringed myotis, *Myotis thysanodes*, from the northwestern coast of the United States. Texas Tech University, The Museum, Occasional Papers 123:1-6.
Martin, R.A., and B.G. Hawks. 1972. Hibernating bats of the Black Hills of South Dakota. Distribution and habitat selection. Bulletin of the New Jersey Academy of Science 17:24-30.
Maslin, T.P. 1938. Fringe-tailed myotis bat in British Columbia. Journal of Mammalogy 19:373.

Meidinger, D., and J. Pojar. 1991. Ecosystems of British Columbia. British Columbia Ministry of Forests, Victoria. 330 pp.
Ministry of Environment, Lands and Parks. 1998. Habitat atlas for wildlife at risk: south Okanagan and lower Similkameen. British Columbia Ministry of Environment, Lands, and Parks, Penticton, 124 pp.
Nagorsen, D.W., A. Bryant, D. Kerridge, G. Roberts, A. Roberts, and M. Sarell. 1993. Winter bat records from British Columbia. Northwestern Naturalist 74:61-66.
Nagorsen, D.W., and R.M. Brigham. 1993. Bats of British Columbia University of British Columbia Press, Vancouver. 164 pp.
Nagorsen, D.W. 2002. An identification manual to the small mammals of British Columbia. Ministry of Sustainable Resource Management; Ministry of Water, Land, and Air Protection and Royal British Columbia Museum, 153 pp.
O'Farrell, M.J., and E.H. Studier. 1973. Reproduction, growth, and development in *Myotis thysanodes* and *M. lucifugus* (Chiroptera: Vespertilionidae). Ecology 54:18-30.
O'Farrell, M.J., and E.H. Studier. 1975. Population structure and emergence activity in *Myotis thysanodes* and *M. lucifugus* (Chiroptera: Vespertilionidae) in northeastern New Mexico. The American Midland Naturalist 93:368-376.
O'Farrell, M.J., and E.H. Studier. 1980. Myotis thysanodes. Mammalian Species 137:1-5.
Perkins, J.M., J.M. Barss, and J.A. Peterson. 1990. Winter records of bats in Oregon and Washington. The Murrelet 71:59-62.
Rasheed, S.A., P.F.J. Garcia, and S. Holroyd. 1995. Status of the fringed myotis in British Columbia. Ministry of Environment, Lands and Parks, Wildlife Branch, Victoria. 17 pp.
Rabe, M.J., T.E. Morrell, H. Green, J.C. DeVos, Jr., and C.R. Miller. 1998. Characteristics of ponderosa pine roosts used by reproductive bats in northern Arizona. Journal of Wildlife Management 62:612-621.
Redpath, K. 1990. Identification of relatively undisturbed areas in the south Okanagan and Similkameen valleys, British Columbia. Canadian Wildlife Service, Technical Report Series 108:1-9.
Reducker, D.W., T.L. Yates, and I. F. Greenbaum. 1983. Evolutionary affinities among southwestern long-eared *Myotis* (Chiroptera: Vespertilionidae). Journal of Mammalogy 64: 666-677.
Roberts, G., and A. Roberts. 1992. Grassland biodiversity in Chilcotin bunchgrass subzone and adjacent interior Douglas-fir subzone. Ministry of Environment, Lands and Parks, Williams Lake. 63 pp.
Roberts, G., and A. Roberts. 1993. Biodiversity in the Cariboo-Chilcotin grasslands. Ministry of Environment, Lands and Parks, Williams Lake. 143 pp.
Ross, A. 1967. Ecological aspects of the food habits of insectivorous bats. Proceedings of the Western Foundation of Vertebrate Zoology 1:205-264.
Ruedi, M., and F. Mayer. 2001. Molecular systematics of bats of the genus *Myotis* (Vespertilionidae) suggests deterministic ecomorphological convergences. Molecular Phylogenetics and Evolution 21:436-448.
Sarell, M.J., and K.P. McGuiness. 1993. Rare bats of the shrub-steppe ecosystem of eastern Washington. Washington Department of Wildlife. Olympia. 23 pp. pp.

Sarell, M. J., and A. Haney. 2000. South Okanagan rare bat inventory 2000: spotted bat, pallid bat, and red bat. British Columbia Ministry of Environment, Penticton. 79 pp.
Scheffer, V.B. 1995. Mammals of the Olympic National Park and vicinity (1949). Northwest Fauna 2:1-133.
Studier, E.H., and M.J. O'Farrell. 1972. Biology of *Myotis thysanodes* and *M. lucifugus* (Chiroptera: Vespertilionidae)-I. Thermoregulation. Comparative Biochemical Physiology 41A:567-595.
Studier, E.H., and M.J. O'Farrell. 1973. Biology of *Myotis thysanodes* and *M. lucifugus* (Chiroptera: Vespertilionidae)-II. Bioenergetics of pregnancy and lactation. Comparative Biochemical Physiology 44A:467-471.
Tuttle, M.D., and D. Stevenson. 1982. Growth and survival of bats. Pp 105-150. *in*: T.H. Kunz, editor. Ecology of bats. Plenum Press, New York.
van Zyll de Jong, C. G. 1985. Handbook of Canadian mammals. 2. Bats National Museums of Canada, National Museum of Natural Science, Ottawa. 212 pp.
van Zyll de Jong, C.G., and D.W. Nagorsen, 1994. A review of the distribution and taxonomy of *Myotis keenii* and *Myotis evotis* in British Columbia and the adjacent United States. Canadian Journal of Zoology 72: 1069-1078.
Warman, L., S. Roberston, A. Haney, and M. Sarell. 1998. Habitat capability and suitability models for 34 wildlife species using terrestrial ecosystem mapping (1:20,000) in the south Okanagan and lower Similkameen study area and forest inventory mapping (1:200,000) in the Penticton Forest District. Wildlife Branch, Ministry of Environment, Lands and Parks, Penticton, BC. 32 pp+appendices.
Warner, R.M. 1985. Interspecific and temporal dietary variation in an Arizona bat community. Journal of Mammalogy 66:45-51.
Weller, T.J., and C.J. Zabel. 2001. Characteristics of fringed myotis day roosts in northern California. Journal of Wildlife Management 65:489-497.
Whitaker, J.C., C. Maser, and L.E. Keller. 1977. Food habits of bats of western Oregon. Northwest Science 51:46-55.
Whitaker, J.D.J., C. Maser, and S.P. Cross. 1981. Food habits of eastern Oregon bats, based on stomach and scat analysis. Northwest Science 55:281-292.

BIOGRAPHICAL SUMMARY OF THE REPORT WRITER

Dave Nagorsen holds a B.Sc. degree from the University of Guelph, and an M.Sc. degree in Zoology from the University of Toronto. He was curatorial assistant in the Mammalogy Department of the Royal Ontario Museum, Toronto for 10 years and mammal curator at the Royal British Columbia Museum for 20 years. He is a Departmental Associate in the Centre for Biodiversity and Conservation Biology at the Royal Ontario Museum, in Toronto. He has a broad interest in mammals. During his career he has conducted mammalian field work and inventories in the Caribbean, and various regions of Canada including the Canadian Shield, Hudson Bay Lowlands, the northern Yukon Territory, and British Columbia. He has authored or co-authored more than 50 published scientific papers and reports, three books, a number of unpublished reports, and many publications for a general audience; he is an associate editor for the

Canadian Field-Naturalist. Dave is involved with a number of conservation initiatives including the Vancouver Island Marmot Recovery Team; the Pacific Water Shrew Recovery Team, the Terrestrial Mammals Specialist Group for COSEWIC; and the Rodent Specialist Group, Species Survival Commission of the IUCN.

AUTHORITIES CONTACTED

Bogan, Michael. Mammal Curator, University of New Mexico, US Geological Survey, Museum of Southwestern Biology, Albuquerque, NM 87131.

Dewey, Tanya. University of Michigan Museum of Zoology, Mammal Division, 1109 Geddes Ave., Ann Arbor, MI 48109-1079 USA

Friis, Laura. Species Specialist, Biodiversity Monitoring and Reporting Section, Ministry of Water, Land and Air Protection. PO Box 9338 Stn Prov Govt, Victoria, B.C. V8W 9M1.

Goulet, Gloria. Coordinator, Aboriginal Traditional Knowledge, COSEWIC Secretariat, Canadian Wildlife Service, Environment Canada, Ottawa, ON K1A 0H3.

Science Allocation Section, Ministry of Water, Land and Air Protection. 201 3547 Skaha Lake Road, Penticton, British Columbia V2A 7K2.

Guy, Stewart. Project Manager, Wildlife Conservation Planning, Ministry of Water, Land and Air Protection. PO Box 9338 Stn Prov Govt, Victoria, B.C. V8W 9M1.

Johnson, Richard. Associate Professor, School of Biological Sciences, Washington Sate University, Pullman, WA 99164-4236.

Lea, Ted. Provincial Ecology Coordinator, Ministry of Sustainable Resources Management, Terrestrial Information Branch, PO Box 9516 Stn Prov Govt, Victoria, BC V8W 9C2.

Ramsay, Leah. Ministry of Sustainable Resources Management, Conservation Data Centre, PO Box 9344 Stn Prov Govt, Victoria, BC V8W 9M1.

Roberts, Anna. Consulting Biologist, 2002 Grebe Dr. RR3 Williams Lake, B.C. V2G 1M3.

Sarell, Mike. Ophiuchus Consulting, RR#2 S53a C4, Oliver, B.C. VOH 1TO.

Steciw, Julie. Wildlife Biologist, Fish and Wildlife Allocation Section, Ministry of Water, Land and Air Protection. Ste 400-640 Borland St., Williams Lake, B.C. V2G 4T1.

Surgenor, John. Wildlife Biologist, Fish and Wildlife Allocation Section, Ministry of Water, Land and Air Protection. 1259 Dalhousie Drive, Kamloops, B.C. V2C 5Z5.

COLLECTIONS EXAMINED

Museum of Vertebrate Zoology (MVZ), University of California, Berkeley, CA.
Royal British Columbia Museum (RBCM), Victoria, British Columbia.

Appendix 1. The occurrence of the Fringed Bat (*Myotis thysanodes*) in coastal Washington.

Background

Most distribution maps (e.g., O'Farrell and Studier 1980; Hall 1981) show the Fringed Bat occurring east of the Cascade Mountains north of Columbia River with populations in Washington and British Columbia restricted to arid intermontane grasslands. The Washington records summarized by Johnson and Cassidy (1997) show no coastal occurrences. However, Barbour and Davis (1969) and Manning (1993) noted the occurrence of this species in coastal Washington but gave no actual location records. The only known coastal record for Washington is a specimen collected in 1940 near Quinault Lake in Olympic National Park on the Olympic Peninsula reputedly identified as *M. thysanodes* by Scheffer (1995). The Olympic Peninsula location is in the humid rainforest region of Washington. Although Scheffer (1995) reported the specimen as being deposited in the Olympic Park museum, the museum has no bat specimens. A search of North American museums collections revealed that the specimen was deposited in the collections of the Museum of Vertebrate Zoology, University of California, Berkeley. It was identified as the Little Brown Bat (*Myotis lucifugus*) and catalogued as MVZ 181447. I arranged a loan of the specimen through MVZ and the Royal British Columbia Museum.

Identification

MVZ 181447 is a skin and skull with part of the forearms removed. Body measurements (recorded on specimen tag) are total length=75 mm, tail vertebrae= 35 mm, hind foot= 6 mm, ear=15 mm, tragus=10 mm, and forearm length= 36 mm. From the long ears, pronounced fringe of hairs on the edge of the interfemoral membrane, steeply sloped forehead, and the ratio of the interorbital width/maxillary toothrow length= 0.66, the specimen is clearly a member of the long-eared myotis group and not *Myotis lucifugus*. Except for skull length, the skull measurements fall within the size range of the small coastal subspecies *M. t. vespertinus* found in Oregon and California. Some of the dental measurements and the shorter skull length are consistent with measurements given by van Zyll de Jong and Nagorsen (1994) for the Western Long-eared Myotis (*Myotis evotis*) and Keen's Long-eared Myotis (*Myotis keenii*). In external features the specimen has smaller ears than *M. keenii* and *M. evotis* and has a prominent fringe of stiff hairs (1.5 mm length) on edge of the interfemoral membrane that extend from the tail to an area mid-point with the hind foot, a characteristic of the coastal form *M. t. vespertinus* described by Manning and Jones (1988). Although *M. evotis* and *M. keenii* have hairs on the interfemoral membrane, they are sparse and short (~1 mm).

Measurement	***M. t. vespertinus*[1]**	**MVZ 181447**
Forearm length	38.4 (37.5-39.6) n=7	36
Skull length	15.5 (15.1-15.9) n=8	14.7
Breadth across M^3-M^3	5.9 (5.6-6.1) n=8	5.8
Maxillary toothrow	5.9 (5.7-6.1) n=8	5.9
Lower toothrow	6.3 (5.9-6.5) n=8	6.1

[1]from Manning and Jones (1988)

Conclusions

Misidentified as *Myotis lucifugus*, MVZ 181447 is a peculiar specimen that shows characteristics of the small coastal subspecies of *M. thysanodes* (*M. t. vespertinus*) and characteristics of *M. keenii*. The prominent fringe of hairs on the interfemoral membrane is consistent with *M. thysanodes*. I tentatively identify the specimen as *M. thysanodes*. A tissue sample taken from a wing membrane should be analyzed to determine if a mtDNA sequence can be obtained to verify the identification.

The occurrence of *M. thysanodes* on the west coast of the Olympic Peninsula in the humid temperate rain forest raises the possibility of a coastal population in south-western British Columbia.