

**COSEWIC**  
**Status Appraisal Summary**

on the

**Pacific Water Shrew**  
*Sorex bendirii*

in Canada

**ENDANGERED**  
**2016**

**COSEWIC**  
Committee on the Status  
of Endangered Wildlife  
in Canada



**COSEPAC**  
Comité sur la situation  
des espèces en péril  
au Canada

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

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Production note:

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## COSEWIC Assessment Summary

### Assessment Summary – May 2016

**Common name**

Pacific Water Shrew

**Scientific name**

*Sorex bendirii*

**Status**

Endangered

**Reason for designation**

This shrew is restricted to British Columbia's Lower Mainland and adjacent low valleys. It is rare there, associated with freshwater streams and adjacent wet habitats. Urban development, agriculture, and forestry have reduced the amount and quality of habitat. There is an inferred and projected ongoing decline in habitat and subpopulations in much of its range in Canada.

**Occurrence**

British Columbia

**Status history**

Designated Threatened in April 1994 and in May 2000. Status re-examined and designated Endangered in April 2006. Status re-examined and confirmed in April 2016.



## COSEWIC Status Appraisal Summary

Pacific Water Shrew  
Musaraigne de Bendire  
*Sorex bendirii*

Range of occurrence in Canada (province/territory/ocean): British Columbia

### Status History

#### COSEWIC:

Designated Threatened in April 1994 and in May 2000. Status re-examined and designated Endangered in April 2006. Status re-examined and confirmed in April 2016.

#### Wildlife Species:

Change in eligibility, taxonomy or designatable units:                      yes  no

#### Explanation:

The Pacific Water Shrew (*Sorex bendirii*) was described in 1884 based on morphological characters. Comparisons of variation in nuclear and/or cytochrome-b mitochondrial genomes of Pacific Water Shrew and the closely related Water Shrew (*S. palustris*) has recently confirmed the Pacific Water Shrew as a valid species (O'Neill *et al.* 2005; Hope *et al.* 2014). Three subspecies of Pacific Water Shrew are recognized but there is some debate about the validity of two subspecies (*S. b. bendirii*, *S. b. palmeri*) because they have limited variation (0.7%) in the cytochrome-b sequence (O'Neill *et al.* 2005). Notwithstanding, only one subspecies (*S. b. bendirii*) occurs in Canada (COSEWIC 2006) and there is no evidence to warrant recognition of more than a single designatable unit in Canada.

#### Range:

Change in Extent of Occurrence (EOO):    yes  no  unk

Change in Index of Area of Occupancy (IAO) :                                      yes  no  unk

Change in number of known or inferred current locations<sup>1</sup>:              yes  no  unk

Significant new survey information    yes  no

#### Explanation:

In Canada, the range of the Pacific Water Shrew is restricted to extreme southwestern British Columbia (Environment Canada 2014; Figure 1). Two specimens recorded since the 2006 status report near Squamish, BC have extended the northern range limit for the species, and the EOO from 3350 km<sup>2</sup> to 6140 km<sup>2</sup> (Pacific Water Shrew Recovery Team 2009). The new records are approximately 90 km from a nearest previous record and it is unknown, but possible, that Pacific Water Shrew exist in the area between. The increase in EOO likely reflects sampling effort, rather than a recent increase in range. Survey work that has been conducted since the last status report has not provided significant new information, other than an extension of

<sup>1</sup> Use the IUCN definition of "location."





critical habitat (Environment Canada 2014) but it is not known if this is sufficient to maintain these 23 locations. More than half of the 45 locations likely are not viable or extant.

**Protection:**

Change in effective protection: yes  no  unk

Explanation:

No Pacific Water Shrew occurrence has been found in Parks Canada protected areas (Nantel pers comm. 2015). The 2009 Provincial Recovery Strategy for the Pacific Water Shrew includes three Wildlife Habitat Areas which protect a total of 45.3 ha, consisting of 21.7 and 23.6 ha of core area and management zones, respectively.

Although more land has been protected, only 20% of the Pacific Water Shrew's habitat is estimated to exist on public land. A total of 14 of 16 proposed areas for critical habitat were on private land (BCDC 2015b) and the areas that lack habitat protection for the Pacific Water Shrew are urban, private lands that are most at risk from current threats to the species.

The Federal Addition to the Recovery Strategy for the Pacific Water Shrew identifies 23 polygons of Critical Habitat (Environment Canada 2014). Some of this land is publically-owned by a federal or provincial jurisdiction, and may eventually be protected. Critical Habitat occurring on private land may be protected if a Federal Order by the Minister of Environment is undertaken (SARA Public Registry 2015), which had not occurred, as of winter 2016.

A set of guidelines for Pacific Water Shrew in urban and rural areas was published in order to educate developers and land planners about threats to the species, and suggest methods to mitigate the impacts of new developments on Pacific Water Shrew habitat (Craig *et al.* 2010). While the document does not add to the legal protection of the species, it contributes to on-the-ground efforts to raise awareness about the threats to the Pacific Water Shrew and theoretically contributes to the species' recovery in Canada.

**Rescue Effect:**

Change in evidence of rescue effect: yes  no

Explanation:

There is no evidence of an increased rescue effect since the last status report. Little is known about Pacific Water Shrew populations in Washington, and there have been no studies examining the possibility of a rescue effect (Fleckenstein pers comm. 2015). The species is ranked S4 (apparently secure) in Washington (Nature Serve 2016). However, given the Pacific Water Shrew's limited dispersal ability, any rescue effect across the border is unlikely due to the distances between U.S. and Canadian populations and the fragmentation in the intervening habitat (Environment Canada 2014).

**Quantitative Analysis:**

Change in estimated probability of extirpation: yes  no  unk

Details:

A population viability analysis has not been conducted because population data are unavailable.

### **Summary and Additional Considerations: [e.g., recovery efforts]**

The Canadian range of the Pacific Water Shrew comprises roughly 5% of the global range and is limited to southwestern British Columbia (Pacific Water Shrew Recovery Team 2009). Most historical (<1991) and recent records occur in the most populated and developed region of the province. Within its range, the shrew is apparently rare.

Little new information is available since the last status report. Recent captures of two specimens in Squamish extended the northern limit of the known range of the Pacific Water Shrew further north than previously expected (Nagorsen pers comm. 2015). A comparison of historical and recent records was used to infer a decline in habitat and population size of the species (COSEWIC 2006; Figure 1) and although new data on abundance are not available, a decline in habitat is inferred since that report; threats continue to increase in severity as the growing human population in the lower mainland increases development pressures on shrew habitat, and contributes to habitat fragmentation (Fraser pers comm. 2015). The range in Canada is considered to be severely fragmented.

Recovery efforts for the Pacific Water Shrew include increased habitat protection, research into new survey techniques, creation of Best Management Practices documents, and the development of federal and provincial Recovery Strategies that denote Wildlife Habitat Areas and Critical Habitat. The implementation of protection on private land, where most records have been made, has not occurred.

Pacific Water Shrew in Canada are categorized as critically imperilled at national (N1), and sub-national (S1) levels (Nature Serve 2016), and in British Columbia's Conservation Framework, the species is categorized as 'red-listed' and 'highest priority' (BC Conservation Data Centre 2015b).

### **Acknowledgements and authorities contacted:**

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Author of SAS: Sarah Bird and Luke Crevier

## TECHNICAL SUMMARY

*Sorex bendirii*

Pacific Water Shrew

Musaraigne de Bendire

Range of occurrence in Canada (province/territory/ocean): British Columbia

### Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines (2011) is being used)	1 year
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Unknown
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Unknown
Are the causes of the decline: a) clearly reversible; b) understood; and c) ceased?  <i>Population size and range limited by habitat loss and degradation that is unlikely to cease in next 10 years.</i>	a. No b. Yes c. No.
Are there extreme fluctuations in number of mature individuals?	Unknown, but unlikely

### Extent and Occupancy Information

Estimated extent of occurrence  <i>Increase from 3350 km<sup>2</sup> due to capture of 2 specimens in one new location.</i>	6140 km <sup>2</sup>
Index of area of occupancy (IAO) (Always report 2x2 grid value).	164 km <sup>2</sup>
Is the population “severely fragmented” i.e., is >50% of its total area of occupancy is in habitat patches that are: a) smaller than would be required to support a viable population; and b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	Yes  a. Unknown, but suspected b. Yes

<p><i>Most records are in highly developed private land with ongoing development pressure. Habitat patches contain riparian forest and wetlands but are isolated in a matrix of urbanization, stream channelization, and agriculture. Population viability within patches is unknown but is suspected to be unviable in many locations because only a few animals have been recorded in each location, habitat amount is small, and dispersal between patches appears to be unlikely.</i></p>	
<p>Number of “locations”* (use plausible range to reflect uncertainty if appropriate)</p> <p><i>Locations reflect subpopulations because of fragmentation. Threats to habitat are numerous and vary within sites. The higher value reflects historical data and likely is an overestimate; the lower value was based on amount of habitat remaining on historical and recent sites.</i></p>	23 - 45
<p>Is there an [observed, inferred, or projected] decline in extent of occurrence?</p> <p><i>The observed increase in EOO likely reflected better sampling, rather than range expansion.</i></p>	No
<p>Is there an [observed, inferred, or projected] decline in index of area of occupancy?</p> <p><i>New records beyond the main distribution suggest a wider distribution but some of these records are visual and require confirmation; also, most records still exist within areas with ongoing habitat loss.</i></p>	Uncertain
<p>Is there an [observed, inferred, or projected] decline in number of subpopulations?</p> <p><i>Inferred decline based on ongoing development in most locations. Species is rare and most of the population exists in small, isolated locations that likely are not viable. (see cells 16,17; locations reflect sub-populations).</i></p>	Yes
<p>Is there an [observed, inferred, or projected] decline in number of “locations”**?</p> <p><i>Inferred decline; the new location in Squamish is likely offset by inferred loss of locations in the Fraser Valley, where most records exist.</i></p>	Yes
<p>Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?</p> <p><i>Inferred decline in habitat area and quality due to ongoing development in most of the EOO.</i></p>	Yes
<p>Are there extreme fluctuations in number of subpopulations?</p>	Unknown

\* See Definitions and Abbreviations on [COSEWIC website](#) and [IUCN](#) (Feb 2014) for more information on this term

Are there extreme fluctuations in number of “locations”?	Unknown
Are there extreme fluctuations in extent of occurrence?  <i>The increase in EOO likely reflected better sampling, rather than range expansion. Even though sampling is sparse, there is unlikely to have been large changes in EOO in last 10 years.</i>	Unknown, but unlikely
Are there extreme fluctuations in index of area of occupancy?	Unknown

**Number of Mature Individuals (in each subpopulation)**

Subpopulations (give plausible ranges)	N Mature Individuals
Total	Unknown

**Quantitative Analysis**

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	N/A; Population viability analysis not conducted
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**Threats (direct, from highest impact to least, as per the IUCN Threats Calculator)**

<p>A threats assessment exercise was conducted in the 2009 Recovery Strategy, with similar design as the IUCN Threats Calculator.</p> <p><i>High Level of Concern:</i></p> <ol style="list-style-type: none"> <li>i. Permanent habitat loss and habitat fragmentation from urban development (roads, housing, commercial, industrial activities that impact areas adjacent to, and/or within riparian habitat)</li> <li>ii. Short-term habitat degradation/alteration from forest harvesting</li> <li>iii. Semi-permanent habitat loss from agriculture</li> <li>iv. Water quality degradation from development</li> </ol> <p><i>Medium Level of Concern:</i></p> <ol style="list-style-type: none"> <li>v. Water quality degradation from pollution</li> </ol> <p><i>Medium-Low/Low Level of Concern:</i></p> <ol style="list-style-type: none"> <li>vi. Predation from domestic cats</li> <li>vii. Trapping mortality</li> <li>viii. Climate and natural disasters (such as sudden flood/sediment events)</li> </ol> <p>Habitat specificity is a limiting factor for Pacific Water Shrew. The species is limited to low elevation floodplain and wetland habitats, much of which is on private land where protection is more difficult. These habitat requirements make the Pacific Water Shrew vulnerable to habitat degradation. As the shrew habitat is increasingly fragmented from development activities, the shrew’s dispersal between habitat patches is impeded (Pacific Water Shrew Recovery Team 2009).</p>
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### Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	S4 (Washington)
Is immigration known or possible?	Possible, but unlikely
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Unknown
Are conditions deteriorating in Canada?+	Yes
Are conditions for the source population deteriorating?+	Unknown
Is the Canadian population considered to be a sink?+ <i>N/A; Unlikely that dispersers are entering Canada and able to be impacted</i>	N/A
Is rescue from outside populations likely? <i>Dispersal events not well known and extensive development in border area likely limits rescue.</i>	No

### Data Sensitive Species

Is this a data sensitive species? No

### Status History

COSEWIC: Designated Threatened in April 1994 and in May 2000. Status re-examined and designated Endangered in April 2006. Status re-examined and confirmed in April 2016.

### Status and Reasons for Designation:

<b>Status:</b> Endangered	<b>Alpha-numeric codes:</b> B2ab(iii,iv)
<b>Reasons for designation:</b> This shrew is restricted to British Columbia's Lower Mainland and adjacent low valleys. It is rare there, associated with freshwater streams and adjacent wet habitats. Urban development, agriculture, and forestry have reduced the amount and quality of habitat. There is an inferred and projected ongoing decline in habitat and subpopulations in much of its range in Canada.	

### Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals):  
Not applicable. Declines in total number of mature individuals unknown.

+ See [Table 3](#) ( Guidelines for modifying status assessment based on rescue effect)

Criterion B (Small Distribution Range and Decline or Fluctuation):

Meets Endangered B2b(iii,v).

B1: Meets Endangered B2ab(iii,v). B1: Application uncertain because Extent of Occurrence is greater than the 5000 km<sup>2</sup> threshold but its increase from 3350 km<sup>2</sup> occurred with addition of two specimens from one locality, and all remaining occurrences are in a small area < 4000 km<sup>2</sup>.

Meets Endangered under B2: Index of Area of Occupancy is 164 km<sup>2</sup>, below the threshold of 500 km<sup>2</sup>. Sub-criterion "a" is met, as species is severely fragmented, based on wide separation of suitable habitat patches and apparently small subpopulations, the majority of which may not be viable over the long term. Sub-criterion "b(iii,iv)" is met based on inferred and projected declines in area, quality, and quantity of habitat, and number of subpopulations.

Criterion C (Small and Declining Number of Mature Individuals):

Not applicable. Extent of population declines unknown.

Criterion D (Very Small or Restricted Population):

Not applicable. Population size unknown.

Criterion E (Quantitative Analysis):

Not applicable. Analyses not conducted.

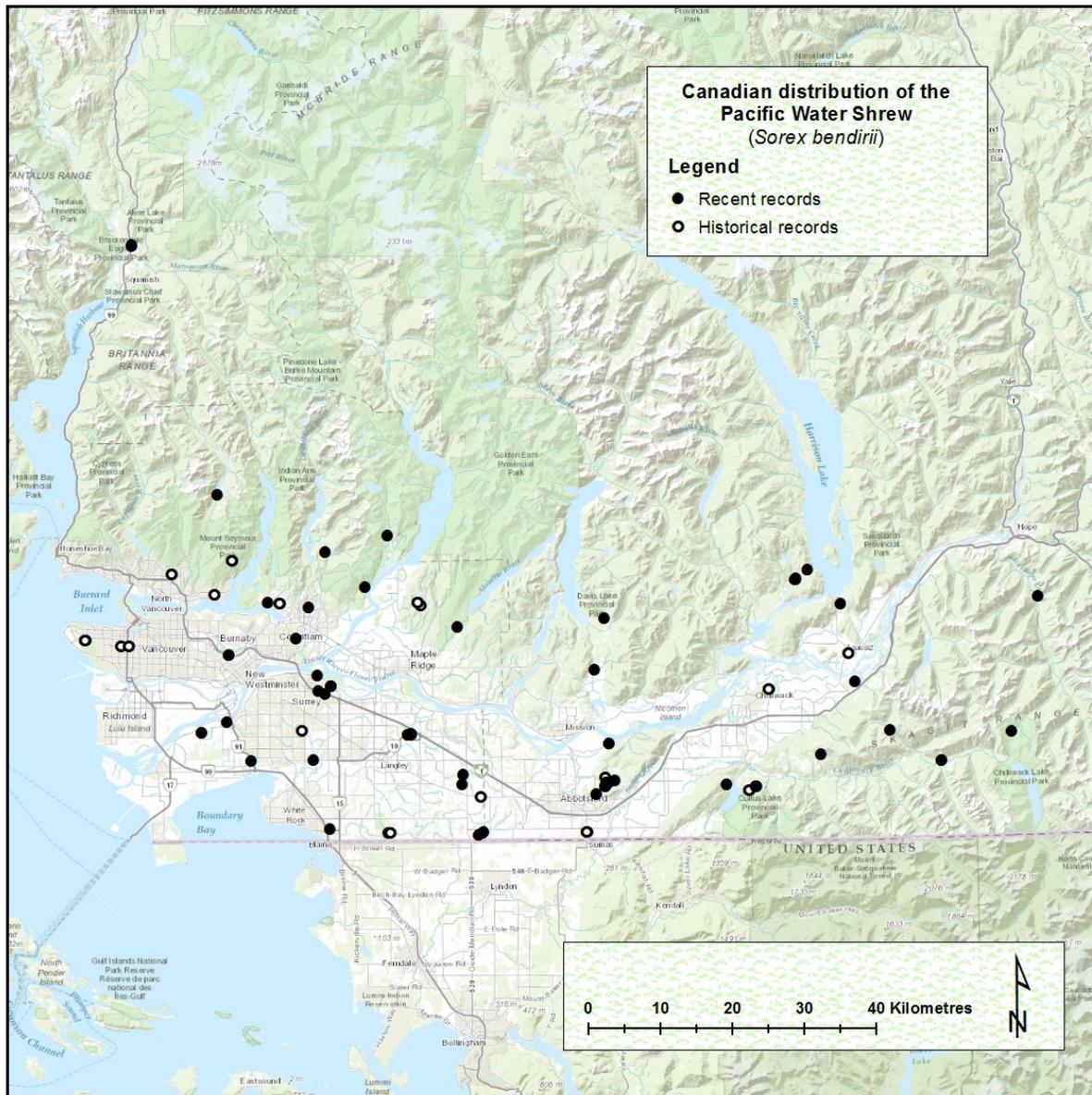


Figure 1. Location of Pacific Water Shrew (*Sorex bendirii*) in Canada. Recent records refers to specimens recorded between 1991 – 2015 from Environment Canada (2015) and BCCDC (2015b) (Map: Alain Fillion, COSEWIC).

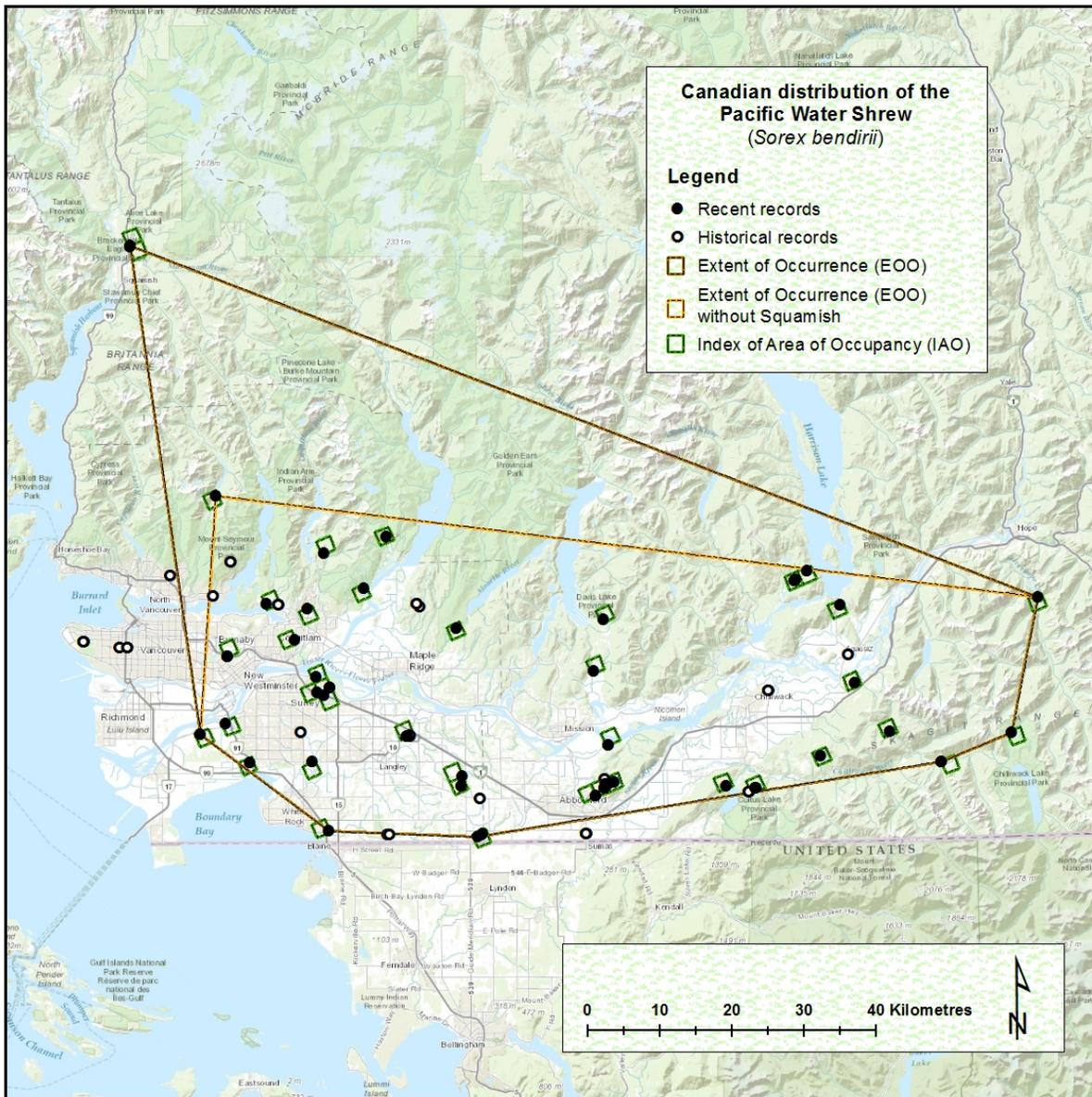


Figure 2. Extent of Occurrence (EOO) and Index of Area of Occupancy estimates for Pacific Water Shrew (*Sorex bendirii*) in Canada. Recent records refers to specimens recorded between 1991 – 2015 from Environment Canada (2015) and BCCDC (2015b). The EOO is shown for recent records with and without the new location near Squamish, British Columbia (Map: Alain Fillion, COSEWIC).



### COSEWIC HISTORY

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

### COSEWIC MANDATE

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

### COSEWIC MEMBERSHIP

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

### DEFINITIONS (2016)

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

\* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.  
 \*\* Formerly described as "Not In Any Category", or "No Designation Required."  
 \*\*\* Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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