Guidelines for
Amphibian and Reptile Conservation
during Urban and Rural Land Development in British Columbia (2014)

A companion document to *Develop with Care*

BRITISH COLUMBIA

Acknowledgements

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Many thanks to those who contributed photographs; please note that photographs may not be used elsewhere without the express permission from the photographers. Photographs credited to Hobbs Photo Images Company are copyrighted.

Cover photos (clockwise from top left): Great Basin Gopher Snake (©Jared Hobbs), Green Frog (Purnima Govindarajulu), Rough-skinned Newt (Kristiina Ovaska), Western Painted Turtle (Kristiina Ovaska), Great Basin Spadefoot (Kristiina Ovaska).

Common Garter Snake

Photo: Judith Cullington

Preface to 2014 Edition of Guidelines for Amphibian and Reptile Conservation

This 2014 edition of Guidelines for Amphibian and Reptile Conservation (*Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (2014*) is a companion document to *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia*. It is an updated version of *Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia* (2003).

There have been extensive changes to the 2014 version of this document. The document format and content have been modified to make it (hopefully) more readable. In addition:

- Hyperlinks and references to British Columbia Ministries and documents have been updated;
- Regional discussions have been updated to reflect the boundaries of the eight Ministry of Forests, Lands and Natural Resource Operations (FLNRO) regions;
- Species accounts have been updated and revised, with photographs and range maps added; and
- The document design has been modified to be consistent with *Develop with Care*.

We hope that readers will continue to find this a helpful resource.

Note: Updates will be made to this document from time to time. The most recent version can be downloaded from the Provincial Guidelines website: http://www.env.gov.bc.ca/wld/BMP/bmpintro.html#second

Western Toad

Photo: Marlene Caskey

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Pygmy Short-horned Lizard (Extirpated)

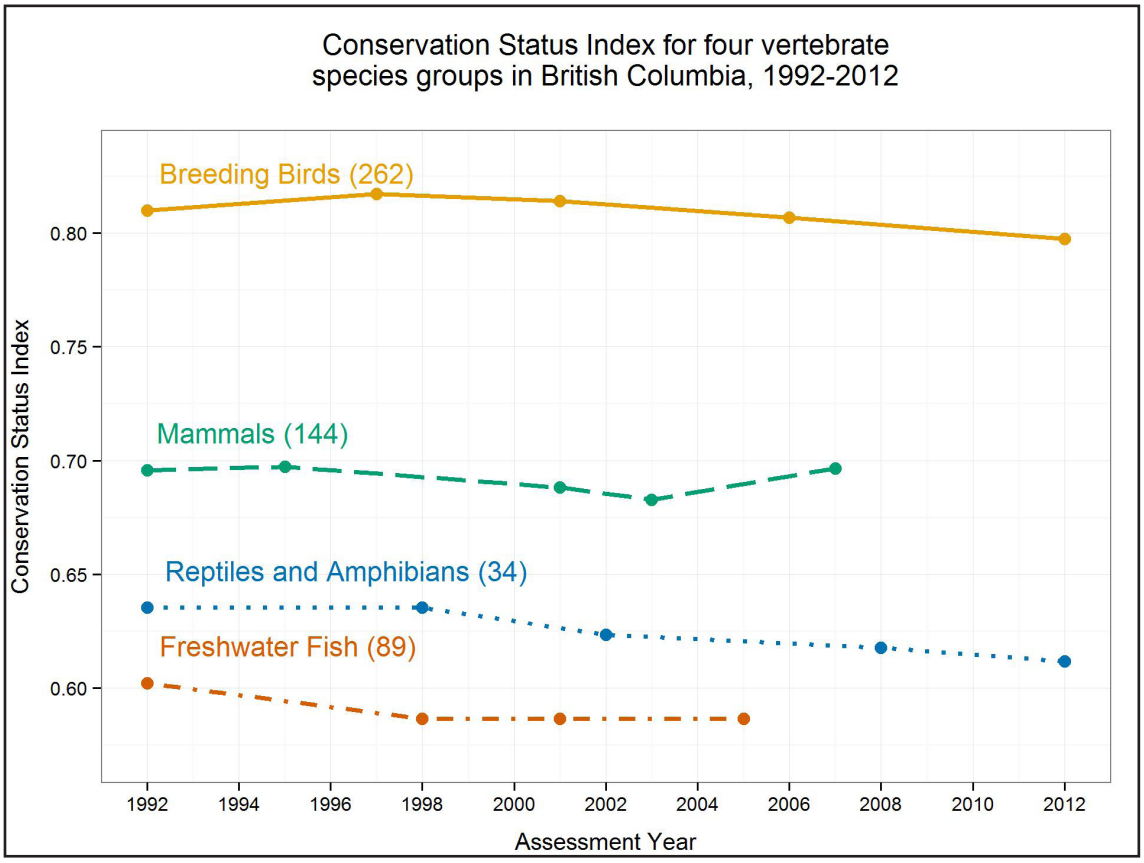
Photo: © Jared Hobbs

1 Introduction

1.1 Stewardship and Land Development

British Columbia (B.C.) is recognized globally for its exceptional wildlife, diversity of ecosystems and rich natural resources. These valuable natural assets provide the essentials of life, as well as recreational activities and economic opportunities that are enjoyed by British Columbians throughout the province. However, rapid urbanization, especially in the southern areas of the province, has resulted in significant impacts on the natural environment, including an increase in the numbers of plant and animal species 'at risk', and a declining community livability. (Ministry of Environment 2007). As shown in **Figure 1.1**, amphibians and reptiles have declined over the last 20 years.

Figure 1.1: Conservation Status of Vertebrates in British Columbia



Source: B.C. Ministry of Environment http://www.env.gov.bc.ca/soe/indicators/plants-and-animals/native-vertebrate-species.html

Results-based Approaches

It is recognized that the 'best' practice for a given location may vary. A results-based approach benefits land developers by allowing them the opportunity to use creative approaches to meet the Province's environmental standards. This model relies on the professional accountability of qualified professionals and the attendant codes of practice and ethics of their governing bodies. An approach designed for a specific location may be less expensive and/or less time-consuming for the developer and approval agency; however, in taking on this responsibility, land developers and approval agencies will also take on risk and should identify and develop strategies for managing it. When land development is not properly planned and implemented, the developer's risks could include increased costs, delays, or legal consequences. Local governments could face impacts on existing municipal infrastructure and quality of life for residents, and may also risk legal consequences. In addition, long-term environmental impacts may occur.

This document—*Guidelines for Amphibian and Reptile Conservation During Urban and Rural Land Development in British Columbia*—encourages and enables British Columbians to achieve excellent environmental stewardship and sustainability during land development by helping to protect amphibians and reptiles and their habitats. The **guidelines**[1] are based on science, experience and the leadership shown by many local governments and developers to create sustainable communities and developments.

The guidelines are part of a results-based approach to land use decisions (see box above). Decisions regarding environmental protection and stewardship are prescribed in a variety of provincial and federal legislation and regulations (see **Section 2**). In addition to these mandatory requirements, the Province sets out objectives that local governments and the development community are expected to meet. These are set out in *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia*. However, the way in which those objectives are met are often best decided at a local or site level, hence they are not prescribed in legislation. If local governments and developers are faced with legal action, they may be expected to demonstrate that they have used **due diligence** to avoid or mitigate environmental problems created by land development activities. Demonstrating that they have followed the guidelines provided in this document will strengthen this due diligence defence.

1 Words in **bold red** are defined in the Glossary

Habitat features add aesthetic and market value to developments

Photo: Judith Cullington

Preserving and managing amphibian and reptile habitat within urban and rural landscapes benefits more than just these species. Many of the habitat features required by amphibians and reptiles add aesthetic and market value to real estate developments, and the presence of wildlife and natural areas enhances the quality of life for residents (see **Section 2** for more information on the ecological and social values of amphibians and reptiles).

1.2 Document Purpose and Layout

The purpose of this document is to provide guidance to local governments, developers and others on ways to protect and enhance habitats for amphibians and reptiles during urban and rural land development activities throughout B.C. For large or complex projects with amphibian or reptile habitat, a developer is encouraged to seek advice from a **professional biologist** with expertise in the appropriate amphibian and reptile species. Readers are also strongly encouraged to review the guidelines provided in *Develop with Care* for additional considerations during urban and rural land development.

Guidelines for Amphibian and Reptile Conservation will also be of interest to biologists and scientists, but it is not meant to be a comprehensive treatise on the ecology and conservation of amphibians and reptiles in British Columbia.

The document is organized as follows:

- **Section 1** provides an introduction to the guidelines;
- **Section 2** provides background on amphibians and reptiles, key issues of concern and legal requirements to protect these species;
- **Section 3** offers guidelines for the protection of amphibians and reptiles during land development;
- **Section 4** presents strategies for **monitoring** the effectiveness of management approaches and for promoting education and stewardship programs;
- **Section 5** provides species accounts for amphibians and reptiles found in British Columbia, together with more detailed species-specific guidelines;
- The **Appendices** include a **Glossary, Literature Cited** (Appendix 1) and **Weblinks for Additional Information** (Appendix 2).

Guidelines for Amphibian and Reptile Conservation During Urban and Rural Land Development in British Columbia is one of a series of Guidelines documents prepared by the Province of British Columbia. Other titles in the series include:

- *Develop with Care 2012: Environmental Guidelines for Urban and Rural Land Development in British Columbia*
- *Best Management Practices for Amphibian and Reptile Salvage in British Columbia (2014, draft in progress)*
- *Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (2013)*
- *Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia (2009)*
- *Standards and Best Management Practices for Instream Works (2004)*

All of these are available from the Guidelines website http://www.env.gov.bc.ca/wld/BMP/bmpintro.html.

2 Amphibians and Reptiles in British Columbia

Amphibians – a class of vertebrates that includes frogs, toads and salamanders in B.C.

Reptiles – a class of vertebrates that includes turtles, lizards and snakes (also some other groups not found in B.C., such as alligators and tuataras)

2.1 Why are Amphibians and Reptiles Important?

Amphibians and reptiles are found throughout B.C. Often inconspicuous and secretive in their habits, they tend to be poorly understood by the public and receive less attention than larger or well-recognized wildlife. However, they play important roles in natural ecosystems and provide many benefits to society.

British Columbia has the greatest diversity of native amphibians and reptiles in Canada. The 34 species recorded for the province include nine salamanders, 11 frogs , two turtles, three lizards, and nine snakes.

- **Aesthetic Values** – *A species' natural beauty and artistic appreciation*. Amphibians (especially frogs) and reptiles have become popular emblems for advertising, logos, calendars, and artwork. This visibility increases public interest and affection for these animals.
- **Spiritual Values** – *A species' relation with and role in human culture, spanning scales ranging from an individual to an entire society*. Cultures from Egypt to India to Central America have worshipped snakes, crocodiles and turtles as gods. In North America, aboriginal people also incorporated amphibians and reptiles into their spiritual practice. Frogs are an important part of culture for some First Nations groups in British Columbia, and their images are often carved in totem poles.
- **Recreational Values** – *Qualities stemming from recreational pursuits associated with the species*. Amphibians and reptiles are fascinating creatures. What child, or adult for that matter, is not amazed by the **metamorphosis** of tadpole into adult frog, or watching a mass dispersal migration of hundreds of toadlets from their natal pond? Amphibian and reptile viewing opportunities can be enhanced

Western Toad toadlets migrating in masses

Photo: Rod Gilbert

through habitat restoration and enhancement in residential gardens and elsewhere. While hunting the **invasive** Bullfrog is more common in the United States than in British Columbia, it is becoming popular in this province, providing new recreational and food experiences.

- **Educational, Scientific and Medicinal Values** – *The study of amphibians and reptiles allows a better understanding of the world around us*. Improved understanding of amphibians and reptiles can add to our knowledge base or be used to improve the quality of human life and ecological conditions. Amphibians and reptiles are good "bio-indicators", whose presence or absence can be reliable indicators of environmental health and may reveal ecosystem stress, pesticide impacts and habitat fragmentation. Amphibians and reptiles are used as model organisms in ecological, embryological, physiological, and genetic research. Rapid advances are taking place in identifying compounds derived from amphibians and reptiles that may have pharmacological importance. Several compounds derived thus far have antimicrobial, analgesic and anti-cancer functions.

Scientists have discovered that proteins secreted from the skin of frogs could help treat cancer and other diseases by disrupting the growth of blood vessels. This discovery has the potential to transform cancer from a terminal illness to a chronic condition. http://www.medicalnewstoday.com/articles/227934.php

- **Ecological Values** – *The roles that species play in the ecosystems they occupy*. Amphibians and reptiles consume a variety of pest organisms such as insects and slugs. Some snakes feed on rodent pests such as rats and mice. In turn, amphibians and reptiles form an important prey base for other animals in the ecosystem. They are valuable components of biological diversity. In some places amphibians (e.g., salamanders in an old-growth forest) are the most numerous vertebrate in an ecosystem even though they are well hidden under logs and rocks.

- **Economic Values** – *How amphibians and reptiles affect the lives and livelihoods of people*. Amphibians and reptiles directly benefit humans by reducing pest species such as insects (e.g., mosquitoes), slugs and rodents. The presence of amphibian and reptile habitat (e.g., wooded areas, **wetlands** and old fields) can add to the economic value and marketability of a property.

Public perceptions of amphibians and reptiles

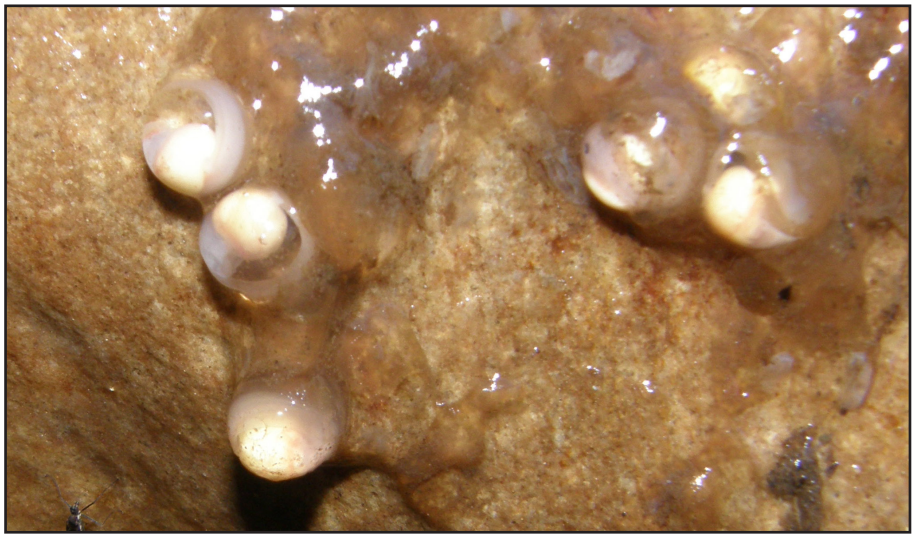
Historically, amphibians and reptiles have been less popular among the public than other vertebrate groups such as birds and mammals. However, this is changing through amphibian monitoring programs such as the Province's Frogwatch program. Frogs may be readily detected due to the vocalizations they produce during the breeding season. Salamanders lag behind frogs in terms of public awareness and interest, partly due to their more secretive nature. Reptiles continue to be largely ignored by the general public, in part due to the fear many people have of snakes. Snakes are sometimes killed as a result of this fear.

2.2 Amphibian and Reptile Biology

Amphibians and reptiles are distinctly different classes of animals. Two distinguishing features are their skin and eggs. While reptiles have internal fertilization and a waterproof scaly skin that allow them to live away from water, amphibians are intimately tied to a watery lifestyle. Amphibians are scaleless with highly permeable skin, requiring a source of moisture so that they do not dry out. Most amphibians mate in the water where they deposit soft, jelly-encased egg masses.

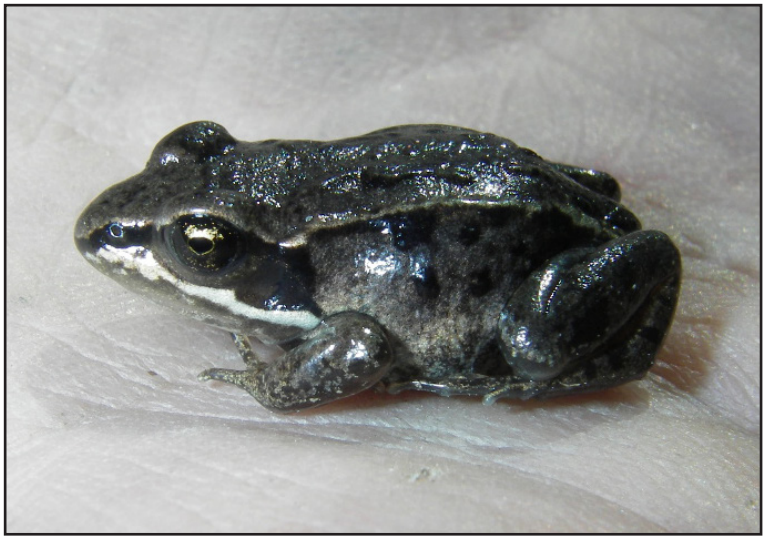
Amphibians and reptiles are **ectothermic** (cold-blooded) meaning that they derive their body heat from the environment, rather than producing it internally. The metabolism of ectotherms slows as their environment cools. While this may put them at risk from predators, there are advantages. An **endotherm** (warm-blooded animal) uses a great deal of energy just to maintain a constant body temperature, while a cold ectotherm can pass months at a time requiring little food or oxygen. In British Columbia, most amphibians and reptiles become dormant during cold winter months (**hibernation**), and some become inactive during hot, dry summer months (**aestivation**).

Amphibians and some reptiles use aquatic environments for at least part of their life cycle—for breeding, foraging or overwintering. They have relatively small home ranges and travel little compared to other vertebrate groups. However, migration of amphibians and reptiles between wintering, breeding and feeding habitats may require crossing roads, with resulting high mortality. Some species are highly **philopatric**, meaning that when they reach sexual maturity, they return to natal breeding areas (where they were 'born') to reproduce. If that natal area is disturbed, they may not switch to another breeding site. Individuals of many species also appear to have very specific summer home ranges and over-wintering sites.



Rocky Mountain Tailed Frog eggs

Photo: Purnima Govindarajulu



Boreal Chorus Frog

Photo: Zsolt Sary

2.2.1 Amphibians

The term "amphibian" originates from the Greek *amphi* (double or circular) and *bios* (life). It refers to the way most frogs, toads and some salamanders start life in the water in a **larval** form with gills and change into a form that can live on land, but must return to the water to reproduce.

The "tail" of the tailed frog is actually an extension of the male cloaca. It is not a true tail.

Amphibians include frogs and toads (Order *Anura*, meaning tail-less) and the tailed Order *Caudata* (salamanders and newts). The combination of mountainous, forested areas and high rainfall in the Pacific Northwest has resulted in a high amphibian species diversity and **endemism** (species found nowhere else).[2]

Amphibians depend upon moist terrestrial habitats such as gullies, riparian areas and wet depressions.[3] Some species need standing water, while others require only moist environments. Amphibians do not drink water but rather absorb it through their skin. They need moisture in order to breathe through their skin (subcutaneous respiration). Plethodontid salamanders and tailed frogs lack lungs altogether. The permeable skin and exposed (shell-less) eggs of amphibians make them vulnerable to impacts that affect aquatic and terrestrial environments (see **Section 2.3**).[4]

Frogs have highly vascularized underbellies that can extract moisture from the surface of soils.

Most adult amphibians remain within 200 m of breeding sites, and juvenile dispersal among populations is believed to be limited to less than 1 km for most species,[5] so populations can become easily isolated from each other.[6] This makes riparian corridors very important for seasonal migrations and/or for dispersal.

Table 2.1 shows the types of habitat used by amphibians.

2 Keister 1971
3 Zug 1993
4 Zug 1993
5 Semlitsch 2000
6 Dodd and Cade 1998

Table 2.1: Amphibian Habitats in British Columbia

	TERRESTRIAL				AQUATIC				
GENERAL HABITAT TYPES	Rural / Agric / Dis-turbed	Forest	Sparsely Veget. (shrub, scrub, rock)	Subter-ranean	Lakes	Wet-lands / Ponds	Sloughs /ditches /dug outs	Creeks / Streams / Rivers	Springs and Seeps
Northwestern Salamander	X	X	X	X	X	X	X	X	
Long-toed Salamander	X	X	X		X	X	X	X	X
Blotched Tiger Salamander	X		X	X	X	X	X	X	
Roughskin Newt	X	X			X	X	X	X	
Pacific Giant Salamander		X	X	X	X			X	X
Wandering Salamander	X	X	X						
Ensatina		X	X			X			
Coeur d'Alene Salamander	X		X	X		X		X	X
Western Red-backed Salamander	X	X	X	X					
Coastal Tailed Frog		X	X			X		X	
Rocky Mountain Tailed Frog		X	X			X		X	
Great Basin Spadefoot	X		X	X	X	X	X	X	X
Western Toad	X	X	X		X	X	X	X	
Northern Pacific Treefrog	X	X	Xa	X	X	X	X	X	
Boreal Chorus Frog		X			X	X	X	X	
Northern Red-legged Frog	X	X	X		X	X	X	X	
Columbia Spotted Frog	X				X	X	X	X	
Oregon Spotted Frog					X	X		X	
Wood Frog		X			X	X	X	X	
Northern Leopard Frog	X		X		X	X		X	
American Bullfrog	X						X		
Green Frog	X						X		
# amphibian species	**15**	**14**	**14**	**7**	**14**	**17**	**13**	**17**	**4**

Source: Best Management Practices for Amphibian and Reptile Salvage in British Columbia (2014, draft in progress).

Wetlands offer a variety of habitats for amphibians and reptiles

Photo: Judith Cullington

2.2.2 Reptiles

Reptiles are ectothermic, scaled creatures that lay eggs on land.

British Columbia has relatively few species of reptiles: only two native turtles, three native lizards and nine species of snakes. This is because much of the province lacks a long-enough warm season to allow ectothermic vertebrates to survive. However, there are significant reptile populations in the Southern Interior, where the warm dry vallleys are contiguous with the reptile-rich desert of the western United States.

Because of their protective scales and their reproductive strategies of laying shelled eggs or bearing live young, reptiles are generally less dependent upon moisture and water, which has allowed them to exploit more arid environments.

Key habitat needs for reptiles are warmth, habitat complexity, and habitat connectivity. **Table 2.2** shows the types of habitat used by reptiles.

"As ectotherms, or 'cold-blooded' animals, reptiles are animals that need an external source of heat in order to maintain their body temperatures at levels suitable for bodily functions such as digestion and the development of embryos." http://www.geog.ubc.ca/biodiversity/efauna/reptiles.html

Table 2.2 Reptile Habitats in British Columbia

	TERRESTRIAL				AQUATIC				
GENERAL HABITAT TYPES	Rural / Agric / Dis-turbed	Forest	Sparsely Veget. (scrub, rock)	Subter-ranean	Lakes	Wet-lands / Ponds	Sloughs /ditches /dug outs	Creeks / Streams / Rivers	Springs and Seeps
Western Pond Turtle			X		X	X		X	
Painted Turtle	X				X	X		X	
Pacific Coast Population	x				x	x		x	
Intermountain - Rocky Mountain Population	x				x	x		x	
Red-eared Slider					X	X	X		
Pygmy Short-horned Lizard			X						
Common Wall Lizard	X		X						
Western Skink	X	X	X	X		X		X	
Northern Alligator Lizard	X	X	X			X			
Northern Rubber Boa	X	X	X	X					
Sharp-tailed Snake	X	X	X	X					
Desert Nightsnake			X	X				X	
North American Racer	X	X	X	X		X	X		X
Gopher Snake	X	X	X		X	X		X	
catenifer subspecies	x	x	x			x			
deserticola subspecies			x		x	x		x	
Common Garter Snake	X	X	X		X	X	X	X	X
Northwestern Garter Snake	X	X	X			X	X	X	X
Terrestrial Garter Snake	X	X	X		X	X	X	X	X
Western Rattlesnake	X	X	X	X		X	X	X	X
# reptile species	**12**	**10**	**14**	**6**	**6**	**11**	**6**	**9**	**5**

Source: Best Management Practices for Amphibian and Reptile Salvage in British Columbia (2014, draft in progress).

2.3 Key Issues of Concern

Urban and rural land development can affect amphibians and reptiles—and other species—in many ways.

A study by the US Geological Survey and two universities found that frogs, toads and salamanders in the United States are disappearing from their habitats "at an alarming and rapid rate." http://www.usgs.gov/newsroom/article.asp?ID=3597&from=rss

- **Habitat loss** from land development is the greatest concern for amphibians and reptiles. Amphibians and reptiles use a great variety of habitats at different life stages: aquatic habitats such as wetlands, seepage areas, ponds, and riparian areas, as well as terrestrial areas such as rock outcrops and caves. Without these important habitats they cannot survive and reproduce.
- Amphibians and reptiles need to migrate between summer and winter habitats and for breeding purposes. Development can isolate these habitats from each other, unless care is taken to maintain **wildlife corridors**. **Loss of habitat connectivity** limits the movement of amphibians within urban areas and effectively isolates populations.
- Roads are of special concern as movement barriers because of their linear nature, prevalence in landscapes, and the vast tracts of lands that they intersect. **Road mortality** occurs when amphibians and reptiles are migrating between habitats, or reptiles are basking on warm roads.

For information on the many benefits of wetlands, see *Wetlands in BC: A Primer for Local Governments* http://bcwetlands.ca/tools/wetlands-primer/

- Development can **change the hydrology**—overland and underground water flows—of an area. Ponds and small wetlands may be drained. Water sources may dry earlier than usual, before larvae can hatch.
- Artificial ponds and wetlands (created for stormwater management or as aesthetic features) can become an "**ecological trap**" that lures them to their death. Stormwater management ponds may have high levels of pollutants that amphibians absorb through their skin. Ponds may dry up in summer, have banks that are too steep for amphibian use, or lack natural emergent and riparian vegetation. As well, these areas are often close to roads, leading to road mortality.

For information on wetland protection, see *Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia* http://www.env.gov.bc.ca/wld/documents/bmp/wetlandways2009/wetlandways_docintro.html

Artificial ponds can become an ecological trap

Photo: Judith Cullington

American Bullfrog
(invasive)

Photo: Bill Hendrickson

- **Recreational access and activities** can alter habitats and disturb wildlife. Shoreline vegetation is changed by beach clearing, development of docks and swimmers damaging nearshore plants. Rock climbers may harm reptile denning and basking sites. Trails create new pathways for predators and invasive species. Noise, lights, garbage, and wildlife harassment (e.g., children capturing frogs and tadpoles) all impact wildlife populations.
- **Pets**—especially cats—are a significant predator for amphibians and reptiles.
- Pollution of aquatic and terrestrial habitats may lead to the death of amphibians and reptiles, or sometimes changes in reproductive ability. When amphibians and reptiles become contaminated, the impacts move up the food chain in a process known as **biomagnification** because they are prey for other species.
- Ecosystems change over time in response to fires, floods, vegetation succession, etc. In areas where there are few natural areas left, such as urban environments, it is important to manage these **natural processes** to maintain habitat quality.
- **Invasive species** such as American Bullfrogs (which eat many other amphibians and reptiles) can devastate native populations. Plants such as Yellow-flag Iris can choke out native plants that provide shelter for amphibians.

Our lack of detailed understanding of how best to successfully protect amphibian and reptile populations is also an issue. These small and sometimes secretive creatures can be hard to find (and easily missed even if sought), and there is often little or no information on where important habitats and migratory routes are. The guidelines in **Section 3** provide guidance on approaches that will help to minimize impacts on amphibian and reptile populations, but cannot replace a detailed inventory and management guidelines from professionals.

2.4 Status and Distribution of Amphibians and Reptiles in British Columbia

"B.C. vertebrate groups have different levels of natural rarity. For example, most of B.C.'s reptiles and amphibians are much rarer than the majority of B.C.'s birds, and thus the Conservation Status Index for the group is lower overall." http://www.env.gov.bc.ca/soe/indicators/plants-and-animals/native-vertebrate-species.html

Table 2.3 shows the conservation status of amphibians and reptiles in B.C., and identifies those that are listed as **species at risk**. "**Red-listed**" species are **Extirpated, Endangered,** or **Threatened** in British Columbia. "**Blue-listed**" species are considered to be of special concern in British Columbia, because of characteristics that make them particularly sensitive to human activities or natural events. COSEWIC (Committee on the Status of Endangered Wildlife in Canada) listings are **Extirpated** (XT), **Endangered** (E), **Threatened** (T), **Special Concern** (SC), and **Not at Risk** (NAR). (See the **Glossary** for more detailed explanations.)

Many species of amphibians and reptiles have been adversely affected by urban and rural land development.[7] The areas of B.C. with the most land development—Vancouver Island, the Lower Mainland, and the Okanagan—are also places with very high natural diversity of amphibian and reptile species. Urban and rural land development creates multiple challenges for amphibians and reptiles, notably habitat loss, habitat degradation (including pollution), barriers to movement, road kill, predation and competition from non-native species, and harassment from humans and their pets.

The Stewardship Centre of B.C. website http://www.speciesatrisk.bc.ca/ allows you to search for species at risk by regional district and by forest district.

Information on amphibian and reptile distribution is also available through the Conservation Data Centre http://www.env.gov.bc.ca/cdc/

Regionally, several species are considered extirpated (locally extinct), including Western Pond Turtle on Vancouver Island, Gopher Snake on Vancouver Island and in the Lower Mainland, and Northern Leopard Frog and Short-horned Lizard in the Okanagan. The Green Frog and Bullfrog are **alien** to B.C., and the Pacific Treefrog and possibly the Red-legged Frog are native to other parts of British Columbia, but have been introduced to Haida Gwaii. One population of Northern Leopard Frogs on Vancouver Island originates from introduced specimens.[8]

Table 2.4 shows the regional distribution of amphibians and reptiles in B.C. The regions in this table refer to the eight Ministry of Forests, Lands and Natural Resource Operations regions (see **Figure 2.1: Map of Regions**).

Photo: Judith Cullington

7 Andrews et al. 2008, Bishop et al. 2012
8 Green and Campbell 1984

Table 2.3: Conservation Status of Amphibian and Reptile Species in B.C.

Scientific Name	English Name	COSEWIC	BC List
AMPHIBIANS			
Ambystoma gracile	Northwestern Salamander	NAR (May 1999)	Yellow
Ambystoma macrodactylum	Long-toed Salamander	NAR (Apr 2006)	Yellow
Ambystoma mavortium	**Blotched Tiger Salamander**	**E (Nov 2012)**	**Red**
Taricha granulosa	Roughskin Newt		Yellow
Dicamptodon tenebrosus	**Pacific Giant Salamander**	**T (Nov 2000)**	**Red**
Aneides vagrans	**Wandering Salamander**		**Blue**
Ensatina eschscholtzii	Ensatina	NAR (May 1999)	Yellow
Plethodon idahoensis	**Coeur d'Alene Salamander**	**SC (Nov 2007)**	**Yellow**
Plethodon vehiculum	Western Red-backed Salamander	NAR (Nov 2001)	Yellow
Ascaphus truei	**Coastal Tailed Frog**	**SC (Nov 2011)**	**Blue**
Ascaphus montanus	**Rocky Mountain Tailed Frog**	**E (May 2000)**	**Red**
Spea intermontana	**Great Basin Spadefoot**	**T (Apr 2007)**	**Blue**
Anaxyrus boreas	**Western Toad**	**SC (Nov 2012)**	**Blue**
Pseudacris regilla	Northern Pacific Treefrog		Yellow
Pseudacris maculata	Boreal Chorus Frog		Yellow
Rana aurora	**Northern Red-legged Frog**	**SC (Nov 2004)**	**Blue**
Rana luteiventris	Columbia Spotted Frog	NAR (May 2000)	Yellow
Rana pretiosa	**Oregon Spotted Frog**	**E (May 2011)**	**Red**
Lithobates sylvaticus	Wood Frog		Yellow
Lithobates pipiens	**Northern Leopard Frog**	**E (Apr 2009)**	**Red**
Lithobates catesbeianus	American Bullfrog		Exotic
Lithobates clamitans	Green Frog		Exotic
REPTILES			
Actinemys marmorata	**Western Pond Turtle**	**XT (May 2012)**	**Red**
Chrysemys picta	**Painted Turtle**	**E/SC (Apr 2006)**	
***Chrysemys picta* pop. 1**	**Pacific Coast Population**	**E (Apr 2006)**	**Red**
***Chrysemys picta* pop. 2**	**Intermountain - Rocky Mountain Population**	**SC (Apr 2006)**	**Blue**
Trachemys scripta	Red-eared Slider		Exotic
Phrynosoma douglasii	**Pygmy Short-horned Lizard**	**XT (Apr 2007)**	**Red**
Podarcis muralis	Common Wall Lizard		Exotic
Plestiodon skiltonianus	**Western Skink**	**SC (May 2002)**	**Blue**
Elgaria coerulea	Northern Alligator Lizard	NAR (May 2002)	Yellow
Charina bottae	**Northern Rubber Boa**	**SC (May 2003)**	**Yellow**
Contia tenuis	**Sharp-tailed Snake**	**E (Nov 2009)**	**Red**
Hypsiglena chlorophaea	**Desert Nightsnake**	**E (May 2011)**	**Red**
Coluber constrictor	**North American Racer**	**SC (Nov 2004)**	**Blue**
Species bolded = Listed Species at Risk			

Source: Best Management Practices for Amphibian and Reptile Salvage in British Columbia (2014, draft in progress).

Scientific Name	English Name	COSEWIC	BC List
Pituophis catenifer	**Gopher Snake**		
Pituophis catenifer catenifer	**Gopher Snake, *catenifer* subspecies**	**XT (May 2012)**	**Red**
Pituophis catenifer deserticola	**Gopher Snake, *deserticola* subspecies**	**T (May 2002)**	**Blue**
Thamnophis sirtalis	Common Garter Snake		Yellow
Thamnophis ordinoides	Northwestern Garter Snake	NAR (May 2003)	Yellow
Thamnophis elegans	Terrestrial Garter Snake		Yellow
Crotalus oreganus	**Western Rattlesnake**	**T (May 2004)**	**Blue**
Species bolded = Listed Species at Risk			
Source: Best Management Practices for Amphibian and Reptile Salvage in British Columbia (2014, draft in progress).			

Figure 2.1: Map of Ministry of Forests, Range and Natural Resource Operations Regions

To determine which reptiles and amphibians occur in your area of interest, refer to Table 2.4 and the distribution maps in Section 5, or go to http://maps.gov.bc.ca/ess/sv/imapbc/ and:

- Zoom into your area
- Go to "Map Layers" at bottom of screen
- Click on "Add DataBC layers" in the pop-up window, and select "Fish, Wildlife and Plant Species"
- Then turn on all BC Frogwatch Layers (Reptiles, Turtles and Amphibians). Select individual species.
- Click the point identify button and then on map to identify the species.

Note that some occurrences such as snake hibernacula or private land occurrences are considered sensitive. These occurrences are displayed at extremely low resolution in the Endangered Species layers. For further information a data request can be sent to cdcdata@gov.bc.ca

Table 2.4: Occurrence of Amphibians and Reptiles by Region

REGION (see Fig 2.1):	WC	SC	TO	KB	Car	Sk	Om	NE
AMPHIBIANS								
Northwestern Salamander	X	X				X		
Long-toed Salamander	X	X	X	X	X	X	X	X
Blotched Tiger Salamander			**X**	**X**				
Roughskin Newt	X	X				X		
Pacific Giant Salamander		**X**						
Wandering Salamander	**X**							
Ensatina	X	X				X		
Coeur d'Alene Salamander				X				
Western Red-backed Salamander	X	X						
Coastal Tailed Frog	**X**	**X**	**X**		**X**	**X**		
Rocky Mountain Tailed Frog				**X**				
Great Basin Spadefoot			**X**	**X**	**X**			
Western Toad	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Northern Pacific Treefrog	Xa	X	X	X	X		X	
Boreal Chorus Frog								X
Northern Red-legged Frog	**Xa**	**X**						
Columbia Spotted Frog	X	X	X	X	X	X	X	X
Oregon Spotted Frog		**X**						
Wood Frog	X		X	X	X	X	X	X
Northern Leopard Frog			**EX**	**X**				
American Bullfrog	I	I	I					X
Green Frog	I	I						
# of amphibian species	**14**	**14**	**10**	**10**	**7**	**8**	**5**	**6**
# of amphibian species at risk	**4**	**5**	**5**	**6**	**3**	**2**	**1**	**1**
Species bolded = species at risk								
X = species occur in the region Xa – occurs in region, introduced to Haida Gwaii			? = Possible occurrence I = introduced EX = extirpated					

Western Skink

Photo: Pamela Rutherford

REGION (see Fig 2.1):	WC	SC	TO	KB	Car	Sk	Om	NE
REPTILES								
Western Pond Turtle		**X**						
Painted Turtle	**X**	**X**	**X**	**X**	**X**			
Red-eared Slider	I	I	I					
Pygmy Short-horned Lizard			**EX**	**EX**				
Common Wall Lizard	X							
Western Skink			**X**	**X**				
Northern Alligator Lizard	X	X	X	X	X			
Northern Rubber Boa		**X**	**X**	**X**	**X**			
Sharp-tailed Snake	**X**	**X**	**?**					
Desert Nightsnake			**X**	**X**				
North American Racer			**X**	**X**	**X**			
Gopher Snake	**EX**	**EX**	**X**	**X**	**X**			
Common Garter Snake	X	X	X	X	X	X	X	X
Northwestern Garter Snake	X	X	X			X		
Terrestrial Garter Snake	X	X	X	X	X	X	X	X
Western Rattlesnake			**X**	**X**				
# of reptile species	**9**	**10**	**14**	**11**	**7**	**3**	**2**	**2**
# of reptile species at risk								

Species bolded = species at risk	
X = species occur in the region Xa – occurs in region, introduced to Haida Gwaii	? = Possible occurrence I = introduced EX = extirpated

2.5 Legal Protection for Amphibians and Reptiles in British Columbia

2.5.1 *Federal and Provincial Government Legislation*

Legal protection for amphibian and reptile species in B.C. is limited, and their habitats are largely unprotected, particularly on private land. Applicable legislation includes the following.

- In British Columbia, all wildlife, including native amphibians and reptiles, are protected under the B.C. *Wildlife Act*. Under the Act it is an offence to collect, handle or trade in native wildlife species unless a permit has been issued. However, the *Wildlife Act* does not currently protect amphibian and reptile habitats.

Information on getting permits for handling wildlife can be found at http://www.env.gov.bc.ca/pasb/applications/process/wildlife.html

- The B.C. *Forest and Range Practices Act* provides protection for habitats on Provincial Forest lands for Identified Wildlife species of amphibians and reptiles but management guidelines for rural and urban environments are lacking. This poses a problem for amphibian and reptile conservation in urban and rural environments where most land is privately owned. Identified Wildlife species include Blotched Tiger Salamander, Pacific Giant Salamander, Coeur de'Alene Salamander, Pacific Tailed Frog, Rocky Mountain Tailed Frog, Great Basin Spadefoot, Red-legged Frog, Gopher Snake, North American Racer and Western Rattlesnake.
- The federal *Species at Risk Act* provides some habitat protection for species at risk on federal lands, however this legislation has limited applicability on private lands and relies on stewardship as a conservation measure.

2.5.2 *Local Government Bylaws and Policies*

While the provincial government retains jurisdiction over amphibians and reptiles in British Columbia, local governments are often in a better position to serve as stewards of amphibian and reptile habitat in urban and rural areas. Through the *Local Government Act* and *Community Charter*, local governments have the authority to regulate development within their jurisdiction. The role of local governments in the maintenance of amphibian and reptile populations is vital as much of B.C.'s best land for development also contains important amphibian and reptile habitat.

Municipalities and regional districts have several legislative and planning tools for protecting amphibian and reptile habitat, including the following.

Amphibians and Reptiles at Risk

In British Columbia more than one-half of the native amphibians and reptiles are considered to be at risk (on the Blue or Red list) by the provincial Conservation Data Centre. For those species that have been evaluated by the federal Committee on the Status of Endangered Species within Canada (COSEWIC), 10 amphibian and eight reptile species are listed nationally as Special Concern, Threatened or Endangered.

- Local governments can identify and map important amphibian and reptile habitats in their jurisdiction, and develop bylaws and guidelines to protect these areas. This approach saves time and money for developers by providing information and certainty regarding what areas may (or may not) be suitable for development.
- Local governments can enact bylaws that support the protection of stream and riparian **buffers**. Where the Riparian Areas Regulation is in effect, bylaws must meet the requirements of this regulation.
- Official Community Plans (OCPs) can be used to delineate Urban Containment Boundaries, Environmentally Sensitive Areas, and Development Permit Areas. Zoning can dictate acceptable land uses and bylaws can provide habitat protection (e.g., stream set-backs). OCPs can be used as a mechanism to protect important amphibian and reptile habitat features, such as snake hibernacula and wetlands used as breeding sites by frogs and salamanders.
- Local governments can facilitate the establishment of Conservation Covenants to protect habitats. Density transfers and density bonuses can be used to reduce urban sprawl and allow the establishment of wildlife conservation zones.

As guided by this document and/or as assisted by expert advice, local government staff unfamiliar with amphibian and reptile ecology can gain confidence to assess, amend, approve, or reject a development application. Further information on how local governments can help conserve wildlife habitats and natural ecosystems is presented in *Develop with Care* and Nowlan *et al.* (2001).

These Painted Turtles are a species at risk

Photo: Trudy Chatwin

3 General Guidelines for Amphibian and Reptile Conservation

Following the guidelines presented below will help to minimize habitat loss and maintain the viability of populations of amphibians and reptiles in areas of urban and rural development. These guidelines are based on their ecological needs and behaviours, and are generally applicable to both urban and rural landscapes and all regions of the Province. Additional species-specific guidelines are provided in **Section 5** of this document.

The guidelines for amphibian and reptile conservation during land development complement the environmental guidelines in *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia*. That document provides information for local government planners (Section 2) and the development community (Section 3) that is essential for successfully maintaining environmental values as land develops.

3.1 Conduct inventories and assessments prior to site planning, design and development

In order to protect amphibians and reptiles during land development, it is critical to know what species are present and what habitats they use. The Conservation Data Centre is an excellent tool to learn what species are in your area.

- ☑ Conduct a preliminary site survey to see if amphibians and reptiles are likely to be found on or near the development site (see Develop with Care Section 3 and Appendix B: Bio-inventory Terms of Reference). Landscape-scale mapping of habitats (e.g., Sensitive Ecosystems Inventories) and habitat capability mapping are useful tools in determining what to look for and where to undertake a more intensive inventory. This scale of mapping is also useful for identifying potential impacts from linear developments.
- ☑ If amphibians and reptiles are (or are likely to be) present on or near the development site, work with a professional biologist to conduct a detailed site bio-inventory. This will provide information about species and their habitats, including connectivity corridors (see sidebar).
- ☑ If there is a recovery plan for a species present on the site, work with a professional biologist to ensure that all actions are guided by the recovery plan recommendations.
- ☑ Map all **important habitats** (see sidebar) within and adjacent to the development area. Important habitats for amphibians and reptiles include talus slopes, hibernacula, nest sites, aquatic breeding sites for amphibians, and connectivity corridors for both amphibians and reptiles.
- ☑ Use standard, specialized survey techniques appropriate to each species. **Section 4.3** provides information on sampling methodologies.

Connectivity implies providing safe wildlife travel routes between seasonal habitats that are spatially separated, connecting small patches of similar habitat that are fragmented by human activities, and providing sufficient connectivity among habitat components to permit population processes at the landscape level.

Important habitats (as the term is used here) include all sites, aquatic and terrestrial, that amphibians and reptiles use for essential life-history activities (i.e. food, shelter, reproduction).

3.2 Protect important habitats and habitat features

The best way to maintain populations of amphibians and reptiles is to set aside their important habitats and maintain habitat connectivity, rather than trying to mitigate impacts or restore habitats that have been lost.

- ☑ Identify and protect important habitats—such as aquatic breeding sites for amphibians, caves and seepage areas for salamanders, turtle nesting grounds, and snake hibernacula—from development or human disturbance.
- ☑ Protect wetlands, ponds, pools, and streams, however small or seasonal.
- ☑ Avoid fragmentation of habitats.
- ☑ Design developments to avoid key habitat features and disturb as little natural vegetation as possible. Cluster housing and concentrate infrastructure in areas of low habitat quality, so that areas of high quality habitat can remain undisturbed.
- ☑ Preserve, restore or incorporate a diversity of habitat features such as coarse woody debris, rocky outcrops, talus, and areas used for burrowing.
- ☑ Maintain **riparian** and **emergent** vegetation cover as it provides protection from predators and climatic extremes.

The UK group "Amphibian and Reptile Conservation" provides handbooks for Amphibian Habitat Management and Reptile Habitat Management

3.3 Control access to important and sensitive habitats

- ☑ Place buffers around important habitats to deter access, trampling and harassment. Buffers are discussed in greater detail in *Develop with Care 2012* (Section 4) . Amphibians and reptiles need undisturbed natural vegetation adjacent to wetted areas for foraging and to complete life-history stages. A buffer zone of 30 to 150 m (the wider the better) on each side of a stream and along wetlands will benefit many species.
- ☑ Restrict access by livestock, humans and their pets to important amphibian and reptile habitat (e.g., shorelines, breeding, denning, and basking sites) by use of fencing, signage, leash laws, and seasonal use restrictions.
- ☑ Design campground areas and trail systems that encourage people to stay in designated areas using boardwalks, fencing and hedgerows. Keep hiking trails narrow to allow amphibians and reptiles to cross them easily.
- ☑ Avoid the placement of schools, playgrounds and housing developments beside important and sensitive habitats.
- ☑ Restrict access to areas with wet soils by horses, hikers and ATVs. These uses increase soil compaction, sedimentation and the spread of weeds.
- ☑ Restrict snowmobile use, as this activity compacts snow over wetlands, reduces the water holding capacity of the snow, and increases peak spring flows into sensitive habitats.

Figure 3.1 Important Habitats for Amphibians and Reptiles

Forests and downed logs

Sparsely vegetated (rocks, shrubs, scrub)

Agricultural and grasslands

Subterranean features

Wetlands and ponds

Lakes

Creeks, streams and rivers

Beaches

Sloughs and ditches

Springs and seeps

Photos: Judith Cullington, Susan Latimer, Alicia Newbury, Jennifer Heron, Grant Bracher

3.4 Maintain or improve habitat connectivity

Amphibians and reptiles need to be able to move between the different habitats that they use. Proper siting of developments and related infrastructure can minimize habitat fragmentation and protect travel corridors. Often this is the single most important measure that can be taken to protect amphibian and reptile habitats.

- ☑ Maintain connectivity between patches of important habitats, small isolated ponds and wetlands, in order to facilitate the migration or dispersal of amphibians.
- ☑ Where habitats are already fragmented, create habitat continuity that allows for movements of animals. If the development area lies adjacent to green spaces or parks, ensure that connectivity is maintained by setting aside undisturbed habitat for travel routes to these areas.
- ☑ Follow the advice of professional biologists with expertise in the specific species to determine the appropriate width, vegetative cover and location of the connections.
- ☑ Protect native plant hedgerows, fencerows and windbreaks that align with animal movements.

3.5 Prevent road mortality

The U.S. Department of Transportation's Wildlife Crossing Structure Handbook: Design and Evaluation in North America includes information on creating tunnels for amphibians and reptiles.

Large numbers of amphibians and reptiles are killed when crossing roads. Mortality can be severe where roads bisect seasonal migration routes. Routing of new roads to avoid important wetlands and key migration routes is the best measure to minimize effects of roads on amphibians and reptile populations.

- ☑ Avoid developing roads near wetlands, snake hibernacula and turtle nesting sites to reduce road mortality.

The U.S. National Parks Service is developing a Wildlife Crossings Tookit

- ☑ Where migration often occurs across roads/road alignments at specific locations, install tunnels under the road with drift fences to keep animals off the road and to guide them through the tunnels.

Roadkill (Northern Leopard Frog)

Photo: Lea Randall

Creating fencing to diverst amphibians into tunnels

Photo: Trudy Chatwin

- Place tunnels along known routes between winter/foraging grounds and breeding grounds.
- Tunnels can be constructed of a variety of materials, including concrete, steel, PVC piping and polymer surface products. Steel is thought to be less desirable because of its high thermal conductivity and coldness during spring migratory periods; metals leaching from galvanized steel may be harmful to amphibians.
- Tunnels of large diameter (approximately 1 m) are more effective and also allow for the passage of other animals; the distance between tunnels should be 50 m or less. Natural substrate should be placed in the culvert.
- Smaller tunnels with overhead openings (vents) for ambient light and moisture are effective; the vents are covered by metal grates to minimize interference with vehicle movements along the road.
- Tunnels should not exceed 30–35 m in length.
- For stream-dwelling amphibians (e.g., Pacific Giant Salamander and tailed frogs), open-bottom culverts are thought to facilitate movements of animals under roads. This culvert design eliminates contact with steel and maintains natural substrates along the bottom of the culvert.
- Fencing is needed to intercept movements of animals and direct them towards the tunnels. Where the drift fencing is parallel to the road, additional fences are needed to funnel the animals towards the tunnel entrance. Drift fences can be constructed of various materials, including hardware cloth, rigid plastic and polyethylene sheets.

A study along the Sea to Sky Highway found that nearly 1,500 amphibians were killed over a two year period. Where fencing was placed, road mortality was reduced by 50%. (Malt 2012)

If you do see dead (or live!) reptiles, please Report your Reptile Sightings to the Ministry of Environment using a wildlife reporting form as this helps with data gathering. For information see http://www.bcreptiles.ca/reportsightings.htm

- Fences about 50 cm in height appear to be suitable for most species; bury the bottom 6–10 cm of the drift fence to prevent animals from tunneling underneath.
- Fences should be regularly inspected for damage.

☑ Where construction of tunnel crossing structures is not possible, use temporary seasonal measures to reduce the risk of road mortality such as short-term road closures and detours, reduced speed zones, signs warning motorists of an amphibian or reptile crossing, and trapping and transport of animals across busy roads.

☑ Where the probability of road mortality is high, consider relocation of hibernacula, nesting areas and breeding sites as an option, under the guidance of a professional biologist. This might involve construction of a permanent fence to keep animals away from the road. This is an option where most of the important habitats are on the same side of the road.

3.6 Maintain hydrological features needed by amphibians and reptiles

☑ Where ponds, marshes or streams are present on or adjacent to the development, document pre-development hydroperiods (patterns of drying and filling), sedimentation loads, flow volumes, and peak flows as baseline information so these can be compared to post-development conditions.

☑ Maintain or restore the natural hydrological regime of an area.

☑ Avoid draining or dredging wetlands.

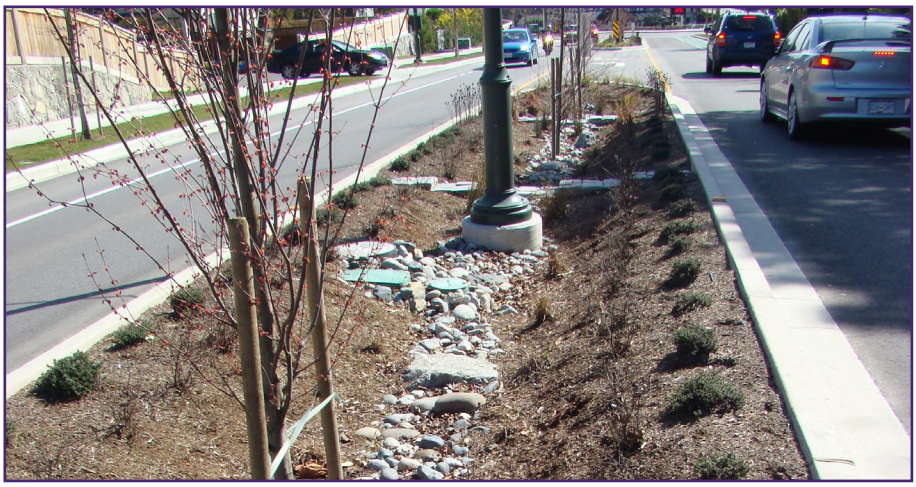
☑ Ensure that management plans consider and protect all wetlands and other watercourses, regardless of their size, flow rates, depth, or duration.

3.7 Reduce pollution in aquatic breeding habitats

Amphibians and reptiles in populated areas are exposed to a wide variety of contaminants that have the potential to affect their health and survival. Amphibians are especially sensitive to environmental pollutants because of their permeable skin and eggs. The main types of pollutants include road salt, pesticides, sediments, organic matter, nutrients, heavy metals, and petrochemicals. Some chemical compounds act as endocrine disrupters and can interfere with hormone signals during sensitive development periods of both amphibians and reptiles. All these substances can be transported through surface runoff or in groundwater and will eventually end up in wetlands and other watercourses.

☑ Avoid the use of chemicals, including pesticides, fertilizers and road salt, near wetlands, lakes, streams, ditches, and other watercourses.

☑ Contain contaminants through appropriate stormwater and wastewater management in and around development sites.



Raingardens can remove pollutants before they enter watercourses

Photo: Judith Cullington

- ☑ Maintain or plant riparian buffers around watercourses. These help to reduce erosion, filter sediment and reduce levels of contaminants before they enter aquatic habitats.
- ☑ Eliminate, restrict or replace pest control methods that rely on the use of pesticides on public parks, golf courses, road sides, utility right-of-ways, and residential gardens.
- ☑ In urban environments, protect or plant vegetated borders around parking lots, golf courses, and industrial/commercial centres to reduce the transport of sediments and contaminants into watercourses.
- ☑ Install oil/water separators to remove hydrocarbons and other contaminants from roads and parking lots before they enter storm sewers and the aquatic environment.

3.8 Prevent the introduction of non-native species

Invasive species include legally or illegally stocked fish, non-native amphibians and reptiles, weedy aquatic plant species, and released pets (such as Goldfish and exotic turtles). Non-native species affect amphibians and reptiles through predation and competition for resources, alteration of habitats and plant community structure, and the introduction of wildlife diseases.

Once a non-native species has become established, its eradication is very difficult. Removal of invasive species is very time consuming and has little chance of success where the potential for immigration from surrounding areas is high. The best line of defence is a proactive approach that prevents the introduction or spread of non-native species and wildlife diseases.

☑ Avoid creating suitable conditions for non-native species:

- In areas where Bullfrogs are found, do not create permanent ponds as this will facilitate their spread;
- Design permanent ponds so that they can be drained in case Bullfrogs do become established;

Yellow Flag Iris (invasive) can outcompete native plants and alter wetland habitats

Photo: Judith Cullington

- Use only native plant species in human-made ponds;
- Avoid the pooling of water and constantly drain from sites where it collects during construction, at gravel pits, or along roadways as they are often favoured by non-native species; and,
- Restore natural habitats where non-native species exist, as this may prevent their persistence.

☑ Avoid accidental or deliberate species introductions:

- Prohibit fishing and fish stocking in amphibian habitats to prevent non-native species introductions. Do not stock fish in currently fishless watercourses as they will compete with amphibians and may prey upon them;
- Avoid moving frogs or frog spawn between ponds;
- Do not plant or allow the spread of exotic species of plants within natural areas. Introduced plants such as Purple Loosestrife and Eurasian Milfoil out-compete native plant species and can quickly overrun wetland habitats. This reduces the diversity of habitats available to amphibians and reptiles; and,
- Limit access to water bodies by humans and pets to reduce the chance of intentional and unintentional introductions or spread of disease.

☑ Display educational signage regarding the illegal capture and release of animals, and the threats that non-native species pose to native **biodiversity**.

☑ Prevent introductions of fungal disease pathogens through the movement of infected habitat material such as water, mud or soil, and of non-native fish or amphibians.

☑ In areas where new introductions are limited, consider removing existing invasive wildlife through trapping, netting, and other means.

Amphibian and Reptile Salvage

Salvage operations for amphibians and reptiles should only be conducted after all other options, such as avoidance, have been considered. If salvage options are considered, the Best Management Practices for Amphibian and Reptile Salvages in British Columbia should be carefully followed. This document is available from http://www.env.gov.bc.ca/wld/BMP/bmpintro.html

[Note that this is currently (January 2014) in draft, contact your local Ministry of Forests, Lands and Natural Resource Operations office if you are unable to locate the document.] .

3.9 Avoid and mitigate the impacts of construction

- ☑ Develop and implement erosion and sediment control plans before the start of any construction activity.
- ☑ Have an emergency response plan in place to contain and clean up oil and fuel spills safely and quickly.
- ☑ Provide temporary fencing of important amphibian and reptile habitat and habitat features, (e.g., wetlands, riparian areas, talus slopes, nest sites, and denning areas) to protect them during construction. Ensure that storage of equipment and materials, as well as parking of vehicles, takes place elsewhere.
- ☑ Inform construction workers as to why some areas are fenced and their importance for amphibians and reptiles.
- ☑ If amphibians and reptiles are present, try to avoid construction during periods when they are congregated for breeding, nesting or seasonal migrations.
- ☑ Whenever possible, avoid compaction and disturbance of the ground within the development or buffer area including soil, the litter layer and coarse woody debris.
- ☑ Install tunnels or other road crossing systems at the same time as new road construction or upgrades.
- ☑ Consider habitat enhancement and restoration; taking advantage of heavy equipment already onsite, as well as any surplus woody debris, rocks, gravel and soil, thus saving time and money compared to doing the work post-construction.

3.10 Restore and enhance habitat

Habitats in urban and rural environments are often highly modified; restoration activities may help populations of amphibians and reptiles survive or repopulate these areas. Habitat enhancement involves improving habitat quality by adding or augmenting features important for a particular species. A diversity of habitats and habitat features promotes species diversity and long-term survival of amphibian and

This wetland was re-created from a former wet meadow

Photo: Robert K. Cox

reptile populations. For purposes of this document, the term "habitat restoration" will also include habitat enhancement activities. Large-scale habitat restoration should only be undertaken with the guidance of a professional biologist.

Restoring habitats for amphibians and reptiles can range from restoration of habitat connectivity at the large-scale to small-scale landscaping by residents in their backyards and gardens. Both large- and small-scale restoration projects require careful planning and knowledge of the requirements of the target species; advice from a professional biologist or herpetologist can be very helpful.

3.10.1 Restoring connectivity of habitats

Information on wetland conservation and restoration is available from the Wetland Network http://wetlandnetwork.ca/

The restoration or maintenance of habitat connectivity is important to allow for dispersal and migratory movements of amphibians and reptiles.

☑ Restore connectivity by restoring natural vegetation in upland habitats between wetlands, repairing gaps in riparian travel corridors adjacent to streams, restoring drained wetlands as stepping stones between core habitat areas, and retrofitting structures to facilitate road crossings by amphibians and reptiles.

3.10.2 Restoration of wetlands

Amphibians and reptiles use a variety of wetlands for different life-history phases and activities. Temporary wetlands include **vernal pools**, floodplain pools, and other shallow depressions that undergo a periodic, annual pattern of filling and drying. Amphibians that breed in temporary water bodies avoid predation by fish and other aquatic or semi-aquatic animals that have poor overland dispersal abilities. Semi-permanent and permanent wetlands include marshes, ponds, lakes, excavated dugouts, and beaver ponds. Permanent water bodies are essential for amphibians that require multiple years for aquatic larval development. Freshwater turtles require permanent water bodies for foraging, over-wintering and other activities, while many snakes (such as several species of garter snakes) use both types of wetlands for foraging.

Avoid creating habitat "sinks" (ecological traps)

Photo: Judith Cullington

- ☑ Avoid creating ponds that are **sink habitats** (i.e., attract amphibians and reptiles but result in their reduced survival). Deep, permanent water bodies, especially those where the shallow shoreline areas have been lost, are unsuitable to most amphibian species. Steep-sided embankments (resulting from dredging to make ponds deeper or to channelize streams) are undesirable.
- ☑ Avoid creating permanent wetlands or changing temporary wetlands into permanent ponds in areas where non-native species such as Bullfrogs have become established.
- ☑ Restore buffers of native vegetation adjacent to wetlands, focus on providing a variety of habitat types within the buffers; often this can be achieved by simply leaving areas in their natural state.
- ☑ Restore natural drainage patterns by removing drainage tiles, filling-in drainage ditches, or removing dams and berms.
- ☑ Remove invasive plants.
- ☑ Restore shallow water zones with native, emergent and submerged vegetation to restore natural ecosystem processes.
- ☑ Increase the habitat complexity of wetlands by re-contouring eroded or modified shorelines using irregular or undulating patterns.

Information on B.C. invasive plants is available at http://www.bcinvasives.ca/.

3.10.3 Restoration of terrestrial habitats

Areas with a diversity of terrestrial and aquatic habitats tend to support a greater diversity of amphibians and reptiles.

- ☑ Control invasive plant species (e.g., Himalayan Blackberry, Scotch Broom, Gorse, and Japanese Knotweed). Once established, they form impenetrable thickets degrading amphibian and reptile habitat. Maintain or restore important habitat features for amphibian and reptiles including downed logs, bark and other coarse woody debris, especially large-diameter pieces in various stages of decay. Within urban areas, public education may be required to ensure that newly fallen trees are not hauled away for firewood. In the arid interior where wildfires may be a problem, removal of branches and smaller pieces might be necessary. The addition of large pieces of coarse woody debris to sites from where they have been removed or depleted is also an option.
- ☑ Restore talus and flat rocks in areas where they have been disturbed or removed. Rocks and talus are important habitat features for reptiles, and when sufficient moisture is present, also for amphibians.
- ☑ Where natural refuges have been degraded, construct artificial structures (rock or brush piles) to provide shelter, over-wintering sites or nesting sites for reptiles.

Once it has been identified that amphibian or reptile species are (or are likely to be) on site, check the species-specific guidelines in Section 5 in addition to the Section 3 General Guidelines.

4 Monitoring, Reporting and Public Education

4.1 The Important of Monitoring

It is important to find out whether particular measures taken to protect, restore, or manage habitats and populations of amphibians and reptiles are effective. Monitoring consists of follow-up activities undertaken to address this issue.

Monitoring is very important for several reasons.

- Time and resources may be wasted on measures that are ineffective or even counter-productive; monitoring can detect problems at an early stage and prevent the waste of resources.
- Refinements of mitigation measures are often needed to fit them to particular settings; monitoring will help direct these adjustments and identify any issues, a process known as "adaptive management". Many of the guidelines are based on the ecology of animals under natural conditions and have never been adequately tested in disturbed habitats or with interacting stressors, so monitoring will help to verify and adjust guidelines as needed.
- Much can be learned from each individual project; and the information gathered will help in the design of other similar projects.
- Monitoring programs often offer excellent opportunities for involving local residents, natural history groups, and other community members in conservation activities, thus promoting awareness and stewardship of amphibians and reptiles and their habitats within urban/rural areas.

The majority of the early amphibian tunnel systems in Europe were later found to be virtually non-functional. Typically, no monitoring was conducted after the tunnels were constructed; had systematic monitoring been incorporated into the plan for each project, the problems (which often included faulty technical design features) would have been detected much earlier. (Podloucky 1989, Ryser and Grossenbacher 1989)

Monitoring is important for several reasons

Photo: Grant Bracher

4.2 Monitoring Strategies

Monitoring should be undertaken under the guidance of a professional biologist, perhaps with help from volunteers. Aspects to consider when setting up monitoring programs include the following.

- **Goals**. Local governments can develop broad management and conservation goals for urban and rural areas as part of zoning and land use plans. It is important to ensure that amphibians and reptiles are included within these plans.

  As with all biological studies, it is important to understand exactly what the objectives of the monitoring program are. If the objectives call for pre-/post-disturbance comparisons, it is important to collect adequate baseline information at the outset. Consulting with an experienced herpetologist is desirable for the design of monitoring studies to ensure that all these factors are considered.

- **Timing**. Monitoring will need to span multiple years, because impacts may take years to filter through a species' population and become detectable. Furthermore, populations of many aquatic-breeding amphibians fluctuate widely from year to year, and surveys carried out during a short period might lead to inaccurate conclusions about the effectiveness of particular management practices. Periodic monitoring should be an ongoing and integral part of ecosystem management and be incorporated into management plans for wildlife.

  It is very important that amphibians and reptiles are surveyed at appropriate times of the year, because their life-history patterns and activities are highly seasonal. Because their activity is greatly influenced by environmental conditions, it is important that surveys are carried out during optimal weather and moisture conditions. Many species are secretive, nocturnal, or partially **fossorial** (living underground), so they can be difficult to find even where abundant.

- **Scope**. Broad-scale (landscape-level) monitoring is used to address whether biodiversity goals have been achieved. Monitoring at local scales focuses on the effectiveness of a particular management or mitigation measure, such as the use of a road crossing structure by amphibians and reptiles. Both types of monitoring are necessary to ensure that scarce resources, funding and efforts are appropriately directed towards those the most effective management practices. Scale is important for aquatic-breeding amphibians, because their populations typically fluctuate widely from year to year. Rather than monitoring their abundance within a local area, such as a pond, it may be more helpful to monitor changes to the distribution or loss of local populations over a wider area.

- **Aspects to measure**. Monitoring might include surveys of important **habitats** (such as ponds and streams within a given area) at periodic intervals and assessment of the number of amphibian and reptile species present. Parks, greenways, and riparian management zones may be good targets for such a program. Performance criteria may include:

- Species richness;
- A statistically significant decline in relative abundance of particular species over several years;
- Reduced number of egg-masses by aquatic breeding amphibians;
- Reduced survival of certain life-history stages;
- Disappearance of sensitive species from the complement of species; and
- Addition of introduced species.

Report observations of species at risk to the Conservation Data Centre to help with broader-scale conservation and population monitoring efforts.

- **Effectiveness monitoring**. Effectiveness monitoring should be incorporated into each project to ensure that the measures implemented are functioning as expected. Without such testing, well-intended efforts may be wasted, or worse, the measures may give the impression that the problem has been solved when in fact it has not. The level of detail required and the length of monitoring will depend on specific projects and objectives. Effectiveness monitoring often involves intensive follow-up efforts initially after the implementation of mitigation measures, and periodic monitoring thereafter. Sufficient detail must be collected to adequately address potential problem areas.
- **Uncertainty**. Because natural ecosystems are extraordinarily complex and characterized by a multitude of interactions and poorly understood processes, there is always uncertainty about the outcome of even well-tested management methods when applied to particular local or regional conditions. The potential for interactions and unexpected responses should be kept in mind when designing monitoring programs. The distribution of many amphibians and reptiles are patchy in the environment, and survey efforts must be carried out at an appropriate scale that these dispersion patterns into account.

The Partners in Amphibian and Reptile Conservation has a comprehensive guide to inventory and monitoring of amphibians and reptiles: *Inventory and Monitoring: Recommended Techniques for Reptiles and Amphibians*, with application to the United States and Canada. See http://www.parcplace.org/publications/inventory-and-monitoring-guide.html for more information.

4.3 Standard Methods for Sampling Amphibians and Reptiles

Many effective sampling methods are available for amphibians and reptiles. Heyer et al. (1994) provide a summary of standard methods for measuring and monitoring amphibian populations. Olson et al. (1997) discuss standard sampling methods and experimental and monitoring designs for amphibians in wetland and pond habitats. The Resources Information Standards Committee has developed standard methods for amphibians and reptiles of British Columbia. These standards exist for:

- Plethodontid salamanders (RISC 1999);
- Pond-breeding amphibians and the Painted Turtle (RISC 1998a);
- Pacific (also known as Coastal) Giant Salamander and Tailed Frog (RISC 2000); and
- Snakes (RISC 1998b).

Krebs (1989) provides basic methods for experimental design and statistical analysis

in ecological studies.

The Interim Hygiene Protocols for Amphibian Field Staff and Researchers describes hygiene protocols to be used by amphibian field staff and researchers to reduce risk of disease transmission among sites and among animals within a site.

The Ecological Monitoring and Assessment Network (EMAN) and Parks Canada have developed a standardized protocol for monitoring population trends of plethodontid salamanders at EMAN ecological plots, within parks, or as a part of other environmental programs (Zorn and Blazeski 2002).

4.4 Public Education and Stewardship

Many species of amphibians and reptiles are poorly known to the public and have received little attention by local governments. For example, many people are afraid of snakes and will kill them, even though most are completely harmless and beneficial because they feed on pest animals. Other people may capture amphibians and reptiles for pets or inadvertently injure them. Accidental introductions of non-native species such as Bullfrogs can result in severe, irreversible impacts on native species.

For guidelines to be accepted and implemented, there is a need for greater awareness about the ecological importance, status, and vulnerabilities of amphibians and reptiles.

The "Frogs in the Classroom" brochure talks about the threats caused by classroom pets.

There are many ways for people to find out information on amphibians and reptiles, some of which are listed overleaf.

- **B.C. Frogwatch**: A program to collect and share information on frogs, toads, salamanders, and turtles in British Columbia. This program trains volunteers in British Columbia and helps them to advocate at the local level and raise the awareness of amphibians and their conservation needs. The website includes information on individual species, how to identify them, how to find and count

Public education increases understanding

Photo: Judith Cullington

Photo: Judith Cullington

them, and how to report a sighting. B.C. Frogwatch partners are the Habitat Conservation Trust Foundation, B.C. Ministry of Environment, the Conservation Data Centre, Thompson Rivers University, and the Ecological Monitoring and Assessment Network. They work closely with the Federation of BC Naturalists (BC Nature), the Community Mapping Network, the BC Wetlandkeepers and Wild BC.

Amphibian road mortality during migratory movements, which can be highly visible and draws public attention, has been used as a focal point for efforts aimed at restoring habitat connectivity (Langton 1989a).

- **Canadian Amphibian and Reptile Conservation Network** (CARCNET): CARCNET represents the Canadian biologists who study, protect and educate people about amphibians and reptiles. They work to conserve Canada's native species of amphibians and reptiles, and their ecological and evolutionary functions in perpetuity. They help to coordinate public involvement in frog and toad monitoring programs across Canada and are developing a system to designate Important Reptile Areas and Important Amphibian Areas in Canada to raise awareness about the areas that are special for these animals.

BC Hydro's Fish and Wildlife Compensation Program has delivered more than 1,500 projects that conserve and enhance fish, wildlife and their supporting habitats affected by the creation of BC Hydro owned and operated generation facilities in the Coastal, Columbia, and Peace regions of British Columbia.

- The **Reptiles of British Columbia** website: Hosted by Thompson Rivers University, this website provides a wealth of information on British Columbia's reptiles, including photographs and species accounts.
- **E-Fauna BC**: E-Fauna BC is a biogeographic atlas of the wildlife of British Columbia that provides a centralized source of scientifically accurate information for use in conservation, education and research and includes information on amphibians and reptiles.
- **SARA Species at Risk Public Registry**: The SARA Registry provides links to species accounts for federally listed species at risk including amphibians and reptiles.
- *A Guide to Amphibians: Frogs, Toads, Salamanders of Vancouver Island and the Gulf Islands* (published by Frogwatch of British Columbia Ministry of Environment and Salt Spring Island Conservancy May 2011).

5. Species Accounts

The accounts accompanying this report were compiled from existing sources, including primary and secondary literature, and the personal expertise and observations of **herpetologists** from different regions of British Columbia. Secondary sources included field guides: Green and Campbell (1984), Gregory and Campbell (1984), Leonard et al. (1993), Storm and Leonard (1995), Corkran and Thoms (1996), and St. John (2002).

Each account contains the following: status (national and provincial); distribution in British Columbia and within different Regions, a brief description of life-history and habitats; and an assessment of compatibility with human landscapes. Species-specific guidelines are included where applicable.

Range maps are provided with each species account, showing potential places where that species could be found. For some areas and species, there has been little inventory done, and the range may in fact include a larger area. This is especially true along parts of the coast and the northern reaches of the Province. Any additional observations, especially those that are outside of the range shown, can be submitted to Frogwatch. This will help to refine these boundaries as additional information is available. Note that these ranges may change over time as a result of climate change and other factors. The ranges have been created from a variety of sources including the Ministry of Environment, Species Inventory Database (SPI, 2013) Survey and Incidental Observations layers; Conservation Data Centre; Frogwatch; BC Reptiles website; Corkran and Thoms' "*Amphibians of Oregon, Washington and British Columbia*"; Government of Northwest Territories; and expert opinion.

Northern Alligator Lizard

Photo: Trudy Chatwin

5.1 Frogs

5.1.1 Family *Ascaphidae* - Tailed Frogs

Coastal Tailed Frog (Ascaphus truei)

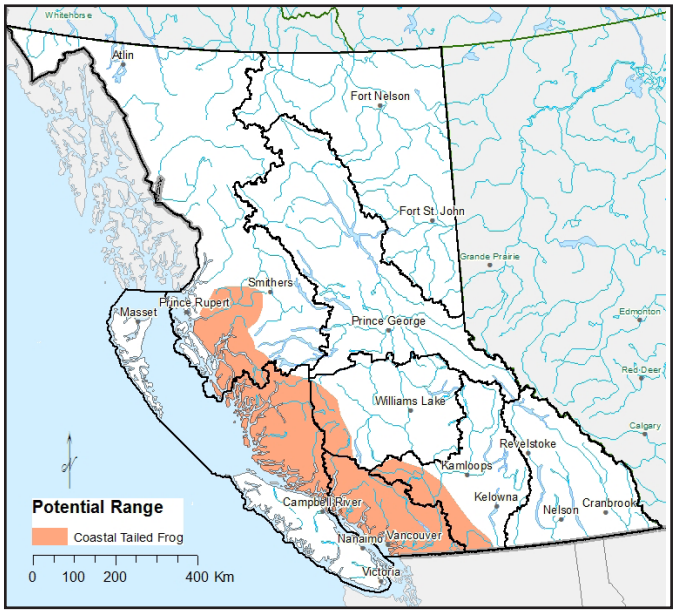


Photo:Alexis McEwan

Rocky Mountain Tailed Frog (Ascaphus montanus)

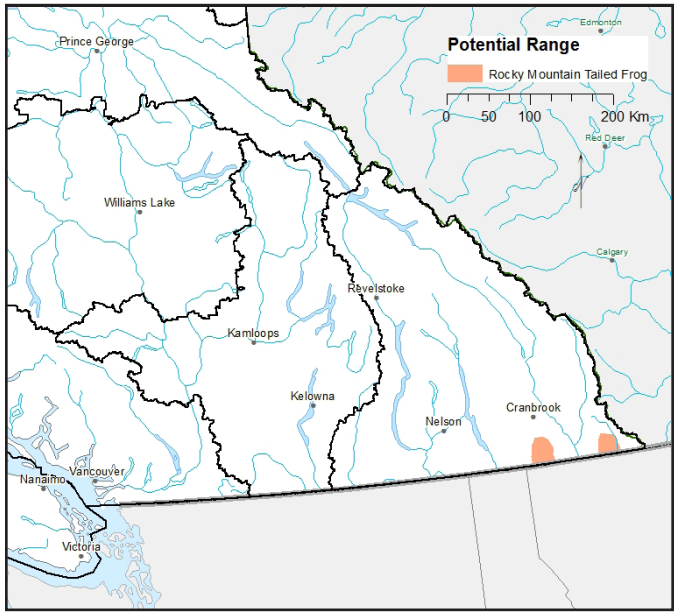


Photo:Purnima Govindarajulu

Identification

- Tailed frogs (family *Ascaphidae*) require cool, clear, fast-flowing, permanent mountain streams with stable rocky substrates and associated closed-canopy forests
- Total adult length 30–50 mm; juveniles can be very small (<20mm)

- Grainy, rough skin; adults are usually olive, gray or tan in colour although some may be black or even reddish; light-coloured bar or triangle commonly found between the eyes
- Adult tailed frogs can be distinguished from Western Toad and other frogs by the lack of tympanum (round external ear) behind eye
- Vertical diamond-shaped pupils (in bright light)
- Tail (copulatory organ) only present on males, has the same skin colour and texture as the rest of the frog
- Toes on the hind feet are flat, wide and webbed
- Tadpoles have very large sucker-like mouths, and range from 10–60 mm in length depending on age. Older tadpoles can be mottled grey to brownish or black and commonly have a white spot on the tip of their tail; hatchlings can be almost transparent

Coastal Tailed Frog
COSEWIC: Special concern
B.C. Status: Blue-listed

Rocky Mountain Tailed Frog
COSEWIC: Endangered
B.C. Status: Red-listed

Distribution

Coastal Tailed Frogs are found from western coastal British Columbia and south to California. In British Columbia, the range extends inland to the leeward side of the Cascade Mountains in the south, and the Coast mountains to the north, extending east of Bella Coola in the central coast (Cariboo Region) and into the Hazelton Mountains (Skeena Region) at the northern extent of its range.

The Rocky Mountain Tailed Frog occurs in the extreme southeast of British Columbia. It is present only in a few streams in both the Border Ranges and the Columbia Mountains, on either side of the Rocky Mountain Trench. This species was considered a geographically separate population of the Coastal Tailed Frog until quite recently (2001). Within its range, distribution is quite patchy.

Life History and Habitat Requirements

Tailed frogs live in and around cool, clear, fast-flowing, permanent mountain streams. They need stable, sediment-free cobble and boulder substrates that provide ample pore space as shelter from the swift currents, debris transport and predators. Small shaded channels without fish are favoured.

Tailed Frogs do not call. They have no eardrums, though they may be able to sense vibration in the water.

Tailed frog tadpoles cling to rocks with specialized mouthparts. All life stages are most active at night; during the day, tadpoles and frogs may hide between and on the underside of boulders and cobble. When away from the stream, adults and juveniles are highly sensitive to desiccation and temperature increase so they seek refuge inside or under large woody structures/complex forest floors near the stream edge, or in moist micro-habitats such as ephemeral stream channels or wet draws.

Adult tailed frogs eat terrestrial and aquatic insects, snails and other small invertebrates. Tailed frog tadpoles scrape algae from submerged rocks and consume small insects and pollen that fall into the water. Tadpoles and frogs may be eaten by a range of vertebrates, including fish, birds, small mammals, and Giant Salamanders.

Breeding occurs from September to October, and adults may aggregate to breed. Males copulate with females using their cloacal "tails" to facilitate internal fertilization, thought to be an adaptation to breeding in flowing water. In winter, frogs of all ages reduce activity levels and take refuge in and under the forest floor and stream banks, though this process is poorly understood. After spring emergence, the female lays about 50–60 pea-sized whitish or cream-coloured eggs in June or July. Females may aggregate to lay their eggs in gelatinous strings that are attached to the underside of a large rock.

Embryos hatch in late August after approximately six weeks and grow rapidly. Metamorphosis from tadpole to frog occurs within 1–4 years depending on elevation and latitude. Juvenile frogs disperse out from their natal streams into the adjacent forest, reaching sexual maturity at approximately 7–8 years of age. At high elevations and in the north, females breed in alternate years only. Tailed frogs may live 15–20 years, making them one of the longest-lived frogs in the world.[9]

Compatibility with Human Landscapes

It is unlikely that tailed frogs can co-exist with the types of permanent habitat conversion that may accompany urban or rural development. Aquatic and terrestrial habitat loss and degradation from logging, road building, run-of-river hydropower, and linear developments present specific and cumulative threats. Populations of Rocky Mountain Tailed Frogs are patchy and occur at relatively low densities, putting populations at particular risk due to the limited potential for re-colonization after local extirpation.[10]

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Where possible, confirm suitable stream occupancy and protect key habitats (e.g., larval rearing, breeding, egg-laying, and over-wintering).
- ☑ Maintain structurally complex, closed-canopy forested habitat along headwater and occupied streams (minimum 30 m wide on both banks). Where possible, widen or add additional management zones to buffer the streamside reserve, and optimize the amount of available streamside habitat.
- ☑ Maintain networks of upland and riparian structurally complex, closed-canopy forest among and between occupied streams throughout the species range.
- ☑ In areas without specific Tailed Frog inventory, maintain water and substrate quality in suitable mid-gradient streams with coarse rocky substrates and natural step-pool channel structure.
- ☑ Maintain abundant coarse woody debris and ground complexity in harvested and otherwise disturbed riparian and upland forests adjacent to suitable streams.

9 Frogwatch 2013
10 Frogwatch 2013

5.1.2 Family *Pelobatidae* – Spadefoot Toads

Great Basin Spadefoot (Spea intermontana)

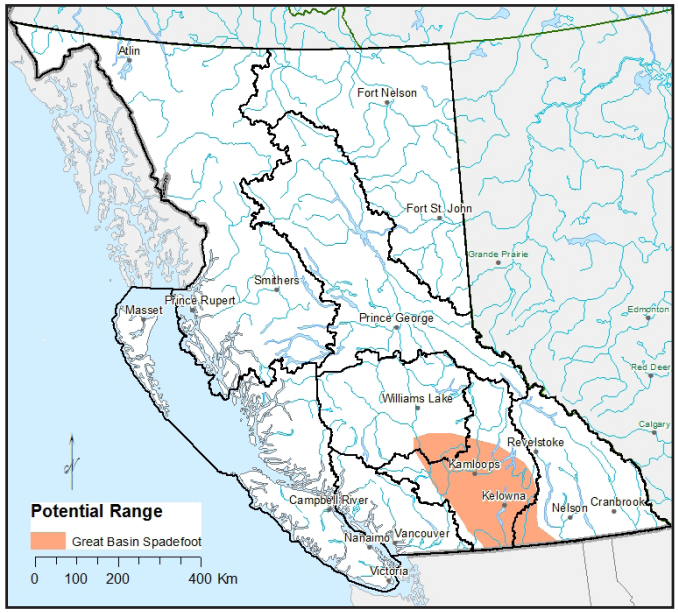


Photo:Kristiina Ovaska

Identification

- Body length 40–65 mm
- Squat body with relatively short and stubby limbs
- Eyes large, golden yellow, and set on the sides of the head; pupils vertical
- Ear drums small and subtle; no parotoid (poison) glands on cheek behind eyes
- Skin soft with small dark brown or reddish bumps
- Grey or olive green back; light-coloured stripes down the sides of the back, and underside pale
- Distinctive black "spade" on the first toe of each hind foot, used for digging

COSEWIC: Threatened
B.C. Status: Blue-listed

Great Basin Spadefoots can lose up to 48% of their body moisture without ill effect

Distribution

This species occurs in the intermontane region between the Rocky Mountains and the coastal ranges from eastern California and northern Arizona to southern British Columbia. In British Columbia, it is limited to relatively dry south-central areas.

Life History and Habitat Requirements

The Great Basin Spadefoot inhabits dry grasslands, shrub lands and open woodlands. It breeds in shallow ephemeral pools, ponds, irrigation ditches, sloughs, and shores of small lakes which retain water from breeding time to tadpole transformation (April to end of June, depending on location and conditions). Spadefoots require access to adjacent terrestrial foraging habitat with friable, crumbly soils that allow digging (often containing rodent burrows); these are used as day-time retreats and for escaping unfavourable dry or cold periods. They may spend up to 7–8 months of

the year in refuges. At night, Spadefoots actively forage on the surface, especially on wet nights. Adults and transformed juveniles feed on earthworms, ants, beetles, and grasshoppers. Tadpoles feed on algae, aquatic plants and occasionally on dead fish.

Breeding is stimulated by warm conditions and rainfall. Males gather at breeding sites and produce a characteristic advertisement call, which resembles loud snoring. Females lay up to 800 eggs in shallow water, often attached to sticks and pebbles in small clumps. The egg and larval development of Spadefoots is the most rapid of any North American frog. Hatching occurs after 2–3 days. Tadpoles metamorphose into juveniles in 3–8 weeks, depending on water temperature, and migrate from the wetlands to nearby terrestrial habitats (within about 500 m of breeding sites).[11] The young attain sexual maturity in two or more years. Reproduction may take place only during years with intense spring rains.

Compatibility with Human Landscapes

The Great Basin Spadefoot can co-exist with rural development, provided upland and breeding habitats are protected. It is unlikely they can co-exist with urban development. The dry grassland habitat is one of the rarest habitat types in B.C., making up only 6% of the province's land area. They are vulnerable to habitat loss and degradation caused by housing development, crop production and roadways.[12] Such developments contribute to changes in hydrology, pollution, trampling of breeding ponds, disruption of dispersal routes, and road-related mortality. Irrigating grasslands produces dense mats of grass and vegetation and destroys the crumbly soils that the frogs need for digging. Fish introductions at breeding sites in permanent water can also be problematic.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Preserve all natural grassland and woodland wetlands, ponds and pools (however small or ephemeral) within the Spadefoots' range.
- ☑ Where wetland complexes or series of ponds occur, attempt to secure larger blocks of land and avoid fragmenting the area by roads or infrastructure.
- ☑ Preserve terrestrial habitat around breeding sites (within 500 m) and avoid conversion of grassland into turf, which is unsuitable for Spadefoots.
- ☑ Avoid altering natural patterns of flooding and drying of wetlands or reducing water tables of known breeding sites (e.g., though irrigation, livestock use or human consumption). If seasonal water withdrawal is required, e.g., for irrigation or flood prevention, do so at a time when Spadefoots have completed their development to avoid stranding eggs or tadpoles.
- ☑ Feed and water livestock away at least 50 m from wetlands to avoid contamination of natural wetlands used by Spadefoots.

11 BC MOE 2008b
12 BC MOE 2008b

5.1.3 Family *Bufonidae* - True Toads

Western Toad (Anaxyrus boreas)

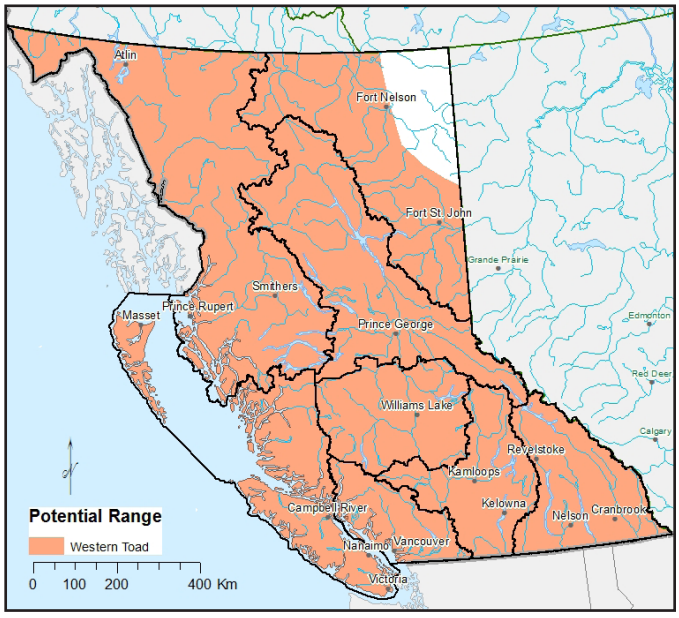


Photo: Trudy Chatwin

Identification

COSEWIC: Special concern
B.C. Status: Blue-listed

- Total body length 55–145 mm
- Range in colour from pale green to dark brown; cream-coloured belly mottled with black; may have a stripe down the back
- Prominent oblong parotoid gland (swelling) behind each eye
- Stocky body; short legs; crawl rather than hop
- Gold-flecked eyes with distinctive horizontal oval pupils
- Tadpoles: black or charcoal colour, with dark fin; often school

The 'warts' on the Western Toad are not warts at all, but glands that produce a bitter, sticky, white poison when the toad feels threatened.

Female Western Toads produce an average of 12,000 eggs, or as many as 16,500 eggs, in a single clutch! More than 99% of these will not survive to adulthood.

Distribution

The range of the Western Toad extends from southeast Alaska south to Baja California and from the West Coast to east of the Rocky Mountains. It is found throughout most of British Columbia, but is absent in the far northeast. It is the only amphibian native to Haida Gwaii.

Life History and Habitat Requirements

Western Toads are active from late winter to fall and require three different types of habitat: breeding wetlands, terrestrial summer range and winter hibernation sites. They breed in wetlands but wander great distances (2 km or more) through fields, forests, meadows, or shrubby thickets outside of the breeding season. This species travels extensively throughout terrestrial environments and prefers a mosaic of upland habitats, seeking moist depressions during dry periods. Preferred breeding sites include permanent or temporary water bodies such as ponds, the backwaters of

rivers and slow-moving streams, and the edges of lakes with sandy bottoms. Outside of the breeding season, they are nocturnal, spending the day concealed in rock crevices, under logs, or in burrows of other animals. As winter approaches, Western Toads retreat underground and into hibernation, typically from November through to April.

Western Toads feed on flying insects, ants, beetles, sowbugs, crayfish, spiders, centipedes, slugs, and earthworms. Tadpoles feed on aquatic plants, detritus and algae. Western Toad tadpoles are vulnerable to birds, snakes, newts, fish, and predaceous insect larvae and adults. When threatened adults may secrete a mild, white poison from parotoid glands on each side of the head and from larger "warts" on their back and sides.

Breeding is typically a little later than for other native amphibian species, occurring as early as March in some areas of southwestern B.C., but later at higher elevations and latitudes. Breeding aggregations may be large and "explosive" with breeding completed in as little as a week. Western Toads typically return to the same egg-laying locations within a breeding site each year. Males clasp females from behind and fertilize the eggs as the female deposits them into the water. Each female can deposit 12,000 or more small black eggs in long strings of jelly, tangled together or among sticks or vegetation in very shallow water (e.g., along shorelines or on floating vegetation mats). The eggs hatch in 3–10 days depending on water temperature. Tadpoles are highly active and form large schools, often congregating in warm, shallow, water. In 6–8 weeks (mid-summer to early autumn) transformation occurs and large concentrations of toadlets can be observed at pond edges, roaming the forest floor, and crossing roads to the terrestrial habitat. The migration patterns of toadlets leaving their natal ponds en masse for upland areas where they mature and overwinter are variable. The young reach sexual maturity in 2–3 years and may live 10 years or more.

Compatibility with Human Landscapes

The Western Toad appears to have low tolerance for rural and urban development. It can co-exist with rural development provided extensive terrestrial, riparian and wetland habitat connectivity is maintained. This species can make use of artificial water bodies for breeding (e.g., dugouts). It is sensitive to human development and the degradation, fragmentation and loss of wetland breeding habitats. The biggest threat from both rural and urban development comes from roads bisecting travel corridors. Toads often experience mass mortality while crossing roads during seasonal migrations in late summer and autumn. This species has declined significantly in recent years within southern portions of its range in the United States. Disease has been identified as a factor in the decline of some populations in those areas.

Guidelines for Conservation

- ☑ Preserve all known aquatic breeding sites, especially in south coastal areas where these sites are relatively rare (lakes, wetlands, ponds, and pools).
- ☑ Avoid fragmentation of riparian zones and adjacent wetlands and upland habitats which can destroy, isolate or extirpate local populations.
- ☑ Ensure adequate buffers to wetlands are applied to protect the broadest range of habitat features and functions for this species (minimum 30 m wide on both banks and an additional 100 m for connectivity and habitat management).
- ☑ Protect breeding sites and surrounding vegetation from trampling (e.g., livestock and ATVs) and other disturbances (e.g., people removing tadpoles or allowing dogs to run through egg masses and tadpoles).
- ☑ The migration patterns of toadlets leaving their natal ponds en masse for upland areas where they mature and overwinter are variable. Migrations should be monitored and roads closed where crossing culverts do not exist or are not being used. Road kill of migrating adults is also a concern.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

5.1.4 Family *Hylidae* - Tree frogs

Northern Pacific Treefrog (Pseudacris regilla)

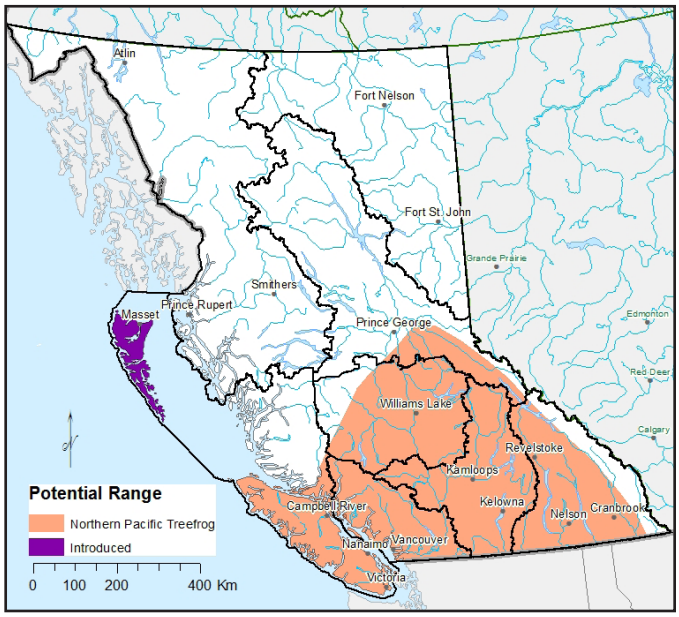


Photo:Trudy Chatwin

Identification

COSEWIC: Not listed
B.C. Status: Yellow-listed

- Northern Pacific Treefrog (family *Hylidae*) is a semi-terrestrial frog that climbs low vegetation to search for food
- Small frog; total length of 50 mm
- Range in colour from pale grey or tan to bronze or bright emerald green
- Dark “mask” or stripe extending from the nostrils through the eye as far as the shoulder

- Dark patches or stripes on the back; usually pale cream underneath
- Long, slender legs; distinctive round sticky toe pads; little webbing between the toes

Distribution

The Northern Pacific Treefrog can change colour rapidly from light to dark. These colour changes possibly occur in response to changes in temperature and humidity.

Northern Pacific Treefrogs are found across the southeastern third of British Columbia to southern Arizona, Baja California and Mexico, and from the Pacific Coast east to western Montana, Idaho and Nevada. They are not found east of the Rocky Mountains.

In British Columbia, they occupy Vancouver Island and the adjacent mainland possibly as far north as Prince George. They were introduced to Haida Gwaii and have become well established.

Northern Pacific Treefrogs are ventriloquists. It can be quite difficult to close in on a frog by following its call.

Life History and Habitat Requirements

Northern Pacific Treefrogs live in a variety of habitats. Outside the breeding season, Northern Pacific Treefrogs may be found up to 400 m from standing water.[13] Home ranges include upland, overwintering and aestivation sites, breeding ponds, and migratory corridors between these habitats. Suitable habitats include moist woodlands, meadows, pastures, and even urban areas where they are found in gardens. Breeding occurs in a variety of shallow wetlands, including wet meadows, forested swamps, ditches, marshes and even pools above the tide. Breeding sites typically contain abundant emergent and shoreline vegetation. The breeding wetlands are often seasonally wet, thereby avoiding predatory fish and Bullfrogs which require permanent water bodies. Pacific Treefrogs tend to be nocturnal and will seek moist, cool retreats for aestivation and for hibernation in the fall.[14] They can be difficult to find as they stop calling if they feel threatened.

Northern Pacific Treefrogs feed on a variety of spiders and insects. Tadpoles graze on algae and detritus. They are preyed on by Bullfrogs, and tadpoles are vulnerable to fish.[15]

Breeding occurs from February until June at low elevations and may not begin until June or July at higher elevations. The breeding period is prolonged and may last months. Loud choruses of males establishing territories mark the start of breeding season. Females lay from 400–1,000 eggs in several small, loose clusters attached to vegetation or sticks in quiet bodies of shallow water; each egg cluster contains 10–70 jelly-coated eggs. Embryos develop rapidly and hatch within two weeks to a month. Tadpoles transform into froglets after 2–3 months from June (at low elevations) to late August (at high elevations). They reach sexual maturity in about a year, and generally use the same breeding site from year to year.

13 AmphibiaWeb 2013
14 AmphibiaWeb 2013
15 Frogwatch 2013

Compatibility with Human Landscapes

Northern Pacific Treefrogs can co-exist with urban and rural development if threats are managed, and are common in many suburban/urban and rural settings. Threats to this species are loss and disturbance of ephemeral breeding habitats and surrounding upland areas caused by development (and associated roadways), contamination by pesticides and pollution, and introduced predators such as Bullfrogs and fish.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

☑ Avoid altering aquatic habitats by changing natural patterns of flooding and drying; temporary wetlands often have few predators and are important for this amphibian.

Boreal Chorus Frog (Pseudacris maculata)

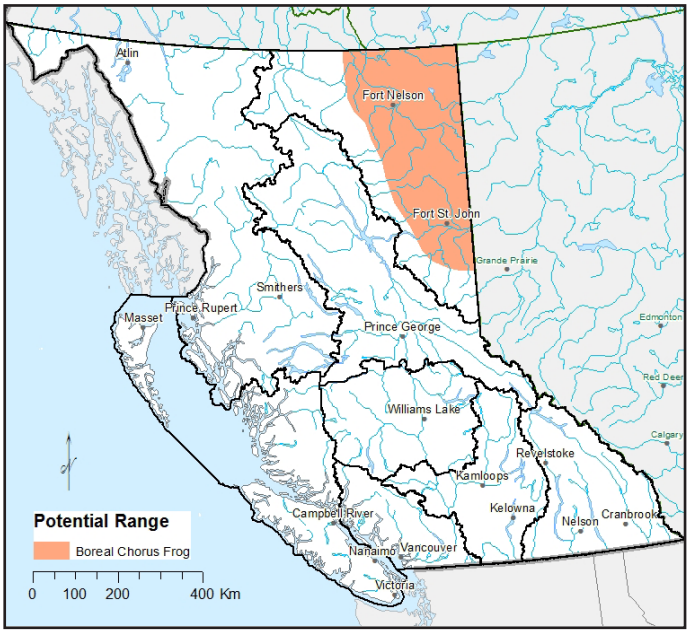


Photo: ©Jared Hobbs

Identification

- Smallest frog in B.C; total body length less than 40 mm
- Long body, relatively short legs; long straight toes with indistinct toe pads; webbing along the base of the toes
- Colour varies, may be grey, tan, brown, red, olive, or green
- Well-defined dark stripe along the side from tip of the nose through the eye to the groin
- Three dark-coloured, irregular stripes, often broken or blotched down the back
- Skin on the underside is granular and pale
- Sometimes marked with a few dark spots on the throat and chest

COSEWIC: Not listed
B.C. Status: Yellow-listed

- Males distinguished by swollen thumb pad developed in breeding season, and by greenish-yellow to dark olive throat and vocal sac
- Tadpoles: dark with gold flecks above; light with a metallic shine below; arched tail fin marked with small dark spots; grow to 30 mm in total length

The Boreal Chorus Frog (family *Hylidae*) is one of the earliest amphibians to arise from hibernation, before the snow and ice are melted

Distribution

Boreal Chorus Frogs range from east of the continental divide in the Yukon Territory across to Hudson Bay, and southwest through Wisconsin down to New Mexico. In British Columbia, this species is found in the lowland and montane areas around Fort St John and Fort Nelson.

Despite their tiny size, these frogs call so loudly that if you stand at the edge of a large chorus, your ears will ring.

Life History and Habitat Requirements

Boreal Chorus Frogs are active in spring and autumn, inhabiting damp grassy areas, meadows, or woods surrounding marshes. They are poor swimmers and climbers, and spend much of the summer underground or under leafy litter or woody debris.[16] They hibernate in relatively dry sites. During the breeding season they are widespread and may be found almost anywhere there is shallow, standing water. Tadpoles are often found among emergent vegetation.

Adult Boreal Chorus Frogs feed on ants, spiders, flies, beetles, aphids, snails, millipedes, caterpillars, mites, and springtails; tadpoles feed on algae.

In British Columbia, the breeding season begins in May and may continue through June. Males emerge from hibernation and begin to call day and night from among mats of dead grass, or partially frozen and snow covered ponds. Breeding pairs join together to fertilize and deposit eggs. Females produce 150–1,500 eggs which are laid in small clumps of 30–75 and are attached to submerged plants.[17] Tadpoles transform in about two months. Juveniles reach maturity the following year, and it is possible that individuals live no more than 1–2 years in the wild.

Compatibility with Human Landscapes

The Boreal Chorus Frog can co-exist with urban and rural development although much of this species' distribution in British Columbia is in remote areas, resulting in little human disturbance.

Local populations may be at risk from human activities that alter habitats, but little is known about the natural history of populations in B.C.[18]

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Guidelines for Conservation

☑ Preserve the integrity, abundance and connectivity of ephemeral wetlands and associated riparian habitats (e.g., damp grassy areas, meadows, and woods surrounding marshes).

16 Matsuda et al. 2006
17 Frogwatch 2013
18 Frogwatch 2013

5.1.5 Family *Ranidae* - True, Semi-aquatic, Web-footed Frogs

Northern Red-legged Frog (Rana aurora)

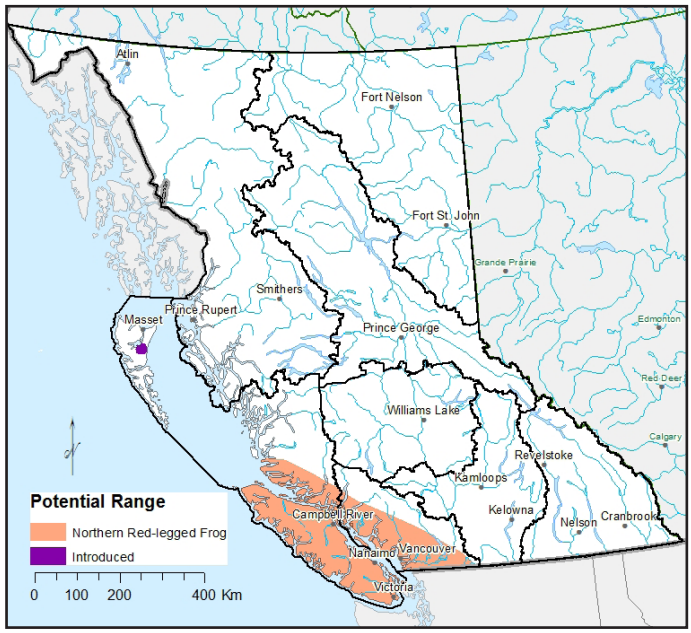


Photo: Trudy Chatwin

Identification

- The Northern Red-legged Frog is a true frog (family *Ranidae*) with a semi-terrestrial lifestyle
- Total length 70–100 mm
- Medium sized brown or reddish; smooth skin marked by small black “freckles”
- Slim with long, slender hind legs; prominent dorsolateral folds run from the eyes down the sides of back
- Dark mask; light upper jaw stripe running back to shoulder
- Most distinctive trait is red colouring of underside of hind legs; skin has translucent quality
- Eyes are gold; oriented to the sides; appear mostly covered by eyelids when viewed from above
- Hind foot webbing does not extend to toe tips
- Have a distinct posture on land—they sit straight up
- Hard to tell Red-legged and Spotted frogs apart; orientation of eyes on the head, toe webbing and geographic location are all required for identification

COSEWIC: Special Concern
B.C. Status: Blue-listed

Distribution

The Northern Red-legged Frog is found in southwestern British Columbia, extending south through western Washington and Oregon to northern California. In British Columbia it ranges throughout Vancouver Island, on several of the Gulf Islands, and on the adjacent mainland east through the Fraser Valley to Hope. This species was introduced on Graham Island, Haida Gwaii.

Northern Red-legged Frogs can scoot through forest litter faster than a person can follow them. They make long, low hops and go under the fallen branches that trip their pursuers.

Life History and Habitat Requirements

The Red-legged Frog is a forest-dwelling species that breeds early in shallow, temporary or permanent wetlands or in pools within slow-moving streams, particularly ones with marshy shorelines and emergent/submergent vegetation. They will often take shelter under logs or other debris to stay cool and damp. Outside the breeding season, adults and juveniles are highly terrestrial and can sometimes be found far from water in forest habitats. Frogs may hibernate in water or on land.

Adult Northern Red-legged Frogs feed on insects and other small invertebrates, which they hunt along the edges of streams and ponds, and in more terrestrial environments. Tadpoles graze on algae.[19]

The breeding begins shortly after emergence from hibernation, as early as January or February and ends in just a few weeks. Males are highly vocal during the short breeding season but call under water, so are seldom heard. The female lays a large number of eggs (750–1,300) in large, loose, gelatinous masses that are typically weakly attached to emergent vegetation. The tadpoles metamorphose into terrestrial juveniles during the summer of the same year. The juveniles require 3–4 years to reach sexual maturity.

Compatibility with Human Landscapes

The Red-legged Frog can co-exist with rural developments provided sufficient upland habitat, wetland vegetation and water quality are maintained, and introduced species are controlled. It is unlikely they can co-exist with urban development. In some low-density residential areas the species coexists with humans and uses backyard ponds. However, these frogs require extensive terrestrial, forest habitat for foraging, as well as suitable aquatic breeding sites. They are susceptible to road mortality during breeding migrations and juvenile dispersal, as well as disease, pollution, habitat loss and fragmentation from development and logging. They are also very sensitive to the presence of predatory fish and Bullfrogs in their breeding habitat.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Guidelines for Conservation

- ☑ Maintain networks of upland and riparian dispersal habitat among and between occupied ponds throughout the species range.
- ☑ Preserve moist, forested areas with course woody logs, bark and other cover features.

19 Frogwatch 2013

Columbia Spotted Frog (Rana luteiventris)

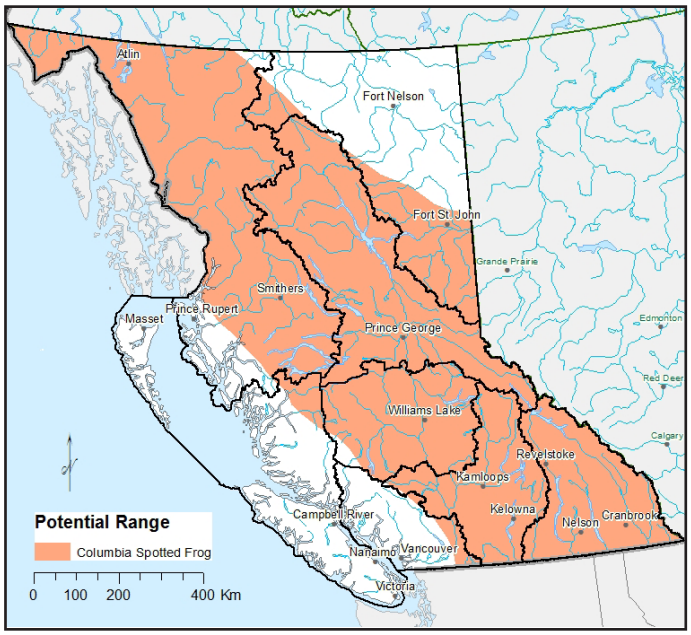


Photo: Kristiina Ovaska

Identification

COSEWIC: Not at risk
B.C. Status: Yellow-listed

- The Columbia Spotted Frog is a true frog (family *Ranidae*) with a highly aquatic lifestyle
- Total length up to 100 mm
- Green, brown or reddish-brown; juveniles are brown or olive green
- Undersides are cream-coloured with mottled reddish or salmon-coloured pigmentation on the lower abdomen and hind-legs; can also be yellow in some populations
- Irregular black spots, usually light-centred, on head, back, sides and legs
- Two dorsolateral folds run from frog's head partway along the back
- Eyes are angled slightly upwards
- Webbing on feet extends to ends of toes
- Tadpoles are dark brownish-green, with gold flecks above and iridescent yellow to bronze below; broad-finned tail is often twice the length of body; usually reach 80 mm in length before maturing to adults
- Hard to tell Red-legged and Spotted frogs apart; orientation of eyes on the head, toe webbing and geographic location are all required for identification

The main visible difference between Oregon and Columbia Spotted Frogs is the amount of mottling on the belly – leave it to the biologists to tell them apart!

Distribution

The range of the Columbia Spotted Frog extends between the Rocky Mountains and the Coast Mountains from the Alaskan Panhandle south to northwestern Wyoming, with some small disjunct populations further south. This species occurs throughout much of British Columbia but is absent from the far reaches of the northeast, islands

off of the coast (including Haida Gwaii and Vancouver Island), and southwestern coastal areas. This species was distinguished from the Oregon Spotted Frog (*Rana pretiosa*) in 1997.

Because the Columbia Spotted Frog lacks an amplifying vocal sac, male mating calls are so weak they only carry 15–30 metres. If Northern Pacific Treefrog were calling simultaneously, the calls of the Columbia Spotted Frog would be lost in the shuffle.

Life History and Habitat Requirements

Columbia Spotted Frogs can complete their entire life cycle in or near permanent springs, ponds, marshes, lakes, or sluggish rivers or streams, but will also migrate seasonally using different water bodies for breeding, summer feeding and overwintering.[20] Aquatic habitats are most often associated with non-woody wetland plant communities consisting of sedges, rushes and grasses. Highly oxygenated water that does not freeze to the bottom is necessary for survival in winter where they burry themselves in the muddy bottom. Columbia Spotted Frogs are tolerant of relatively low water temperatures and occur at high elevations, up to the tree line. These frogs occasionally leave water bodies to forage in meadows or damp woods during rainy periods; usually they feed in or at the edge of the water, primarily during the day,

Columbia Spotted Frogs eat a variety of land and aquatic insects, snails, crustaceans and spiders. Larvae feed on algae and organic debris. They are vulnerable to predation by fish and Bullfrogs.

Breeding occurs early in the spring, usually before the ice has fully disappeared from the surface of breeding ponds and lasts only a couple of weeks. Females usually lay their partially submerged eggs in communal egg masses in the same locations each year. The clutch size is from 700–1,500 eggs. Breeding and subsequent development of tadpoles takes place in shallow water at vegetated edges of wetlands and lakes, often in areas subject to seasonal flooding. Tadpoles usually transform sometime during their first summer of development but may overwinter as tadpoles in the north. Male frogs reach maturity in 2–4 years, females in their fifth or sixth year. Columbia Spotted Frog may live 10 years or more.[21]

Compatibility with Human Landscapes

Columbia Spotted Frogs can co-exist with rural development provided that water hydrology, water quality and wetland conditions are maintained, and introduced species (Bullfrogs and fish) are controlled. Beavers may be important in creating breeding habitat for this species, thus beaver removal may be detrimental. Due to their low reproductive potential, this species may be sensitive to disturbances resulting from habitat loss and degradation.[22]

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Guidelines for Conservation

☑ Maintain breeding habitat by leaving beavers and their dams in place.

20 Frogwatch 2013
21 Frogwatch 2013
22 Frogwatch 2013

Oregon Spotted Frog (Rana pretiosa)

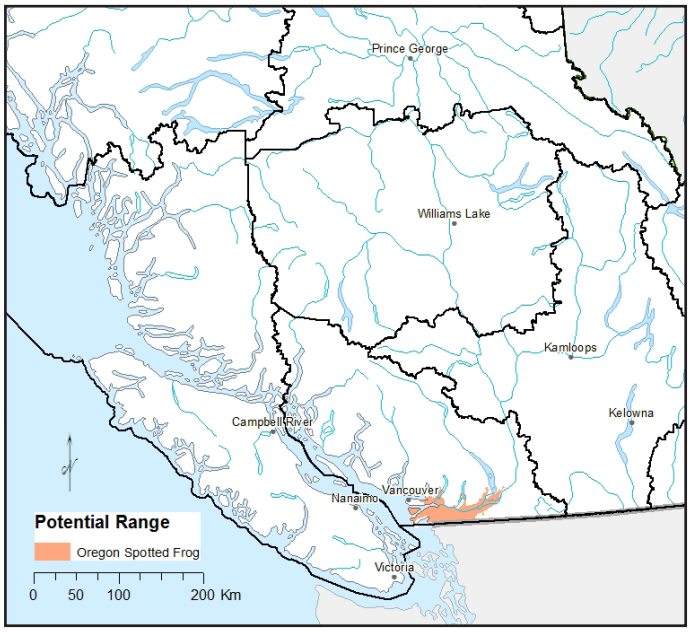


Photo: ©Jared Hobbs

Identification

COSEWIC: Endangered
B.C. Status: Red-listed

- The Oregon Spotted Frog is a true frog (family *Ranidae*) with a highly aquatic lifestyle
- Total length of 50-100 mm
- Green, brown or reddish brown; juveniles are brown or olive green
- Light-centred black spots on the head and back
- Two dorsolateral folds appear as stripes part way along the back
- Eyes are oriented upward on the head
- Feet are fully webbed to end of toes
- Have a distinct posture on land—they crouch to the ground
- Hard to tell Red-legged and Spotted frogs apart; orientation of eyes on the head, toe webbing and geographic location are all required for identification

The Oregon Spotted Frog has received an "emergency listing" as an endangered species in Canada.

Distribution

The Oregon Spotted Frog is limited to the extreme southwestern corner of mainland British Columbia, and south to the northeast corner of California.[23] In British Columbia, this species is found only in the Fraser River Lowlands and its habitat consists of four wetland sites that are isolated from one another. The Oregon Spotted Frog was identified as a separate species from the more widely distributed Columbia Spotted Frog in 1997, and it was thought that it had been extirpated from British Columbia. Globally, populations of this species have been lost in over 90% of its historic range.

23 BC MOE 2012b

Life History and Habitat Requirements

Oregon Spotted Frogs are highly aquatic. They move between ponds with connecting waterways and leave water only for very short periods when foraging.[24] They occupy floodplain wetlands, side channels and sloughs with emergent vegetation, bordered by upland forest. This species appears to require large marshlands (> 4 ha) that warm up in the summer. During the winter months adults move several hundred metres from breeding and summer habitats to springs, seeps, or low-flow channels to bury themselves in silty substrates or clumps at the base of vegetation.[25] Oregon Spotted Frogs are often difficult to find because they move to the pond bottom if disturbed.[26]

Adult Oregon Spotted Frogs feed on beetles, flies, spiders, and water striders; tadpoles feed on algae, decaying plant matter and detritus. Predators include Bullfrogs, Green Frogs, garter snakes, and various birds and mammals. Tadpoles and eggs are also eaten by fish, Roughskin Newts and larval Northwestern Salamanders.

The Oregon Spotted Frog breeds in early spring (February to March) in shallow, sparsely vegetated, areas of permanent wetlands. Breeding season usually lasts less than one month. In spring, male frogs may be seen in breeding ponds calling females during the day. Females lay one clutch of about 600–1,000 eggs annually. Masses of 10–75 eggs are deposited communally and typically in the same location each year.[27] Eggs hatch in 18–30 days, and tadpoles transform in about four months. Tadpoles and adults live in well-vegetated areas with rushes, sedges and mucky substrates that provide cover. Maturity is reached in two years or more. The lifespan of Oregon Spotted Frogs is unknown, but is probably not more than 4–5 years.[28]

Compatibility with Human Landscapes

It is unlikely the Oregon Spotted Frog can co-exist with urban and rural development. Habitat loss as a result of land developments, agricultural land conversion, resource extraction and hydrological alternations is likely the cause of decline in their historical range.[29] With only four remaining Canadian breeding populations and less than 350 estimated breeding individuals, continued habitat fragmentation and isolation, coupled with pollution, introduced Bullfrogs, predatory fish, and Reed Canarygrass, have the potential to cause extirpations of these remaining populations.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Preserve all floodplains, connecting waterways and surrounding riparian habitats within this species' known range and the surrounding 3 km, where land is below 260 m in elevation.
- ☑ Preserve watersheds and isolated patches of suitable habitat within 400 m of identified habitats.

24 Frogwatch 2013
25 BC MOE 2012b
26 Frogwatch 2013
27 BC MOE 2012b
28 Frogwatch 2013
29 BC MOE 2012b

Wood Frog (Lithobates sylvatica)

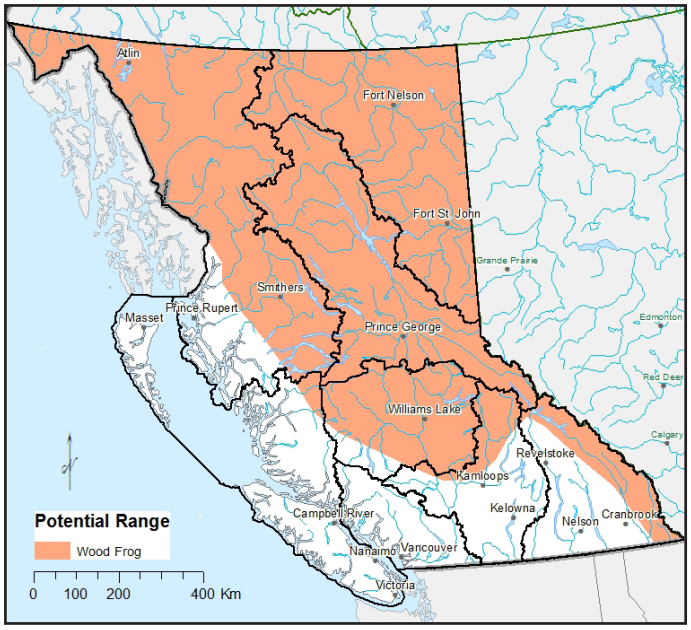


Photo: Purnima Govindarajulu

Identification

- The Wood Frog is a true frog (family *Ranidae*) with a highly terrestrial lifestyle
- Total body length 20–60 mm
- Broad dark mask-like band passing through the eye from snout to shoulder
- White lip line; moustache-like
- Variable in colour light tan, grey, deep brown, blue-green, or distinctly red
- Often have dark spots or mottling on back and side; some have a single prominent white stripe down the middle of the back
- Two broad light-coloured stripes may also be present on the back
- White bellies with some dark mottling at the sides and on the throat
- Prominent dorsolateral ridges that run down the back
- Males have a dark, swollen thumb during the breeding season and two throat pouches that inflate when they call
- Tadpoles: short, round body; arched tail fin that begins high on the back; uniformly dark with gold flecks in lines around mouth; belly may be dark with silver sheen, or cream coloured with pinkish iridescence; grow to 5 cm in length

COSEWIC: Not listed
B.C. Status: Yellow-listed

Distribution

You may often hear male Wood Frogs calling early in the spring. Don't be fooled! If you hear "quacking" but can't see any birds, you are probably listening to a Wood Frog chorus.

The Wood Frog is widespread in Canada and the United States, and extends north past the Arctic Circle. In Canada, it ranges from the Maritime Provinces across Quebec, Ontario and the prairies to the Yukon. It is found across northern British Columbia, east to the Coast Mountains, south through the interior, and along the Rocky Mountains to the B.C./Alberta/USA border.

Life History and Habitat Requirements

Wood Frogs are supercool! They are the only North American amphibian that occurs north of the Arctic Circle. They have an incredible ability to survive freezing winter temperatures, and in spring, warm up and hop away!

The Wood Frog occupies a wide variety of habitats. Adults and juveniles are relatively terrestrial and common in forest, wet meadows, riparian areas, open fields, brushy areas, and muskeg. They may wander widely in terrestrial habitat and can be found far from water. They hibernate on land, underneath the forest litter and **humus** in root channels, or burrows made by other animals. They are cold tolerant (sometimes called the "freezing frogs") and can withstand temperatures down to –6°C. Breeding occurs in water bodies that vary considerably in size, substrate and plant associations, ranging from seasonal pools, shallow ponds, marshy lake edges, to flooded meadows and quiet stretches of streams. The species' home range is unknown.

Wood Frogs feed on insects, worms, snails, millipedes, molluscs, and other small invertebrates. Tadpoles feed on algae and other plant material.[30]

Breeding begins early in the spring, usually well before all ice has melted. The breeding period is very short, from a few weeks in the southern parts of its range to only a few days in the north. Males congregate in shallow clear ponds and will call day and night. Mating pairs join together to fertilize and deposit the eggs. Once the eggs have been laid, adults quickly disappear into the surrounding forest. The globular egg masses are attached to submerged sticks and plants, or are floating. Each clutch may contain as many as 2,000–3,000 eggs. Eggs hatch in 4–7 days. Tadpoles usually live in the shallowest, warmest parts of wetlands. They grow quickly even at comparatively low temperatures and are able to transform in 45–80 days after eggs are laid, usually by mid-summer. Males mature one year after metamorphosis, while females attain maturity in about two years. Wood frogs seldom live more than 3–4 years.

Compatibility with Human Landscapes

The Wood Frog can co-exist with rural development provided measures to maintain sufficient quality and quantity of wetland, upland and forested habitats are taken. However, it is unlikely they can co-exist with urban development. Wood Frogs are vulnerable to land development projects that cause direct loss, alteration, and fragmentation of their habitats. A study in Connecticut found that Wood Frogs were absent from areas with less than 30% forest cover across the landscape. Other risk factors include pollution, disease, and predatory fish and vertebrates; however, their impact is not well understood.

30 Frogwatch 2013

Guidelines for Conservation

- ☑ Maintain moist forested and upland habitats between occupied ponds or streams throughout the species range.
- ☑ Maintain important habitat features (e.g., small mammal burrows, woody debris, humus in root channels).
- ☑ Avoid logging activities that change the microclimate and structure of aquatic and terrestrial habitats (e.g., temperature and moisture control, abundance of moist woody debris and canopy cover).
- ☑ Avoid use of fire to control vegetation as this causes mortality, loss of vegetative cover and increased predation exposure.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Northern Leopard Frog (Lithobates pipiens)

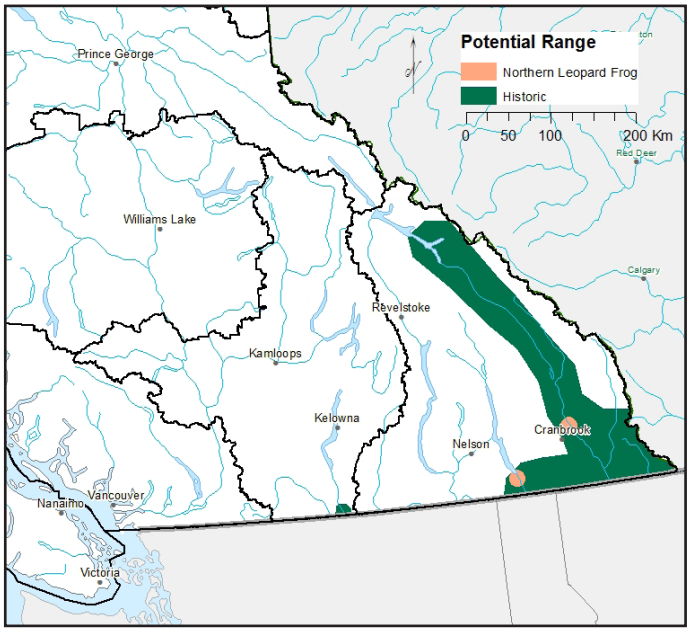


Photo: Barb Houston

Identification

- The Northern Leopard Frog is a true frog (family *Ranidae*) with a semi-terrestrial lifestyle
- Total length 75–110 mm
- Green or brown frog with distinctive dark haloed spots; number and colour of spots is variable
- Large hind legs with dark bars, pale underparts
- Prominent dorsolateral ridges run the length of body
- White stripe runs along upper jaw and back to shoulder
- Tadpoles: dark brown or grey; light blotches on underside; tail is pale tan

COSEWIC: Endangered
B.C. Status: Red-listed

Distribution

The Northern Leopard Frog has one of the broadest distributions of any North American frog. In Canada, populations exist from southeastern British Columbia east to the Maritimes, while in the United States, the species ranges south to California and New Mexico and east to South Carolina. The range of this species has been significantly reduced in Alberta, and is declining in Saskatchewan, Manitoba and in the western United States.

The species name "pipiens" means "peeping" in Latin. When Northern Leopard Frogs were first collected and studied, the people collecting them heard peeping cries and named the frogs accordingly. The peeping was probably a Spring Peeper, not a Northern Leopard Frog at all.

In British Columbia, this species was once common in the eastern Kootenays, Creston Valley and South Okanagan. It now consists of one native population in the Creston Valley Wildlife Management Area and a reintroduced population in Bummers Flats in the Upper Kootenay River Ecological Drainage Unit.[31] British Columbia populations are disjunct from prairie populations.

Life History and Habitat Requirements

The Northern Leopard Frog lives in and around permanent and temporary wet meadows and riparian areas having abundant vegetation for cover. Breeding habitat is highly variable, although open areas and shallow, permanent water with abundant littoral vegetation are favoured. They hibernate from October to March in shallow muddy depressions at the bottom of ponds that do not freeze solid in winter;[32] however they may also make use of underground burrows and caves.[33] This species is most active during the day, feeding on land and in water. These distinct seasonal habitats are typically less than 2 km apart and are returned to year after year.[34]

The Northern Leopard Frog feeds on beetles, ants, flies, leafhoppers, pillbugs, worms, snails, and slugs, as well as other amphibians, small snakes and birds. They are prey for several snake species, turtles, fish, larger frogs, and some birds. Tadpoles mostly graze on algae.

Breeding begins in early spring with males migrating to breeding ponds often before the ice has fully melted. Mating is completed within a 2–7 day period. Eggs are deposited in flattened, round clusters about 115 mm in diameter, and usually attached to emergent vegetation or sticks in warm, shallow, water (less than 50 cm deep).[35] Females can lay up to 5,000 eggs, and egg masses are often laid close together. Hatchlings emerge within a week or two and are often found amongst littoral vegetation. Tadpoles transform within 60–90 days, and juveniles take 2–3 years to reach sexual maturity. Northern Leopard Frogs have a lifespan of about four years in the wild, and have been known to live nine years in captivity.[36]

31 BC MOE 2012a
32 Frogwatch 2013
33 BC MOE 2012a
34 BC MOE 2012a
35 BC MOE 2012a
36 Frogwatch 2013

Compatibility with Human Landscapes

It is unlikely the Northern Leopard Frog can co-exist with urban and rural development. Although the cause of the severe declines of this species is unknown, it was likely habitat destruction resulting from wetland draining and reclamation. More recently declines are best explained by the introduction of chytrid fungus which has been causing significant mortality in B.C. populations.[37] Other threats to the Northern Leopard Frog include natural systems modification, human disturbance, agriculture, energy production, pollution, and habitat fragmentation which disrupts dispersal corridors. The B.C. populations of Northern Leopard Frog are vulnerable to extirpation and their recovery is limited by small population sizes, low yearly egg mass production, low disease resistance, and low genetic variation.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Prevent introductions of fungal disease pathogens (e.g., *Chytrid* fungus) through the movement of infected habitat material (e.g., water, mud, soil) between wetlands; use disinfection protocols between sites. (See the *Interim Hygiene Protocols for Amphibian Field Staff and Researchers*.)
- ☑ Protect shallow water foraging areas and emergent vegetation from trampling and other disturbances (e.g., recreation, livestock, maintenance of water control devices).

37 BC MOE 2012a

5.1.6 Non-native Frog Species

Green Frog (Lithobates clamitans)

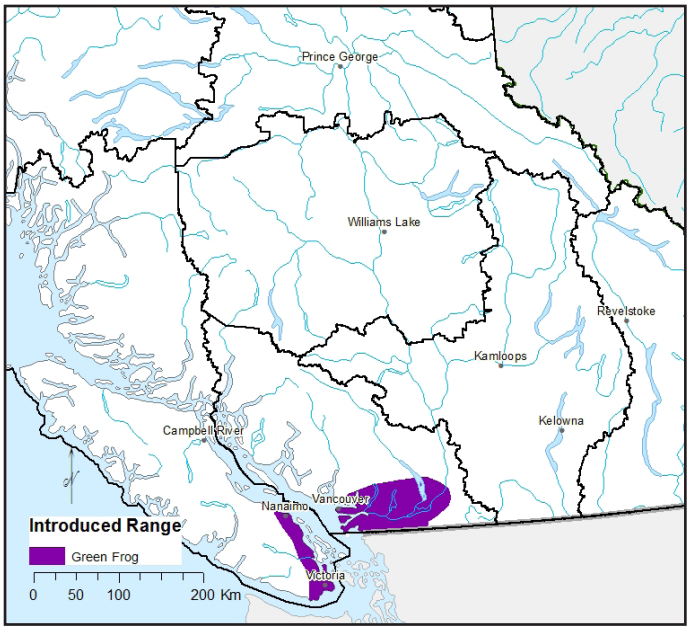


Photo: Purnima Govindarajulu

COSEWIC: Not assessed
B.C. Status: Exotic

Identification

- The Green Frog is a highly aquatic true frog (family *Ranidae*) and is not native to British Columbia
- Total length up to 100 mm; larger than most native frog species in B.C.
- Green or bronze in colour
- Distinct dorsolateral fold from the head down the sides of the frog's back
- Large tympanum ("ear") behind each eye
- Males have a yellow throat; very bright during breeding season
- Tadpoles have long, oval bodies with pointed snouts; olive green with vague dark blotches; cream coloured belly
- Green Frogs have loud, distinctive calls that sound like a stretched rubber band being plucked

The species name "clamitans" means "clamouring" in Latin – in other words, this is the loud-mouthed frog! Green Frogs are called Banjo Frogs in some parts of their range, because of their loud plunking call.

Distribution

The Green Frog is native to eastern North America east of the Great Plains from Ontario, Quebec and the Maritimes, and south through much of the eastern half of the United States to the Gulf of Mexico. In British Columbia this introduced species has become established on southern Vancouver Island and in the Lower Mainland.

Life History and Habitat Requirements

The Green Frog is highly aquatic and seldom strays from permanent standing water, although juveniles apparently disperse into adjacent woods and fields during rainy weather. Individuals are often found along banks of ditches and ponds during the day. In their native range this species lives in a variety of aquatic habitats including lakes, ponds, swamps, and stream margins with abundant vegetation. Adult Green Frogs remain active in cool weather, but will hibernate in winter conditions by burrowing into the mud at the bottoms of ponds.[38]

Green Frogs feed primarily on aquatic insects but will also prey on small fish and frogs. Their tadpoles graze on algae and detritus.

Breeding takes place in permanent water in late spring or early summer and after most native frog species have completed their breeding season. Males are territorial, defending good egg-laying habitats and calling loudly to attract females to their location.[39] Each female lays 1,000–5,000 eggs in a large, loose mass (less than 30 cm in diameter) floating among aquatic vegetation at the water's surface. Embryonic development is rapid and tadpoles may begin emerging from egg capsules in less than a week. Tadpoles transform in late summer or may overwinter in the breeding pond.[40] Juveniles mature in 2–3 years. Their lifespan in the wild is unknown, but Green Frogs in captivity have lived up to 10 years.[41]

Compatibility with Human Landscapes

Green Frogs readily co-exist with urban and rural development. It is unclear how much of a threat Green Frogs pose to native amphibians, but issues with Bullfrogs and other non-native aquatic species such as fish suggest that further introductions and the spread of this species should be prevented. They do compete with native frogs for food and habitat and may cause extirpations of native populations. Green Frogs have been implicated as a factor in the decline of Red-legged Frogs in British Columbia.

See **Section 5.7** for Guidelines to Prevent the Introduction and Spread of Non-native Species.

38 Frogwatch 2013
39 Frogwatch 2013
40 Frogwatch 2013
41 Frogwatch 2013

Bullfrog (Lithobates catesbeianus)

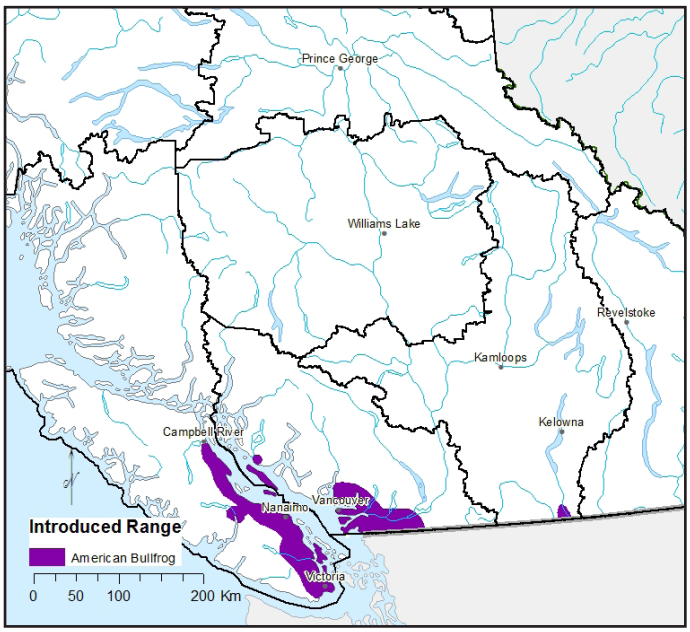


Photo:Westwind Photos

COSEWIC: Not assessed
B.C. Status: Exotic

Identification

- The Bullfrog is a highly aquatic true frog (family *Ranidae*) and is not native to British Columbia
- Total length up to 200 mm (not including legs); 750 g in weight
- Large, robust, green or brown in colour with large golden eyes; no dorsolateral fold
- Large, distinct tympanum ("ear") just behind and below the eye; male's tympanum is roughly twice the size of the eye; female's tympanum about the same size as the eye
- Males have yellow throats, often quite bright; females have paler cream or white throats
- Often seen floating just beneath the water's surface with only eyes and green snout visible
- Call is a deep "bwaa, bwaa" and can carry up to a kilometre
- May hear juvenile frogs leaping into water with loud splashes and "eep!" cries
- Tadpoles are quite large; total length up to 150 mm ; very dark green, almost black, arrowhead-shaped body; dorsal fin that begins behind the body

Distribution

The Bullfrog is native to eastern and the mid-western United States and Canada but is now well-established west of the Rockies in many locations. In British Columbia this introduced frog has become established in the southern Okanagan Valley, southern Vancouver Island to Campbell River, some of the Gulf Islands, and the Lower Mainland.

Life History and Habitat Requirements

Bullfrogs are highly aquatic inhabiting low-altitude, permanent wetlands of variable depth, with population densities greatest in shallow, quiet water bodies with abundant shoreline and emergent vegetation. Although they prefer weedy, heavily vegetated ponds and lakes, they are also found in smaller, muddy-bottomed ponds and ditches. Bullfrogs are active day and night, and only leave the water, and vegetated banks during warm, rainy periods. Occasionally juveniles and adults travel short distances on land, adults in the spring to new ponds; juveniles in the fall after metamorphosis. Depending on regional climates, adult Bullfrogs may hibernate at the bottom of breeding ponds in colder regions or just reduce their activity in milder ones.[42]

Adult Bullfrogs can turn the tables on snakes – garter snakes (which usually prey on frogs) have been found in Bullfrog stomachs, and injured snakes are sometimes found near Bullfrog ponds.

Bullfrogs are voracious and feed on almost anything they can fit in their mouth including insects, fish, amphibians, reptiles, small mammals, and birds. Bullfrog tadpoles feed on algae and detritus competing for food and habitat used by native frog tadpoles. There is evidence that Bullfrog colonization of lakes cause declines in native Red-legged Frog and Northern Pacific Treefrog populations.[43]

Bullfrogs can leap as far as two metres, or ten times their body length! Bullfrogs defend their territory with a special call, and if that doesn't work, by kicking, pushing and wrestling.

Breeding takes place in warm water over much of the summer and later than most native frog species.[44] This species is known for their deep resonating breeding call used to attract females as they defend prime egg-laying sites. Females deposit masses of up to 20,000 eggs (more than 30 cm in diameter) in a film that floats at the surface then later sinks to underlying vegetation. Eggs typically hatch in 4–5 days and, tadpoles overwinter in the breeding ponds transforming toward the end of their second or third summer. They reach maturity in two or more years. Bullfrogs may live up to 10 years in the wild, but mortality is very heavy in the first few years.[45]

Compatibility with Human Landscapes

Bullfrogs readily co-exist with urban and rural development. This species has been implicated in the declines and local extinctions of native frogs and turtles, including the Oregon Spotted Frog, Red-legged Frog, Northern Leopard Frog, and Western Pond Turtle. Urban and rural development needs to be managed in such a way that further introductions and spread of Bullfrogs are avoided. Maintenance and creation of wetlands that favour native amphibian species over Bullfrogs should be encouraged (i.e. more temporary wetlands rather than permanent ones). By moving or releasing tadpoles of frogs, people have contributed to the spread of Bullfrogs to the detriment of native frogs. Eradication measures for Bullfrogs are limited, so prevention of introductions and further spread are the only effective means of controlling this species.

See **Section 5.7** for Guidelines to Prevent the Introduction and Spread of Non-native Species.

42 Frogwatch 2013
43 Frogwatch 2013
44 Frogwatch 2013
45 Frogwatch 2013

5.2 Salamanders

5.2.1 Family *Plethodontidae* – Lungless, Terrestrial Salamanders

Ensatina (Ensatina eschscholtzii)

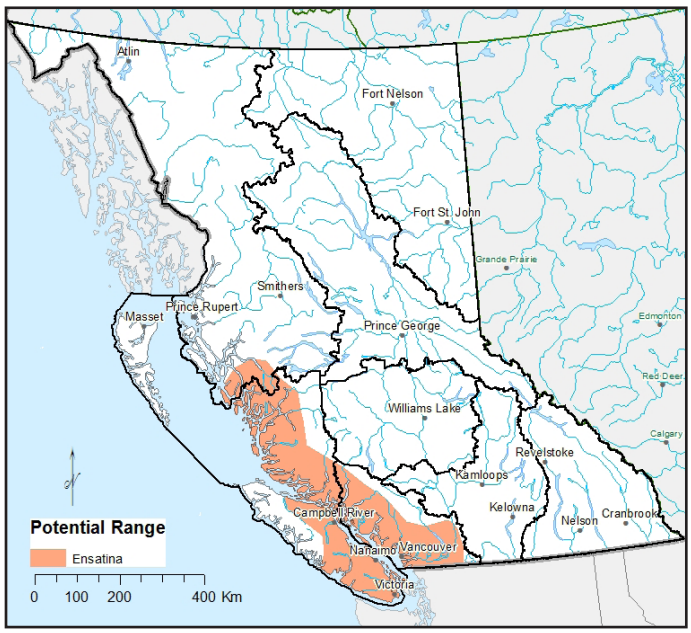


Photo: Kristiina Ovaska

COSEWIC: Not at Risk
B.C. Status: Yellow-listed

Identification

- Ensatinas are entirely terrestrial, lungless salamanders (family *Plethodontidae*) that breathe through their moist thin skin and the linings of their mouths
- Adults reach a total length of 70–120 mm
- Brown to pinkish tan colour; often have yellowish tones on the base of the limbs and feet
- Large, prominent brown eyes
- Snout is rounded and has distinctive grooves that run from the nostrils down to the top lip of the mouth (naso-labial grooves)
- Distinguished from other salamanders by a noticeable constriction at the base of the tail. This feature is difficult to see in very small individuals
- Hatchlings are dark purple, juveniles resemble adults; both can have variable light and dark flecking on their sides

Distribution

Ensatinas are found along the coast from British Columbia to Baja California in Mexico. Several distinct subspecies and colour variations occur in the United States. In British Columbia, they occur on the mainland coast and the southern and eastern sections of Vancouver Island.

Life History and Habitat Requirements

Ensatinas are completely terrestrial and dependent on cool, moist, forest environments such as downed logs and sloughed-off bark at bases of snags and stumps. They may also make use of coarse woody and leafy debris, rocks and rodent burrows. They are inactive and stay underground during cold or hot and dry periods. They emerge and are most active in the fall with the onset of the rainy season and when temperatures are moderate.[46] Ensatinas have small home ranges from a few metres to a few dozen metres in diameter.[47] They are nocturnal, secretive and seldom seen.

The constriction at the base of the tail causes the tail to detach when it is grabbed by predators. Ensatina are capable of regenerating lost limbs, as well as other body parts

Ensatina are a predatory species whose diet includes invertebrates such as spiders, mites, beetles, crickets, centipedes, millipedes, termites, earthworms and snails. For protection, this salamander secretes a noxious milky white substance from the tail that repels potential predators.[48]

Ensatinas breed mainly in fall and spring, but may also breed throughout the winter. Females do not breed every year. Typically in April or May, females retreat to their summer site under bark, in rotting logs or underground where they lay 3–25 eggs.[49] Females attend their eggs until hatching takes place several months later, in the fall or early winter. The young resemble adults with a smaller but similar body form, having fully developed in the egg. Ensatinas have no free-living larvae. They reach sexual maturity at 3–4 years, and can live up to 15 years in the wild.[50] They are unique among vertebrates, since they are capable of regenerating lost limbs as well as other body parts.

Compatibility with Human Landscapes

The Ensatina can co-exist with rural development, provided there are abundant downed logs, loose bark and other moist coarse woody debris available in the habitat. However, it is unlikely Ensatinas can co-exist with urban development. It can tolerate somewhat drier conditions than other Plethodontid salamanders in the province, which might facilitate its persistence in forest edge habitats. It also does not have a dependency on wetlands or water bodies that change seasonally and that can be impacted by development. Ensatinas move mostly at night so crossing busy highways can result in high mortality.[51]

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Preserve moist, forested areas with a variety of habitat landscapes. Developments should include a forested buffer with course woody logs, bark and other features.
- ☑ Avoid removing downed wood and bark (especially large diameter pieces) in various stages of decay as these provide shelter and egg-laying sites.

46 NatureServe 2012
47 AmphibiaWeb 2013
48 Nature Mapping Foundation 2013
49 CaliforniaHerps 2013
50 Matsuda et al, 2006
51 AmphibiaWeb, 2013

- ☑ Provide forest corridors between suitable habitats.
- ☑ Avoid handling Ensatinas; they breathe through their pores and improper handling can cause undue stress and/or loss of tail. (See the *Interim Hygiene Protocols for Amphibian Field Staff and Researchers*.)

Western Red-backed Salamander (Plethodon vehiculum)

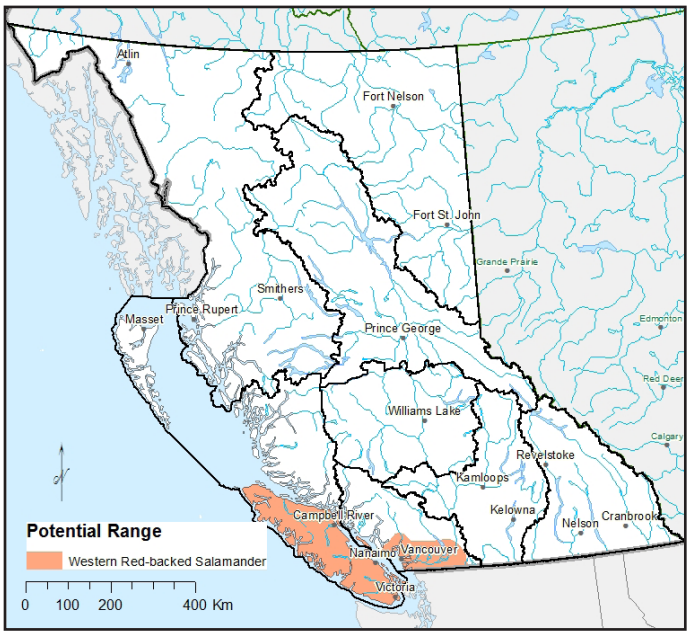


Photo: Kristiina Ovaska

COSEWIC: Not at risk
B.C. Status: Yellow-listed

Identification

- Western Red-backed Salamanders are entirely terrestrial, lungless salamanders (family *Plethodontidae*) that breathe through their moist thin skin and the linings of their mouths
- Adults reach a total length of 115 mm
- Slender body; short legs
- Distinguished from other salamanders by the typically dark brown or black body and broad even-edged yellow, orange or olive stripe extending down its back to the tail
- Some coastal area individuals lack a distinguishable stripe
- Black or dark grey sides with white flecking on the underside
- Long head with a rounded snout and eyes well forward on the head
- Hatchlings: very small, slender and insect like in appearance; reach 20 mm in total length

Distribution

Western Red-backed Salamanders are found along the coast from British Columbia southward to western Washington and Oregon in the United States. In British Columbia, they occur on Vancouver Island and the Lower Mainland from the coast to Hope. The northern limits of its distribution along the coastal mainland are poorly known.

Too much water such as in floods can cause stress for Red-backed Salamanders. These salamanders can swim but can drown due to lack of oxygen if they cannot escape.

Life History and Habitat Requirements

Western Red-backed Salamander is completely terrestrial and dependent on moist habitats found in old-growth, or young unmanaged, coniferous and mixed-wood forests. They require moist forest floor conditions and abundant cover for shelter and foraging. Cover includes coarse woody debris and a well-developed litter layer. Individuals typically confine their activities to a small home range on the forest floor. They have little need for streams or ponds but can occasionally be found in riparian areas.[52] During the day they shelter under cover, but on calm wet nights they are active on the forest floor. During the winter, Western Red-backed Salamanders move deep into the talus.[53]

The diet of Western Red-backed Salamanders consists of small invertebrates including annelids, isopods, snails, spiders, mites, millipedes, centipedes, as well as other insects and ants.[54]

Breeding begins in late summer and goes into the fall. Females lay small grape-like clusters of 8–20 eggs in damp, secluded locations. They are yellowish-cream, 4–5 mm in diameter and are attached to the nesting chamber by a gel-like substance. Eggs are best identified by the presence of the female, who is often curled around the eggs until hatching takes place in late summer or early fall. The young resemble miniature adults and reach sexual maturity at 2–3 years. There is no aquatic larval stage. Females reproduce every second or third year. Western Red-backed Salamanders can live 10 or more years.[55]

Compatibility with Human Landscapes

The Western Red-backed Salamander can co-exist with rural development where sufficient moist forest habitat, coarse woody debris and a well-developed litter layer is available. They do not fare well in clear cuts or open sunny areas so it is unlikely they can co-exist with urban development. Populations can persist within urban parks; however, these salamanders are unlikely to occupy small city parks.

52 Matsuda et al, 2006
53 AmphibiaWeb 2012
54 AmphibiaWeb 2012
55 Matsuda et al 2006

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Preserve moist, forested areas with a variety of habitat landscapes. Developments should include a forested buffer with course woody logs, bark and other features.
- ☑ Avoid removing downed wood and bark (especially large diameter pieces) in various stages of decay as these provide shelter and egg-laying sites.
- ☑ Avoid activities that result in the drying of the forest floor such as clear cutting that opens their forest floor habitat to sun exposure.

Coeur d'Alene Salamander (Plethodon idahoensis)

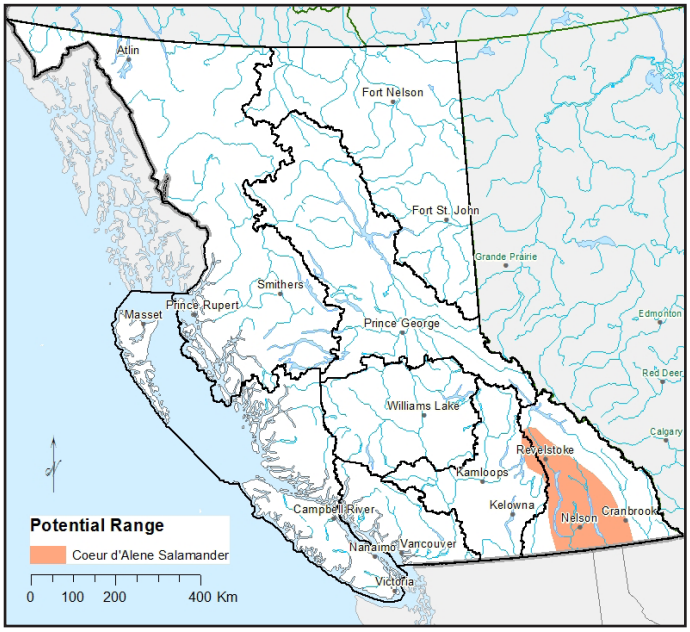


Photo: Kristiina Ovaska

COSEWIC: Special Concern
B.C. Status: Yellow-listed

Identification

- Coeur d'Alene are entirely terrestrial, lungless salamanders (family *Plethodontidae*) that breathe through their moist thin skin and the linings of their mouths
- Adults reach a total length of 100–120 mms
- Distinguished from other salamanders by their long slim black body, distinctive yellow throat and wide stripe with scalloped edges down its back
- Stripe can be yellow, orange, green, or red
- Distinctive grooves that run from the nostrils down to the top lip of the mouth (naso-labial grooves)
- Long head with a rounded snout and bulbous, frog-like eyes
- Long legs and short, slightly webbed toes
- Hatchlings are similar in appearance to adults and reach 35 mm in length

Distribution

The Coeur d'Alene Salamander is found in southeastern British Columbia and extends south to the Idaho panhandle and northern Montana, where the species occurs at scattered sites. A closely related species, Van Dyke's Salamander (*Plethodon vandykei*) occurs in parts of western Washington. Until recently the two were considered the same species. The Coeur d'Alene Salamander is the only representative of the lungless salamanders in the southern interior of British Columbia. Scattered populations occur from the Washington border to about 95 km north of Revelstoke, and from approximately 50 km west of Castlegar to Cranbrook.

Life History and Habitat Requirements

The Coeur d'Alene is completely terrestrial and although it does not breed in water, it is among the most aquatic of western Plethodontid salamanders. It is restricted to very moist habitats by seepages, waterfall splash zones, and wet riparian areas. Populations also occur in caves and mineshafts. In British Columbia, this salamander's habitat is generally in steep terrain where access is difficult. These salamanders do not travel far, living in their chosen locations all year round.[56] They require discrete rocky microhabitats, in addition to a source of moisture. They take shelter in rock crevices during dry summer and cold periods (less than 4°C), hibernating during the winter months. They only come to the surface on moist nights in spring and fall and spend about seven months of the year without coming to the surface at all.[57] They are rarely seen.

The Coeur d'Alene eats mostly aquatic and semi-aquatic insects, flies and their larvae.[58] Spiders and snails are also consumed.[59]

The Long-Toed Salamander is the only salamander species that co-exists with the Coeur d'Alene Salamander. As they are both nocturnal and feed at night, it is possible that these are two competing species.[60]

Breeding occurs in early spring or fall. The female stores sperm for up to nine months before she lays a small clutch of 4–12 eggs in April or May. Egg clusters are placed in moist, secluded locations such as in rock fissures or underground crevices, where the female guards them until they hatch at the end of summer. Hatchlings fully develop in the egg resembling miniature adults upon release. There is no larval stage. Coeur d'Alene Salamanders reach maturity in 3–5 years. Females reproduce every second or third year.

56 Frogwatch 2013
57 Frogwatch 2013
58 Matsuda et al 2006
59 SARA Registry 2012
60 SARA Registry 2012

Compatibility with Human Landscapes

The talus and steep slopes often frequented by the Coeur d'Alene Salamander likely afford it some protection from human disturbance. Highway construction and maintenance activities (such as road widening, rock scaling, and herbicide application), logging and any activities that remove shade and modify groundwater levels or rock formations within salamander habitats have been identified as threats to populations in British Columbia. Consequently, it is unlikely that this species can co-exist with urban and rural development.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Preserve seepages, riparian splash zones, caves, talus, and other moist rocky sites.
- ☑ Avoid blasting, road-building and other development activities in talus areas, especially near streams. If work must be done in these areas, conduct pre-work salamander surveys and if any are found, undertake the work during dry summer weather or in winter when the salamanders take shelter in rock refuges.
- ☑ Prevent sedimentation of interstitial spaces.
- ☑ Avoid trampling of stream edges as these salamanders often hide under flat stones.
- ☑ Avoid forest removal, water diversion or alterations to groundwater flow which can destroy their habitat by reducing humidity in subterranean retreats.

Wandering Salamander (Aneides vagrans)

Photo: Kristiina Ovaska

COSEWIC: Not assessed
B.C. Status: Blue-listed

Identification

- Total length (including tail) up to 130 mm
- Body relatively robust with large head, wide at the jaw, and large protuberant eyes
- Limbs and digits relatively long and the toes are characteristically square-tipped rather than rounded
- Mottled grey and black back. Often with a bronze tinge, and whitish to brownish underside with white flecking

Distribution

In British Columbia, the Wandering Salamander is found on Vancouver Island. It also occurs in northern California but is absent from Washington and Oregon. A closely related species, the Clouded Salamander (*Aneides ferreus*), occurs in southern Oregon. Until 1998, the two were regarded as the same species.

Life History and Habitat Requirements

The Wandering Salamander is a completely terrestrial salamander that lacks an aquatic larval stage. They lack lungs and rely on their moist skin for respiration. As a result, they are very susceptible to dehydration and require moist forested habitats for survival. They require abundant, moderately-decayed coarse woody debris for shelter and are commonly found under loose bark or cracks in downed logs on the forest floor. They can also be found under beach logs, or in burrows of other animals, and can climb large trees to shelter in moss mats or bark crevices.[61] They are

61 AmhibiaWeb 2013

nocturnal and most active during wet weather. Their diet consists of ants, springtails, mites, and other arthropods.[62]

In late spring or early summer females lay grape-like clusters of 3–28 eggs in moist, sheltered locations within decaying wood, and attend them for several months until they hatch. Eggs are suspended from the roof of the nesting chamber by long, gelatinous strands that often twist together. Development is direct, and the young resemble miniature adults. The young take at least three years to reach sexual maturity. Females do not breed every year.[63]

Compatibility with Human Landscapes

The Wandering Salamander can co-exist with urban and rural development, provided that forest habitat with abundant, downed logs with loose bark and other moist course woody debris are available. Large-diameter pieces of logs or woodpiles that remain moist and undisturbed are thought to be necessary for nesting. These salamanders sometimes get transported with firewood to urban areas, where they can persist and reproduce. An urban population of this species occurs in a residential area of Victoria, but the long-term viability of urban populations is unknown. Wandering Salamanders have been found to occupy forested parks within urban areas.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Preserve remnant old growth and maturing forest stands whenever possible. Even relatively small patches may support populations, provided that moist forest floor conditions and abundant coarse woody debris are available.
- ☑ Retain snags and downed wood and bark in various stages of decay, including large diameter logs which provide essential shelter and egg-laying sites for salamanders.
- ☑ Avoid intense management of forests (short rotation cycles) which lead to drier forest floor conditions and depletion of large woody debris over time.

62 Matsuda et al 2006
63 Matsuda et al 2006

5.2.2 Family *Ambystomatidae* – Mole (burrowing), Semi-aquatic Salamanders

Northwestern Salamander (Ambystoma gracile)

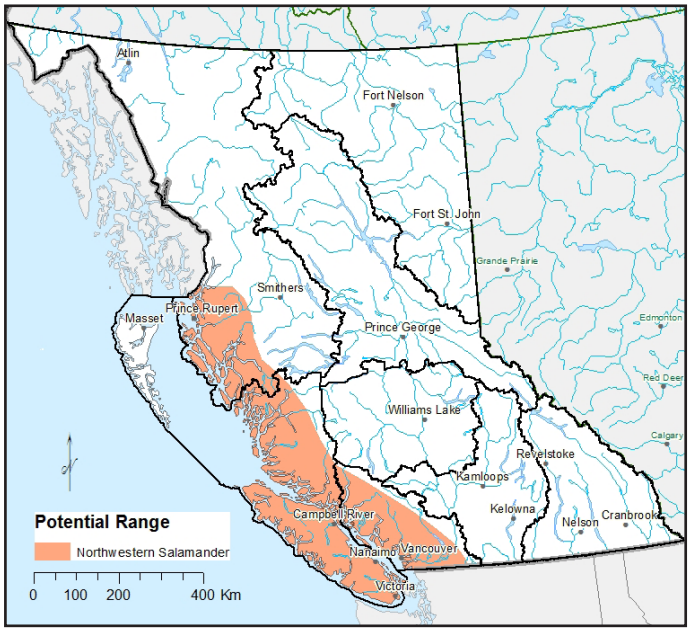


Photo: Kristiina Ovaska

Identification

COSEWIC: Not at risk
B.C. Status: Yellow-listed

- Northwestern Salamanders are semi-aquatic (family *Ambystomatidae*), dependent on forest and permanent water bodies for their survival
- Large, robust salamander reaching a total length of 250 mm
- Solid dark brown with light-coloured mottling and a tail with dark spots
- The underside of the body is usually white, cream or gold in colour
- Large, dark, protruding eyes
- Prominent poison gland on each cheek, behind the eye; folds along the sides and tail ridge also contain poison glands
- Broad, vertically flattened tail and large hind feet used for swimming and burrowing
- 10–12 prominent costal grooves (furrows that resemble ribs along the side of the body) between the front and rear legs
- Aquatic larvae are olive brown with large dark spots, they have a broad snout and large head with feathery gills, and a glandular ridge on the tail
- Juveniles resemble adults
- Large firm globular egg masses (~10 cm in diameter) containing individual jelly-coated eggs sets this species' eggs apart from those of other species

Some salamanders have a **neotenic** life stage where they become sexually mature without metamorphosing; thus, they still have gills and can be quite large.

Distribution

The Northwestern Salamander ranges from British Columbia, north to southeast Alaska and south to northwest California. In British Columbia, this species occurs on Vancouver Island and all along the mainland coast, north to the Alaskan border. On the Lower Mainland the range extends east to Hope.

Life History and Habitat Requirements

The Northwestern Salamander occurs in a variety of forested terrestrial habitats, primarily older forests and in and around ponds and wetlands. They require abundant cool, moist refuges on the forest floor and shelter in underground burrows or beneath decaying logs and other coarse woody debris. They remain aquatic throughout their life, also inhabiting permanent ponds and lakes that do not freeze solid in winter. Northwestern Salamanders breed in permanent or semi-permanent ponds, lakes, or pools in slow streams and ditches, and migrate seasonally to and from these breeding sites. Outside of the breeding season, these nocturnal salamanders are rarely seen, except perhaps during fall rains. Northwestern Salamanders are generally inactive in winter, seeking refuge underground.

The Northwestern Salamander is one of the few native amphibians able to survive in areas where predatory fish and Bullfrog populations have become established. This is likely due to the poisons they secrete which is strong enough to kill some small predators such as snakes and shrews, but can only cause mild skin irritation in people.

All life stages of Northwestern Salamanders are carnivorous. Juveniles and adults eat tadpoles and a wide variety of terrestrial invertebrates, including insects, spiders, worms, flies, and slugs. Larvae feed on invertebrates and tiny aquatic plankton. Larval and adult salamanders are vulnerable to predation by some fish, mammals, birds, and reptiles. If disturbed, these salamanders exhibit special defensive postures and behaviours.[64]

Northwestern Salamanders breed February through August in permanent or semi-permanent ponds, streams or pools. In early spring, females attach a clutch of 60–140 eggs around underwater plant stalks, sometimes near the bottom of the pool. Symbiotic green algae often develop in a jelly layer around the eggs, giving the egg masses a greenish tint. The eggs develop slowly compared to other amphibians and may take several months to hatch depending on water temperatures. Larvae over-winter at the breeding sites transforming into their terrestrial form over one or more seasons. Larvae can often be seen year round at these breeding sites. In some habitats, particularly at high elevations, they may reach sexual maturity while retaining larval characteristics. Transformed juveniles spend at least one year in terrestrial habitat before returning to the water to breed. They live at least five years.

Compatibility with Human Landscapes

The Northwestern Salamander can co-exist with rural development provided there are woodlots or forests near permanent or semi-permanent ponds which are required for breeding. Ponds, lakes or streams must be accessible from the terrestrial forest habitat. Due to these requirements, it is unlikely they can co-exist with urban development. Northwestern Salamanders can breed in drainage ditches and artificial ponds; however, the young may not survive due to agricultural run-off

64 Frogwatch 2013

of pesticides and other contaminants, or the water being drained before young fully develop. Aquatic stages are sensitive to the presence of predatory fish and although populations can persist in lakes with fish, densities are typically reduced.

Guidelines for Conservation

- ☑ Preserve all wetlands, ponds, pools, and streams —however small.
- ☑ Avoid draining or altering watercourses and wetlands used for breeding or altering natural patterns of flooding and drying of wetlands.
- ☑ Maintain sufficient terrestrial habitat next to breeding access to enable amphibians to complete all life history phases.
- ☑ Avoid removing downed wood and bark in various stages of decay.
- ☑ Prevent contamination of habitats from agricultural and industrial runoff, and the introduction of fish.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Long-toed Salamander (Ambystoma macrodactylum)

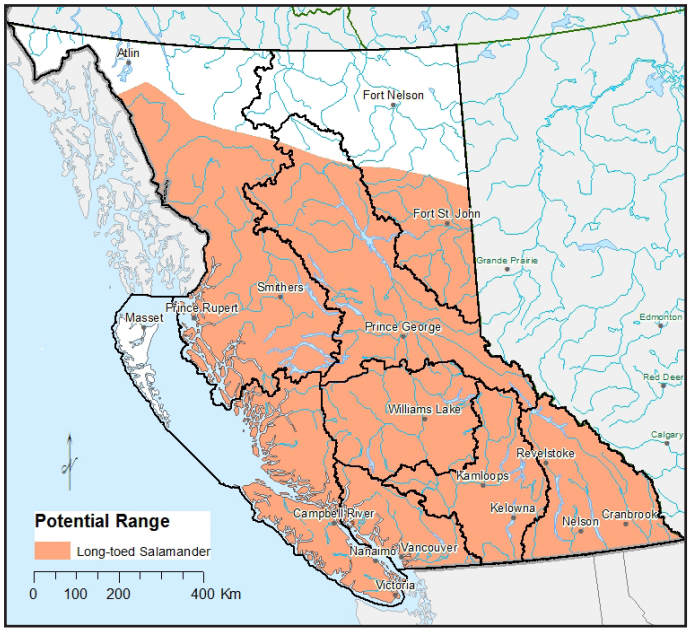


Photo: Kristiina Ovaska

Identification

COSEWIC: Not at risk
B.C. Status: Yellow-listed

- Long-toed Salamanders are semi-aquatic (family *Ambystomatidae*), found in and around ponds, wetlands and surrounding forest
- Reach 165 mm in length
- Named for the long fourth toe on each hind foot
- Dark grey to black skin flecked with golden speckles; yellow to green stripe with irregular edges along the mid-back and tail, often broken into blotches
- Tail is keeled rather than rounded

- Large oval head with bulbous eyes and a blunt snout
- Twelve costal grooves on each side of the body
- Aquatic larvae are brownish grey or tan with dark flecking; head large with broad snout; large feathery gills on both sides of the head
- Larvae metamorphose at less than 35 mm snout to vent length

Distribution

The smooth skin appears wet—most salamanders produce a mucous-like secretion that keeps them from drying out on land, and acts as a 'wetsuit' underwater to control the amount of water soaking through the skin.

The Long-toed Salamander ranges from British Columbia north to southern Alaska, south to northern California, and east to the Rocky Mountains of western Alberta, Idaho and western Montana. In British Columbia it is widely distributed and is found in all Regions, but is absent from much of the far northern part of the province.

Life History and Habitat Requirements

Many species in the Mole Salamander family have sticky poison secretions. In some species, this gluey substance can be as strong as rubber cement. It is used to stick predators to the ground for up to 40 minutes while the salamander makes a getaway.

Long-toed Salamanders occupy a variety of habitats, including forest, grassland, and disturbed areas. They often occur in moist, forest edge habitats and require abundant cover, such as coarse woody debris, abandoned rodent burrows or rock piles. This secretive salamander overwinters underground, although they are not good at digging. They can be spotted in April and May spending much of their time in hiding along pond edges. They breed in pools and ponds with abundant aquatic vegetation. Long-toed Salamanders are mostly nocturnal hunters, foraging in forest or meadows. When threatened, this salamander secretes a distasteful poison from glands on its back and tail. They may lose their tail to help escape from predators.[65]

The Long-toed Salamander's diet includes insects, tadpoles, worms, beetles, and small fish. Their larvae eat insects, aquatic plankton and other amphibian larvae.

Long-toed Salamanders breed early in the spring. The male deposits a little "packet" of sperm for the female to pick up with her cloaca. Shortly after breeding, females lay their eggs singly or in clusters of 10–30 eggs, often attached to aquatic plants or sticks at pond edges. At lower elevations and in the southern part of the province the larvae transform into terrestrial juveniles the same year. At high elevations and in the north larvae may not transform until the next year, after overwintering in the breeding ponds. Northern populations may have neotenic individuals that never leave water. Juveniles can often be seen leaving breeding ponds for burrowing sites, in late summer or fall. They reach sexual maturity 2–5 years later and may live for 6–10 years.[66]

Compatibility with Human Landscapes

The Long-toed Salamander can co-exist with urban and rural development provided there is temporary or permanent water available, abundant woody debris along the shore and in terrestrial areas, and non-native species are controlled. They have been occasionally reported from basements or cellars in residential areas where these

65 Frogwatch 2013
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features act as traps and the salamanders die. Open basement steps or open pits on industrial sites are especially bad. These salamanders are flexible in their habitat requirements, and can use a variety of pools and ponds for breeding, including recently disturbed areas. The Long-toed Salamanders will hide under pieces of board and plywood on disturbed sites, and may die when boards are removed. Abundant emergent vegetation in breeding ponds and cover along pond edges facilitate the species' existence in disturbed areas.

Guidelines for Conservation

- ☑ Preserve all wetlands, ponds, pools, and streams—however small or ephemeral.
- ☑ Maintain sufficient terrestrial habitat or access to terrestrial habitat for amphibians to complete all life history phases.
- ☑ Avoid removal or alteration of coarse woody debris, abandoned rodent burrows or rock piles, in forests, grasslands and pond edges.
- ☑ Do not leave boards or open pits on industrial or construction sites.
- ☑ Prevent introductions of fish to breeding ponds, especially for higher-elevation year round aquatic populations.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Retain downed logs and wetted areas

Photo: Judith Cullington

Blotched Tiger Salamander (Ambystoma mavortium)

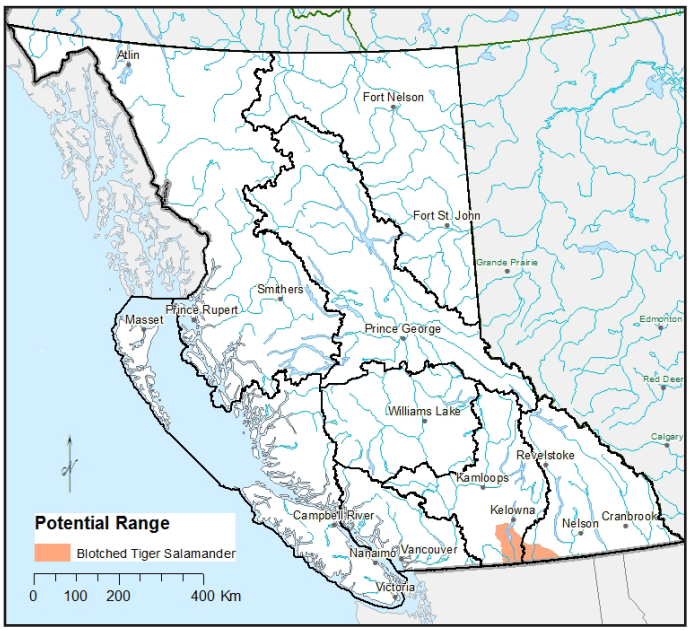

Photo: ©Jared Hobbs

COSEWIC: Endangered
B.C. Status: Red-listed

Identification

- Blotched Tiger Salamanders are semi-aquatic salamanders (family *Ambystomatidae*), dependent on grassland or shrub-steppe and permanent water bodies for their survival
- Large, powerful salamanders that grow up to 327 mm, but most are 140–180 mm in length
- One of the largest land-dwelling salamanders in the world
- Golden yellow or olive green in colour; black or dark grey stripes or blotches cover their skin making a tiger-like pattern
- Eyes small and widely spaced on the sides of the head
- Thirteen rib-like grooves down each side of the body
- Two small rounded projections (tubercles) on the bottom of each foot help in digging burrows
- Aquatic hatchlings are silvery-grey with large tail fins and long, feathery gills; they reach 80 mm in length

When there are lots of larvae but little food in the pond, some salamander larvae can become cannibal morphs.

Distribution

The Blotched Tiger Salamander is widespread in North America. Its distribution includes northern Mexico, central, mid-western, and eastern United States, and parts of southern Canada. Several subspecies are recognized within this wide range; one (*A. tigrinum melanostictum*) occurs in British Columbia. The range of the British Columbia population is contiguous with the range of populations in northeastern Washington, but is disjunct from other Canadian populations in southern Alberta, Saskatchewan and Manitoba. In British Columbia it is restricted to a small part of the arid, southern interior in the South Okanagan, lower Similkameen and Kettle drainages.

Life History and Habitat Requirements

Blotched Tiger Salamanders are burrowing, semi-aquatic salamanders that breathe and drink through their thin, permeable skin. They occupy bunchgrass and Ponderosa Pine habitats, and are tolerant of dry, desert-like conditions. Blotched Tiger Salamanders are secretive burrowers that are rarely seen, spending much of their time underground. They are only active at night and forage on the surface during or after rains in spring through autumn. The Blotched Tiger Salamander is a predator which feeds on beetles, earthworms, snails, frogs, and mice. Larvae and neotenic salamanders consume small crustaceans, insect larvae, small fish, and the larvae of other salamanders.

In early spring Blotched Tiger Salamanders migrate to permanent or semi-permanent aquatic breeding sites including lakes, farm ponds and reservoirs. They are able to tolerate alkaline conditions that are unsuitable for most other amphibians. The male lays down a packet of sperm for the female to fertilize her eggs. Females lay up to 5,000 eggs either singly or in small clusters and attach them to aquatic plants, stones or debris in shallow water. The gill-breathing larvae may transform to lung breathing terrestrial adults the year they hatch or may delay transformation until the following year. In some permanent water bodies, larvae may attain sexual maturity without transformation (called “neoteny”) and remain in the water. Transformed juveniles leave their aquatic habitat at night during wet weather. These salamanders may live 20 or more years, but likely live no more than 5–6 years in the wild.[67]

Compatibility with Human Landscapes

The Blotched Tiger Salamander can co-exist with rural developments provided breeding sites and terrestrial habitats can be adequately protected from human disturbance. However, it is unlikely they can co-exist with urban development. Urban development, wetland infilling and road building near breeding ponds threaten the survival of this species. Because of their scattered distribution and reliance on upland habitats within an otherwise hostile, dry environment, potential conflicts with human activities are intensified. Eggs and larvae can be eaten by introduced predatory fish, and adult salamanders are sensitive to trampling of their burrows and road mortality.

Guidelines for Conservation

- ☑ Maintain sufficient terrestrial habitat near breeding ponds for amphibians to complete all life history phases.
- ☑ Use buffer zones around wetlands to exclude cattle and prevent trampling of vegetation.
- ☑ Maintain important habitat features (e.g., small mammal burrows, riparian and emergent vegetation, and non-compacted soils).
- ☑ Ensure breeding sites do not experience water extraction to the point that reproduction is impaired (e.g., from irrigation intake lines).

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

67 Frogwatch 2013

5.2.3 Family *Dicamptodontidae* – Highly Aquatic Salamanders

Pacific Giant Salamander (Dicamptodon tenebrosus)

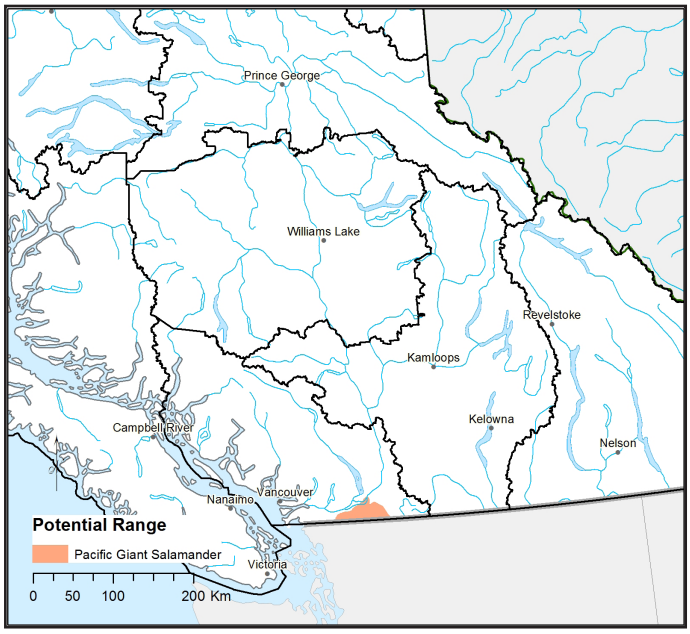

Photo: Brent Matsuda

COSEWIC: Threatened
B.C. Status: Red-listed

Identification

- The Pacific Giant Salamander is the largest semi-aquatic salamander (family Dicamptodontidae) in North America
- Total length 150–250 mm, some reach up to 340 mm
- Stout body with tan, gold or grey mottling on top of a dark brown, reddish-brown or grey background; some individuals lack the mottling and may appear black
- Twelve distinct costal grooves on each side of the body, underbelly is light brown or off-white
- Broad head with a blunt snout
- Dark hardened toe tips used for digging and climbing
- Aquatic larvae are dark brown or grey (some with similar mottling as adults); short, bushy, purplish-red gills and a tail fin that extends to hind limbs

Pacific Giant Salamanders are one of the only salamanders capable of vocalization: when this salamander feels threatened, it has been known to produce a low-pitched growl or bark!

Distribution

The majority of the Pacific Giant Salamander's range is in the United States, where its distribution extends south through Washington and Oregon to northwestern California. In British Columbia, this species is restricted to the Chilliwack River Valley and adjacent small drainages within the South Coast Region.

Life History and Habitat Requirements

The Pacific Giant Salamander occupies cool, clear, well-oxygenated streams and moist, forested, narrow (about 50 m) riparian zones associated with these streams.

They may also occur in lakes and rivers that do not contain salmon or trout). Terrestrial adults are nocturnal, secretive and rarely encountered. They are active from spring through fall spending much of their time in underground burrows or under woody debris. They come above ground primarily on warm rainy nights and are dormant in winter. Aquatic (neotenes) Pacific Giant Salamanders can be found in streams year round. Larvae and neotenes inhabit small to medium-sized, cool, clear, fast-flowing streams that contain pools and cover in the form of boulders, logs and overhanging banks. Larvae may also occur in ponds and lakes that do not contain fish.

Adults feed on insects, slugs, snails, worms, shrews, mice, and amphibians. Larval salamanders eat aquatic organisms such as caddisflies, mayflies, stoneflies, beetles, worms, snails, small fish, and other larval amphibians.[68] Adults demonstrate aggressive behaviour when being attacked by predators, or when being territorial. They may bite, lash their tail, or exude noxious skin secretions from the top of their tail.

Little is known about the mating behaviour of the Pacific Giant Salamander. British Columbia populations are believed to breed sometime between May and October.[69] Males deposit sperm packets, which are picked up by the female. Females lay 135–200 eggs in a variety of sheltered stream habitats and guard them until hatching in the fall. Each egg is attached to the substrate to keep it from being displaced by the current. Larvae require several years before transformation into terrestrial forms. In large water bodies, especially at high elevations, neotenic larvae remain aquatic for life. Pacific Giant Salamanders may take up to six years or more to reach sexual maturity. Females lay eggs only once every two years and may live up to 25 years.[70]

Some additional information can be found in the Develop with Care fact sheet on Pacific Giant Salamanaders http://www.env.gov.bc.ca/wld/documents/bmp/devwithcare/Fact-Sheet-19-pacific-salamander.pdf

Compatibility with Human Landscapes

The Pacific Giant Salamander can co-exist with rural development where measures to maintain habitat quality in both stream and adjacent riparian habitats are taken. It is unlikely it can co-exist with urban development, although it is occasionally encountered on lawns, or stranded in wells or drains in residential areas. Aquatic forms are sensitive to sedimentation, alteration of stream habitat and the presence of predatory fish. Terrestrial adults are sensitive to human disturbance to riparian areas and loss of forest cover. Urban development is identified as a threat for this species, mainly through habitat loss.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Maintain moist forested habitat with abundant course woody debris along streams (at least 30 m wide on both banks).
- ☑ Prevent introductions of predatory fish to breeding sites.
- ☑ Prevent siltation or alteration of clear, clean stream habitats.
- ☑ Avoid altering stream-flow patterns, and maintain small pools within streams (pocket or step pools) and abundant in-stream cover.

68 Frogwatch 2013
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70 Frogwatch 2013

5.2.4 Family *Salamandridae* – True Salamanders and Newts

Roughskin Newt (Taricha granulosa)

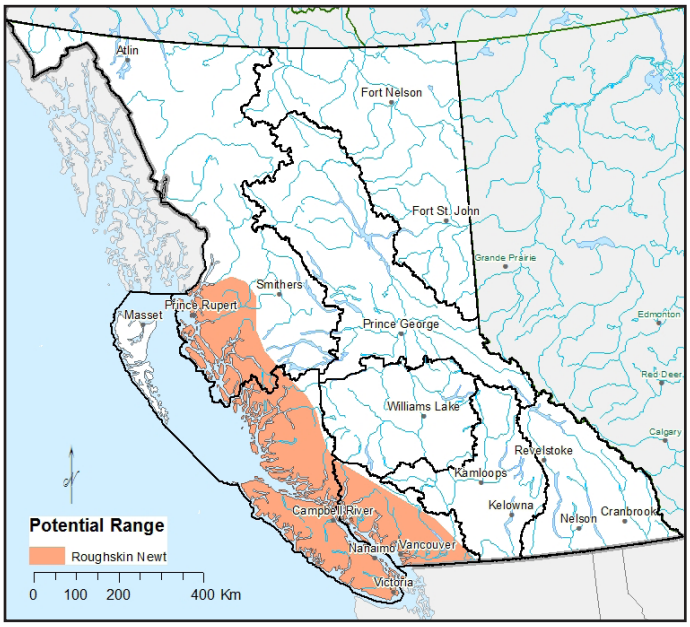

Photo: Trudy Chatwin

COSEWIC: Not assessed
B.C. Status: Yellow-listed

Identification

- The Roughskin Newt is a semi-aquatic, true salamander (family *Salamandridae*)
- Lacks costal grooves along the sides of the body and has dry rough skin
- Distinguished from other species by white spots extending down the sides of their dark brown body and their bright orange underbelly
- Robust medium-sized salamander; adults can reach a total length of 185 mm
- During breeding season skin becomes relatively smooth, and their normally rounded tail becomes flattened like a paddle
- Aquatic larvae have a small head with narrow blunt snout, ragged gills, tan-colour with black flecks, pink or salmon abdomen

Distribution

The Roughskin Newt is the most poisonous amphibian in the Pacific Northwest. It contains enough poison to kill 25,000 mice.

The Roughskin Newt ranges along the entire length of the Pacific Coast from northern California to Southern Alaska. In British Columbia, it is found in mainland coastal areas, Vancouver Island and some Gulf Islands.

Life History and Habitat Requirements

Roughskin Newts are found in and around well-vegetated ditches, ponds and wetlands during the breeding season. When they are not breeding they can be found in forests under decaying downed logs, bark, leaf litter, or in the burrows of other animals. They are semi-aquatic and are active both day and night as their toxic skin reduces the risk of predation. They are inactive in winter and take refuge

underground where they avoid drying and freezing. Larvae are usually present in lakes and ponds in summer, but occur year round at higher elevations where cold temperatures slow transformation. Vancouver Island has a large proportion of male adults that remain in aquatic breeding habitats year-round.[71]

The Roughskin Newt's toxic secretions protects it from predators. The toxin (tetrodotoxin) is highly poisonous to vertebrates but is only harmful to humans if ingested. The Common Garter Snake is apparently unaffected by the newt's poison and is one of its major predators.

Adults eat insects, slugs, worms, and even amphibian eggs and larvae. Newt larvae feed on aquatic invertebrates and zooplankton.[72]

In early spring, newts migrate in large numbers to breeding sites where males release sperm packets for females to fertilize their eggs. Females lay single eggs attached to the stems of vegetation scattered throughout the breeding habitat. The eggs hatch 3–4 weeks later and the larvae then morph into terrestrial forms, usually within the same year. At high elevations this transformation may be delayed until the following summer. Newly metamorphosed newts move to upland forests and return to breeding ponds a few years later when they become sexually mature. Roughskin Newts may live as long as 12 years.[73]

Ability to co-exist with Urban and Rural Development

The Roughskin Newt can co-exist with rural development provided measures are taken to maintain the quality of foraging and breeding habitats and to avoid road mortality. It is unlikely the Roughskin Newt can co-exist with urban development. Aquatic stages appear to tolerate some degree of organic pollution, as the species can breed in water bodies with an abundance of decomposing vegetation. However, these newts require extensive terrestrial foraging habitat and are susceptible to high mortality on roads during mass migrations to and from breeding sites in the spring and autumn.

Guidelines for Conservation

- ☑ Maintain small mammal burrows, decaying downed logs, bark, leaf litter and other important habitat features.
- ☑ Install drift fences and culverts at locations where roads impede migratory breeding routes, and monitor them to assess effectiveness.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

71 Frogwatch 2013
72 Frogwatch 2013
73 Frogwatch 2013

5.3 Snakes

5.3.1 Family *Boidae* - True Boa Constrictor

Northern Rubber Boa (Charina bottae)

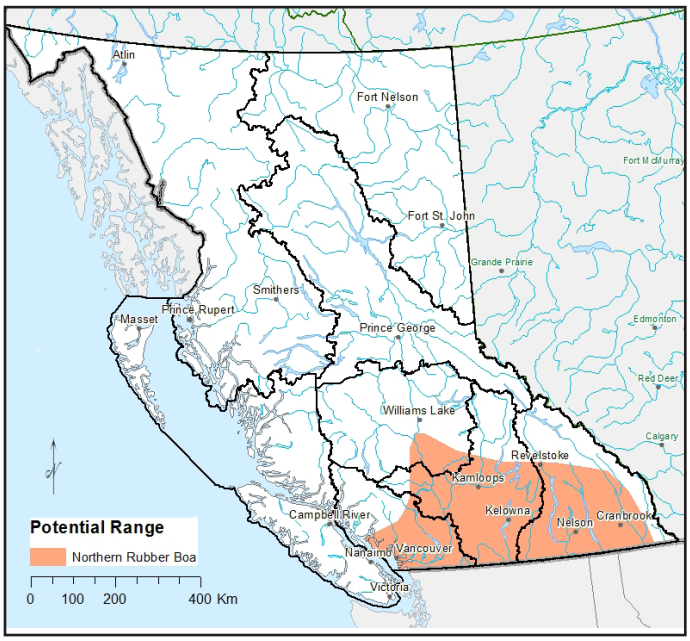

Photo: ©Jared Hobbs

COSEWIC: Special concern
B.C. Status: Yellow-listed

Identification

- The Northern Rubber Boa (family *Boidae*) is one of the most cold-tolerant snakes in B.C.
- Total length 35–80 cm
- Thick-bodied; short, blunt tail resembles the head
- Loose skin; small, smooth scales give the snake its rubbery appearance
- Uniform colouration of dark olive green to brown in colour; underbelly pale yellow to orangish-yellow
- Juveniles: small, pinkish colour; strikingly similar to that of an earthworm; little to no neck

Also known as the "Two Headed Snake", it can be difficult to tell a boa's head from its tail.

- Newborns range from 180–280 mm in length, snout to vent
- Very docile; will not defend itself by biting; will coil into a ball and display its tail to divert attention from its more vulnerable body parts

The *Boidae* family includes Reticulated Pythons and Anacondas

Distribution

The Northern Rubber Boa is found throughout western North America from British Columbia south to California, and eastward to Montana, Wyoming, and northwestern Colorado. In British Columbia, this species is found across the southern part of the

province. In 2009, a population was discovered on Nelson Island; the first confirmed record on coastal islands.[74]

Life History and Habitat Requirements

The Northern Rubber Boa occurs mainly in moist, heavily forested mountainous regions and occupies many types of habitats, such as drier open woods, foothills with sparse vegetation, and talus rock outcrops. Rubber Boas use a variety of features within the landscape for basking, hibernation and protection including coarse woody debris, rocky outcrops, crevices, and rodent burrows. They spend much of their time underground with a preference for sandy or loamy soils. These snakes are very secretive and are active mainly at dusk and at night from mid-March to early November. They may emerge during daylight hours on warm, cloudy days. At higher elevations this species migrates short distances to and from suitable **hibernacula** (winter dens). A winter hibernation for the Northern Rubber Boa is communal.[75]

The Northern Rubber Boa feeds mainly on mice, shrews, birds, and lizards, and occasionally other snakes and salamanders. They can swim, climb and burrow, allowing them to forage for bird eggs, nestling birds, nestling rabbits, small chipmunks, and bats.[76]

Mating occurs in March and May after emergence from hibernacula. The embryos are retained within the female's body and are born live. While it is one of B.C.'s most cold-tolerant reptiles, pregnant females require warmth for embryonic development. In late August or early September, the female gives birth to 2–8 young. Females may reproduce every four years. Northern Rubber Boas live up to 30 years.[77]

Ability to co-exist with Urban and Rural Development

Northern Rubber Boas can co-exist with rural development provided that sufficient suitable habitat and cover features are available. However, it is unlikely they can co-exist with urban development. Forestry, urbanization and agricultural developments that remove all coarse woody debris or fragment habitats decrease the amount of suitable habitat available for this species. As these snakes bask on roadways at night, they are occasionally killed by vehicle traffic. Recreational activities such as mountain biking and off-trail hiking threaten local populations through disturbance of nesting sites and trampling. Intentional mortality by people who are afraid of snakes is also a threat. The patchy distribution and low reproductive potential of this snake make the Northern Rubber Boa vulnerable to local extirpation.[78]

74 Pearson 2010
75 BCReptiles 2013
76 BCReptiles 2013
77 BCReptiles 2013
78 COSEWIC 2012

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Avoid intensive logging activities that destroy or fragment occupied or suitable habitats within this species' range (e.g., urbanization, agricultural developments).
- ☑ Preserve essential habitat features (e.g., rocky outcrops, coarse woody debris, rodent burrows) used as basking, hibernation or nesting sites.
- ☑ Protect nesting sites and foraging habitats from trampling, recreation and human persecution.

5.3.2 Family *Colubridae* – Non Venomous, Egg-Laying Snakes

North American Racer (Coluber constrictor mormon)

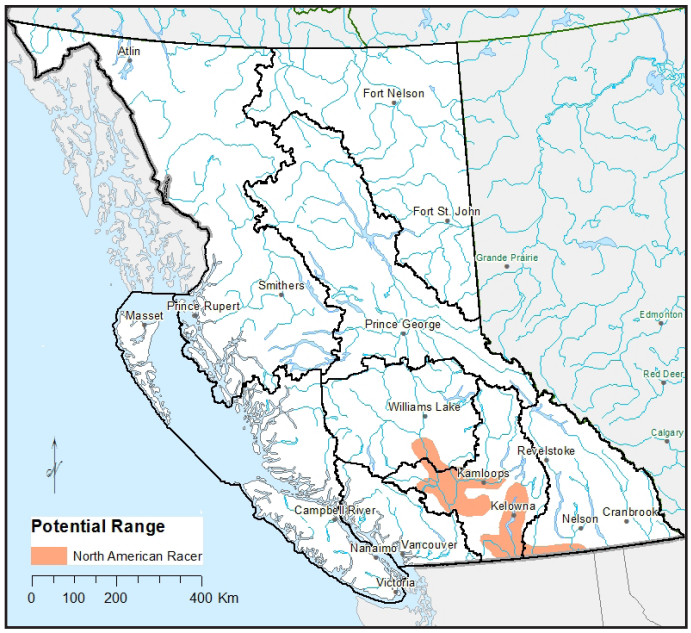

Photo: ©Jared Hobbs

Identification

COSEWIC: Special concern
B.C. Status: Blue-listed

Some herpetologists consider *C.c. mormon* to be a full species (*Coluber mormon*); racers are the fastest and most heat-tolerant snake in B.C.

- Total length from 50–200 cm
- Back and sides are grey to olive-green colour; belly is white to yellow
- Long, slender, tapered snake with large, smooth scales and body; long tail looks like a whip
- Large head; round snout; large eyes with round pupils
- Hatchlings have rusty brown blotches on their back and sides
- Juveniles: orangish-red in colour; spots on the sides; dark bands on the back
- Juveniles often confused with Rattlesnake and Gopher Snake; lack the rattle found on Rattlesnakes; lack ridged scales and squarish blotches found on the Gopher Snake
- Hatchlings average 237 mm in length, snout to vent

- May display aggressive behaviour or bite if cornered

Distribution

Racers are widespread in the United States. In British Columbia, it is found in the Okanagan Valley including the South Columbia, Kettle, Okanagan, Similkameen, Nicola, and Thompson watersheds.

Life History and Habitat Requirements

The name 'Racer' is no accident – these snakes are built for speed. Racers are active snakes, and they use their excellent vision and speed to hunt during the day.

The North American Racer requires three critical habitats: hibernacula, summer range with food and shelter, and nesting sites.[79] Their usual habitat is open, sparsely-treed country, but racers can also be found in meadows, sagebrush flats, forest edges, and fence rows. It is absent from dense forests and high mountain habitats. They prefer exposed sunny environments and are active during daylight hours. The North American Racer may spend the winter (November to March) sharing hibernacula with Rattlesnakes, Gopher Snakes, garter snakes, and other species. Hibernation sites are usually located in rock outcroppings, scree slopes and rock piles located on steep gradients with southern exposures. Racers emerge from their dens in April and quickly disperse to their summer ranges to mate. They lay their eggs in abandoned rodent burrows, in rotting coarse woody debris, under flat stones, in sandbanks, in loose soil, or on stable scree slopes.[80]

North American Racers primarily feed on grasshoppers and crickets but may also feed on small mammals, reptiles, amphibians, and birds. They actively search for prey and commonly move with their head up and off the ground when hunting. They are good climbers and occasionally hunt in bushes. Racers rarely constrict their prey but rather catch and swallow it alive.[81]

In British Columbia, the North American Racer mates in May. Females lay from 4–7 eggs in June or July. Nests are often in abandoned rodent burrows with a southern exposure. Depending on the temperature, the incubation period can last from 40 days to two months.[82] Female racers reach maturity at two or three years of age. They produce a maximum of one clutch of eggs a year, although some breed only once every two years. In the wild, racers live 7–8 years.[83]

Ability to co-exist with Urban and Rural Development

North American Racers can co-exist with rural development provided sufficient open habitat is retained. However, this species is unable to co-exist with urban development. The blotchy pattern on juvenile snakes, which resembles the coloration of young rattlesnakes, renders it highly vulnerable to persecution in urban environments. Individuals can also display aggressive behaviours sometimes vibrating their tail, further perpetuating fear in humans. Habitat loss to urban and

79 BCReptiles 2013
80 BCReptiles 2013
81 COSEWIC 2012
82 COSEWIC 2012
83 COSEWIC 2012

agricultural developments is the main threat. This species is at the northern edge of its distribution, and populations are small and increasingly limited by the lack of suitable habitats.[84] They travel only short distances from their dens, and require hibernation sites, nesting sites and summer feeding habitat for their persistence. Pesticide contamination of foraging sites, disturbance of nest sites and road mortality are also significant threats.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Maintain habitat connectivity between required habitats essential for life history functions
- ☑ Preserve a variety of habitat types (e.g., open, sparsely treed country, meadows, sagebrush flats, forest edges, and fence rows) within the racers' known range.
- ☑ Preserve hibernation and egg-laying habitats and features including rodent burrows, rotting woody debris, flat stones, sandbanks, rocky outcrops, and scree slopes located on steep gradients with southern exposures.
- ☑ Avoid locating buildings or roads near potential denning areas such as south-facing talus slopes. Zone them for low-density developments where unavoidable and use drift fences around residential areas to reduce interactions with people.

84 COSEWIC 2012

Gopher Snake (Pituophis catenifer)

Great Basin Gopher Snake (Pituophis catenifer deserticola)

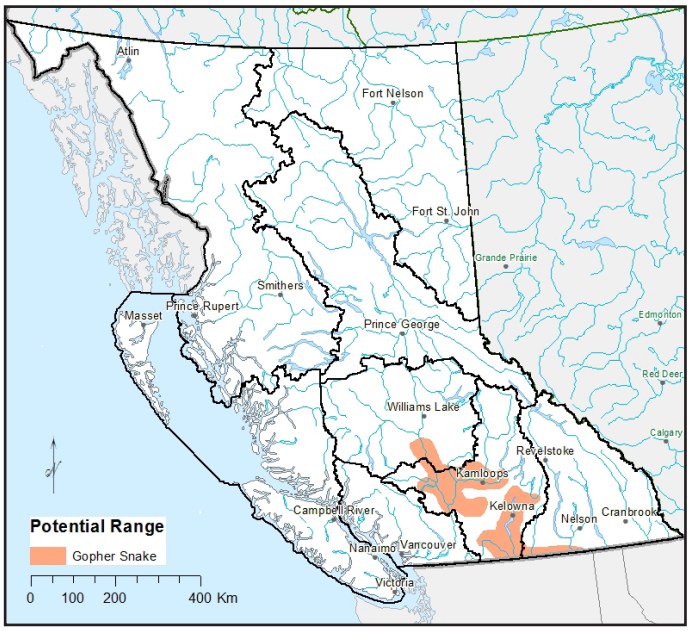

Photo: ©Jared Hobbs

Identification

- The Great Basin Gopher Snake (family *Colubridae*) is B.C.'s largest non-venomous snake and is a true constrictor: squeezing its prey to death before consuming it
- Total length from 90–240 cm
- Tan with dark, square-shaped blotches down the back; may have a series of smaller blotches running along each side
- Dark stripe across the top of the head between the eyes and from the eyes to the back of the jaw; eyes have a round pupil
- Keeled (ridged) scales along the back but not the sides; rough texture
- Commonly misidentified as a Rattlesnake due to similar coloration and behaviour; differs in markings on the body, narrower head shape and lacks a rattle
- Hatchlings average 370 mm, snout to vent
- Harmless to humans

COSEWIC: Endangered
B.C. Status: Red-listed

Distribution

The Gopher Snake is widely distributed over much of the western United States but found only in the dry interior of British Columbia. Of the 10 subspecies, two are known in British Columbia. The Great Basin Gopher Snake (*P. c. deserticola*) is found in the Cariboo, Thompson Okanagan, and Kootenay Boundary Regions. The Pacific Gopher Snake (*P. c. catenifer*) was once found in the Lower Mainland and the Gulf Islands but is now considered extirpated.

Life History and Habitat Requirements

A scared Gopher Snake will flatten its head, hiss loudly, and shake its tail rapidly, doing a convincing rattlesnake imitation. This charade may be useful when facing most natural predators, but may prove to be deadly when facing a scared human.

The Gopher Snake occurs in a wide variety of arid to semi-arid habitats from Bunchgrass grasslands, Sagebrush shrub-steppe, deciduous and coniferous Ponderosa Pine woodlands, and other open habitats around farmland. It is absent from dense forests and high mountains. This species occurs at the northern extent of its range where temperature may limit distribution and affect hatchlings, possibly slowing population recovery.[85]

Gopher Snakes require three critical habitats: hibernacula, egg-laying sites and summer foraging areas.[86] In B.C., biologists discovered that these snakes can have large home ranges, up to 25 ha in size. Rock outcroppings, talus slopes, and rodent burrows provide important habitat for overwintering sites. Hibernacula are often shared with other species like Rattlesnakes, Rubber Boas and garter snakes.[87] Marshes and riparian areas with access to sandy ridges with rodent burrows or other shelter provide particularly good foraging habitat.[88] South-facing slopes covered by sand or loose rocks are important for egg laying. In the spring, the Gopher Snake is active during the day moving from hibernation to summer foraging areas. Migration distances of up to 1.3 km have been documented although most were less than 1 km.[89] In summer, this species restricts its activity to between dusk and dawn. The Gopher Snake is a very active hunter that feeds mainly on mice, voles and rats. They will occasionally hunt small rabbits, lizards and insects, and climb trees for birds and their eggs. Gopher Snakes are true constrictors; they subdue their prey by squeezing and then swallowing them. The Great Basin Gopher Snake emerges from hibernacula to begin mating in late March to late April. Females lay a clutch of 2–8 eggs in June or July but do not incubate their eggs, which hatch in the late summer typically in August or early September. Hatchlings may not overwinter in traditional hibernacula and may overwinter in old rodent burrows and rock crevices close to their birth site.[90]

Ability to co-exist with Urban and Rural Development

The Great Basin Gopher Snake can co-exist with rural development provided that sufficient habitats, features and connectivity among them is maintained, and that humans do not kill them. Although harmless, this species does not co-exist well with urban development because it may be mistaken for a rattlesnake and persecuted. The Gopher Snake is known from residential areas, vegetated roadsides and farm yards. Road mortality, habitat fragmentation, habitat loss through urban and agricultural developments in valley bottoms, and human persecution are the main threats to this species. Other threats include rock extraction and farming machinery which damage egg-laying sites. As the Gopher Snake eats mainly mammals such as rats, small rabbits, mice, and voles, it is beneficial to humans.

85 BC MOE 2008e
86 BCReptiles 2013
87 BCReptiles 2013
88 BC MOE 2008e
89 BC MOE 2008e
90 BCMOE 2008e

Guidelines for Conservation

- ☑ Maintain habitat connectivity between seasonal ranges and essential habitats for life history functions.
- ☑ Preserve a variety of habitat types (e.g., shrubs, grassland, riparian areas, rocky outcrops and dry forest) and maintain good range condition for cover and habitat for prey species (e.g., prevent overgrazing by livestock).
- ☑ Limit access and reduce disturbance to sensitive areas (e.g., communal hibernation sites, talus slopes, rocky outcrops, and wooded areas) from human persecution, trampling, recreation, pets, and vehicles.
- ☑ Avoid locating buildings or roads near potential denning areas such as south-facing talus slopes. Zone for low-density developments where unavoidable and use drift fences around residential areas to reduce interactions with people.
- ☑ Install drift fences and underpasses at locations where road or railway mortality is a concern (e.g., intersect seasonal habitats, dispersal routes and road basking).

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Preserve rocky outcrops and dry forest

Photo: Judith Cullington

5.3.3 Family *Natricidae* – Non Venomous, Live-Bearing Snakes

Terrestrial Garter Snake (Thamnophis elegans)

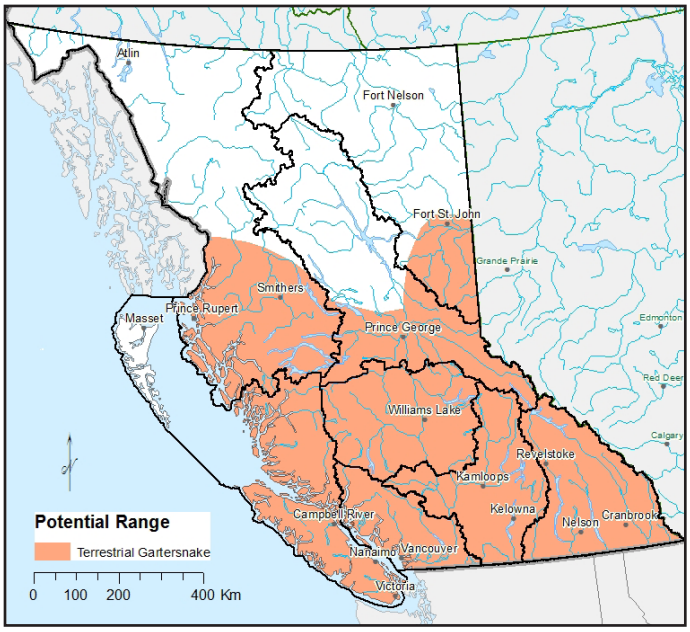

Photo: Kristiina Ovaska

COSEWIC: Not assessed
B.C. Status: Yellow-listed

Identification

- Despite its name, the Terrestrial Garter Snake (family *Natricidae*) is often found near fresh or marine water habitats
- Total length up to 1 m
- Two colour variations in B.C.: a darker coastal type and a lighter interior type; both forms have three stripes running the length of their bodies (one dorsal and two lateral), however, there is variation in colouration, length and visibility of each stripe between individuals and populations[91]
- Can reliably distinguished from other garter snakes by the possession of eight upper labial (lip) scales
- The arrow-shaped head is often a good species indicator
- Newborns measure 118–212 mm in length, snout to vent
- If captured, will spiral in an attempt to escape and may release a smelly mixture from its vent; if it feels threatened it will strike

Distribution

The Terrestrial Garter Snake is found in most areas of British Columbia and extends east to Saskatchewan, and south to central California and New Mexico. The subspecies of Western Terrestrial Garter Snake found in B.C. commonly is called the "Wandering" Garter Snake (*T. e. vagrans*).

91 Tuttle 2012

Life History and Habitat Requirements

Very little is known about the natural history of the Terrestrial Garter Snake. This species is found in a wide variety of habitats but is rarely found far from fresh or marine water. It has a preference for open areas such as grassy meadows, estuaries and open coniferous forests. It can be seen basking or moving through undergrowth or hiding under rocks, decaying wood and debris. The Terrestrial Garter Snake migrates from its rocky, south-facing winter hibernation sites to summer aquatic habitats; sometimes a considerable distance away. On the coast it is often seen foraging in the intertidal zone. When alarmed, these snakes may escape into water, diving to the bottom to hide under submerged rocks and other refuges. The Terrestrial Garter Snake may hibernate with other snake species, including the Western Rattlesnake. In milder climates, this species often hibernates alone in logs and rocky outcrops. In spring, they emerge from hibernation to mate.

The Terrestrial Garter Snake has one of the most varied diets of any of B.C. native snakes. It feeds on slugs, snails, small mammals, amphibians, birds, other snake species and fish (both freshwater and marine). This is the only snake that constricts while biting and chewing its prey.

Female Terrestrial Garter Snakes are live-bearing and give birth to up to 19 young in mid to late summer.

Ability to co-exist with Urban and Rural Development

The Terrestrial Garter Snake can co-exist with urban and rural development provided that sufficient shrubby cover and wet foraging areas are available. It is commonly found in residential and recreational areas. Its large size and ornery nature may be a deterrent for some gardeners, but the snake is harmless to humans. Threats to the species include roadkill and loss of habitat in high-density urban developments.

Guidelines for Conservation

- ☑ Maintain habitat connectivity between seasonal habitats (hibernation sites and summer aquatic habitat) to support all life history functions.
- ☑ Preserve important habitat features used as basking, hibernation and nursery sites (e.g., south-facing rocky slopes) and for cover (e.g., undergrowth, rocks and decaying wood).
- ☑ For lawn maintenance:
  - Leave some grass unmowed in places that adjoin wet areas, sunny forest edges or any other known garter snake habitat;
  - If the grass must be cut, walk the lawn and move or direct any snakes to a safe location prior to mowing;
  - Set the mower blades as high as possible, and mow at a slow speed and be ready to use the brake;
  - Alternatively, use a weed-whacker and leave the grass about 15 cm high.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Northwestern Garter Snake (Thamnophis ordinoides)

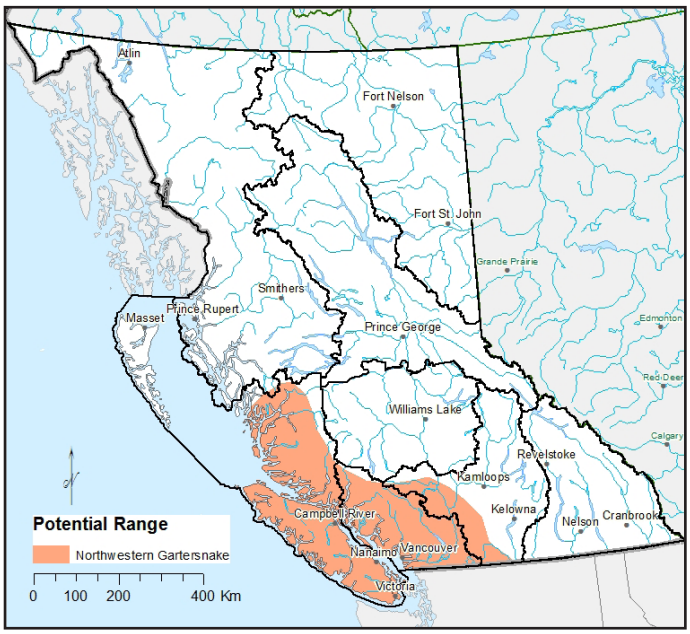

Photo: Kristiina Ovaska

COSEWIC: Not at risk
B.C. Status: Yellow-listed

Identification

- The Northwestern Garter Snake (family *Natricidae*) is the most common snake in coastal B.C.
- Smallest of the garter snakes; total length from 30–66 cm
- Relatively small head size with a pale upper lip and seven scales are the most reliable identification features
- Highly variable coloration; black, brown or olive in colour; may have a yellow, red, tan, blue, white, cream, green or orange stripe down the back; width of the stripe varies and the paired black dots (when present) do not encroach onto the centre back line
- Belly usually pale; sometimes with black or red markings
- Strongly keeled scales; rough texture
- Newborns measure from 110–150 mm, snout to vent
- If handled, it may release a smelly mixture from its vent

Distribution

The Northwestern Garter Snake occurs in southwestern reaches of British Columbia, south through western Washington and Oregon to extreme northwestern California. In British Columbia it is found in coastal areas including the Gulf Islands, Vancouver Island and the southern mainland to east of Manning Park.

Life History and Habitat Requirements

The Northwestern Garter Snake is highly terrestrial and is found in moist, heavily vegetated areas including gardens, meadows and forest edges. It also occurs in

estuaries and on beaches, although it rarely enters into the water.[92] It is known to use abandoned buildings, vacant lots and weedy sections of backyards. They require summer feeding and breeding areas, and winter hibernacula. This species is relatively sedentary and has a small home range. It is generally active from mid-March to late October but is occasionally seen during mild winters on the coast. In colder areas, these snakes hibernate in talus banks or in cracks in fissured rock. They take shelter under rocks, decaying wood, and debris.[93]

The Northwestern Garter Snake feeds mainly on slugs and earthworms, and occasionally on snails and small amphibians. Their variable coloration and stripes make it difficult for predators to tell what direction they have gone or how fast they are travelling, facilitating escape.[94]

The Northwestern Garter Snakes may mate in autumn, but typically mating occurs in spring after emergence from winter dens. Northwestern Garter Snakes are live-bearing and females give birth to 3–20 live young from mid-July to September.

Ability to co-exist with Urban and Rural Development

The Northwestern Garter Snake can co-exist with rural development provided sufficient habitat and cover for refuge, foraging, and hibernation are available. However it is unlikely that it can co-exist in the long term with urban development. Its affinity to hedges and meadows most likely explains its occurrence in urban and rural settings. It is found in many urban and suburban gardens in the Lower Mainland and on Vancouver Island. The Northwestern Garter Snake is beneficial to humans as its diet consists mainly of slugs. Threats include cats, roadkill, grass mowing, and high-density developments.

Guidelines for Conservation

- ☑ Maintain habitat connectivity between seasonal habitats (hibernation sites and summer aquatic habitat) to support all life history functions.
- ☑ Preserve important habitat features used as basking, hibernation and nursery sites (e.g., south-facing rocky slopes) and for cover (e.g., undergrowth, rocks and decaying wood).
- ☑ For lawn maintenance:
  - Leave grass unmowed in places that adjoin wet areas, sunny forest edges or any other known garter snake habitat;
  - If the grass must be cut, walk the lawn and move or direct any snakes to a safe location prior to mowing;
  - Set the mower blades as high as possible, and mow at a slow speed and be ready to use the brake;
  - Alternatively, use a weed-whacker and leave the grass about 15 cm high.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

92 BCReptiles 2013
93 Frogwatch 2013
94 BCReptiles 2013

Common Garter Snake (Thamnophis sirtalis)

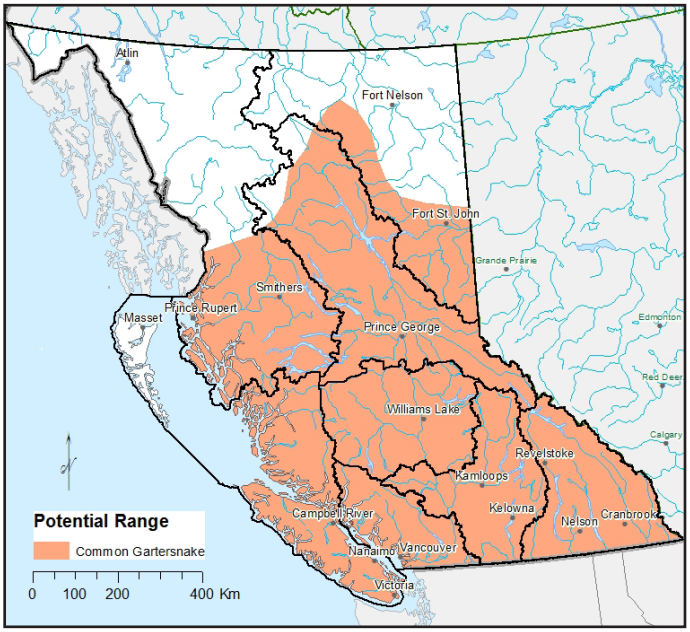

Photo: Kristiina Ovaska

Identification

- The Common Garter Snake (family *Natricidae*) is the most widespread snake in B.C. and represents some of the northern-most reptile populations in the world
- Total length from 46–130 cm
- Has a large head; can be differentiated from other garter snakes by its seven upper lip scales and 10 lower lip scales
- Black to greyish-green body; bright yellow to greenish yellow stripe down the back; markings vary between the three subspecies
- Occasionally have red side stripes, red spots or blotches that combine with their other markings to form unique patterns
- Newborns range from 145–220 mm in length, snout to vent
- If captured it may try to escape by releasing a smelly mixture from its vent, or will strike aggressively

Distribution

COSEWIC: Not assessed
B.C. Status: Yellow-listed

The Common Garter Snake is the most widespread snake in North America, with three subspecies occurring throughout all Regions in British Columbia. The Puget Sound Garter Snake (*T. s. pickeringi*) is restricted to Vancouver Island and immediately adjacent mainland coast. The Valley Garter Snake (*T. s. fitchi*) occupies the bulk of southern B.C. and along the northern coast. The Red-sided Garter Snake (*T. s. parietalis*) occurs along the eastern side of the province.

Life History and Habitat Requirements

The Common Garter Snake can tolerate colder climates than most other snakes. It is found in riparian areas (along streams, rivers, and lakes), marshes, wet meadows and deep coniferous forests.[95] The activity period for the Common Garter Snake varies with the local climate and availability of prey.

Often many males pursue a single female resulting in "mating balls" of snakes with a single female in the middle (BCReptiles2013).

It is active during the day and is often seen out in the open basking in the sun or moving through undergrowth. It takes shelter under rocks, decaying wood, and debris.[96] They overwinter underground in hibernacula on south-facing, rocky slopes. These dens are often shared with other garter snakes, racers, rubber boas, and rattlesnakes. They emerge from dens in March or April to mate.

Mating occurs in the spring in most areas, although occasionally it has been observed in August. Males emerge from the hibernacula first, followed by the females at which time they begin mating. Common Garter Snakes are live-bearing, giving birth to 10–15 young in July or August. After mating most Common Garter Snakes migrate to summer ranges that can be up to several kilometres away, the summer range can be wetlands and riparian habitats, or forested areas.[97]

The Common Garter Snake feeds on amphibians, slugs, earthworms, and occasionally small mammals, fish, other reptiles, and small birds. Young snakes seem to feed mainly on earthworms. Adults can consume prey that other predators find toxic, including the Roughskin Newt and poisonous Western Toad.

Ability to co-exist with Urban and Rural Development

The Common Garter Snake can co-exist with rural development provided there is sufficient connectivity between forested or shrubby habitats with moist meadows or wetlands. This species is less commonly found in manicured gardens in rural areas and in densely populated suburbs. Its variable diet of birds, reptiles, amphibians, fish and earthworms allows it to feed in most rural gardens. Threats to local populations in urban and rural areas include loss of moist foraging areas, grass mowing and roadkill.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Preserve mosaics of riparian areas, marshes, wet meadows, and forests, with connectivity between these habitats for all life history functions.
- ☑ Preserve important habitat features used as basking, hibernation and nursery sites (e.g., south-facing, rocky slopes) and for cover (e.g., undergrowth, rocks, decaying wood, riparian vegetation).
- ☑ For lawn maintenance:
  - Leave grass unmowed in places that adjoin wet areas, sunny forest edges or any other known garter snake habitat;

95 BCReptiles 2013
96 Frogwatch 2013
97 BCReptiles 2013

- If the grass must be cut, walk the lawn and move or direct any snakes to a safe location prior to mowing;
- Set the mower blades as high as possible, and mow at a slow speed and be ready to use the brake;
- Alternatively, use a weed-whacker and leave the grass about 15 cm high.

5.3.4 Family *Dipsadidae* – Slender Rear-Fanged Snakes

Sharp-tailed Snake (Contia tenuis)

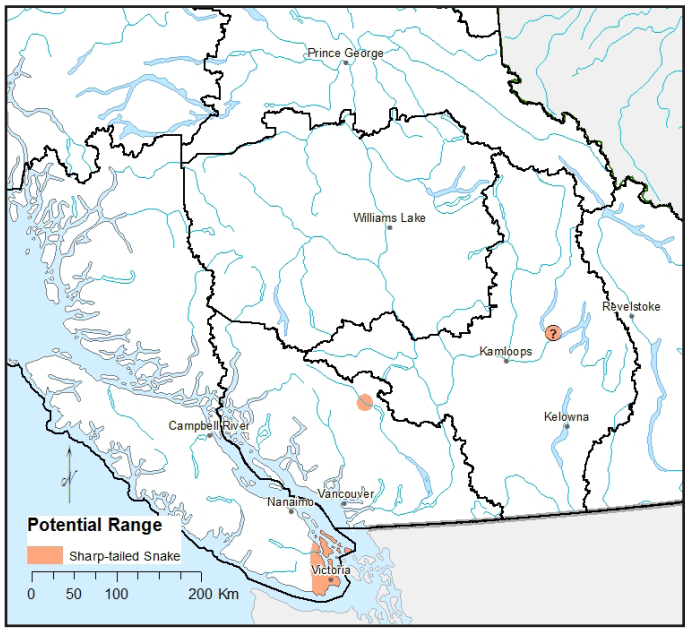

Photo: Kristiina Ovaska

COSEWIC: Endangered
B.C. Status: Red-listed

Identification

- The Sharp-tailed Snake (family *Dipsadidae*) is the only egg-laying snake occurring in coastal B.C.
- Small, slender snake, total length 20–45 cm
- Brown or reddish brown in colour with a red stripe on the sides
- Short, sharp, thorn-like tail tip; smooth body scales; and pale belly with white and black barring distinguish this snake from other young garter snakes
- Head is wider than the neck; nose rounded or squared off
- Usually have a black mask over the eyes
- Hatchlings range from 75–92 mm in length, snout to vent; resemble earthworms
- May push tail spine into your skin if handled

Distribution

The Sharp-tailed Snake is found in southern British Columbia, south along the coast down to California. In British Columbia, this species is only found on southern Vancouver Island and the Gulf Islands (North and South Pender, Saltspring and Galiano) and a recently discovered population near Pemberton.[98] One unconfirmed record exists from near Chase in the Thompson Okanagan Region.

Life History and Habitat Requirements

The semi-fossorial (lives underground) Sharp-tailed Snake requires suitable habitats for **thermoregulation**, egg-laying, hibernation, aestivation, and foraging. Most occurrences are from relatively open woodlands and forests with southerly exposure.[99] Particularly important are small forest openings with south-facing rocky slopes that are used for egg-laying. Cover objects such as rocks, leafy litter or decaying logs are required for shelter. These snakes tend to be active in spring (February to June) before other snakes, and again in late autumn (September to October), which may make them more vulnerable to disturbance during these periods.[100] Their activity is restricted to evenings and nights. They are rarely seen in the open or away from cover.[101] During the heat of summer they retreat to subsurface refugia where they may aestivate. They probably hibernate in winter (mid-November to February), but have been found at the surface during warm periods at this time of year. Tracking studies indicate that this species has a small home range. Their small size and elusive behaviour make the Sharp-tailed Snake one of B.C.'s least understood reptiles.[102]

The diet of Sharp-tailed Snakes consists mainly of slugs, but other soft-bodied invertebrates may be eaten as well. Sharp-tailed Snakes likely fall prey to ground scratching birds, cats, snakes, raccoons, mink, and shrews.

Little is known about the breeding behaviour and life history of the Sharp-tailed Snake. They lay eggs and a few nests have been found at communal egg-laying sites. Females are thought to lay 3–9 eggs in late spring to early summer, and the young likely hatch sometime in autumn.

Ability to co-exist with Urban and Rural Development

The Sharp-tailed Snake can co-exist with urban and rural development provided that sufficient open forested terrestrial habitat and habitat features are retained. This species is found in semi-rural areas throughout its range. They have been found in compost heaps, borders of gardens and woodpiles within low-density residential areas, and they use artificial cover-objects such as asphalt shingles installed in suitable habitat.[103] Their main threat is habitat degradation and loss, as well as

98 BC MOE 2008c
99 Frogwatch 2013
100 BC MOE 2008c
101 BC MOE 2008c
102 BCReptiles 2013
103 BC MOE 2008c

fragmentation caused by urbanization. Other threats include mowing, invasive plants that change the thermal properties of sites, introduced predators such as cats and quail, and road mortality. Because the Sharp-tailed Snake is at the northern limit of its range in B.C., it has limited expansion opportunities into other habitats.[104] The species occurs in low numbers have a fragmented distribution and are poor dispersers, thus limiting the potential for re-colonization of extirpated populations.[105]

Guidelines for Conservation

- ☑ Maintain habitat connectivity between required habitats essential for life history functions.
- ☑ Preserve important habitat features including south-facing rocky talus slopes, rocky outcrops, wooded areas, leafy litter, and decaying logs.
- ☑ Control the spread or introduction of invasive plants (e.g., Scotch Broom and Himalayan Blackberry) which shade basking habitat and reduce gastropod prey.
- ☑ Avoid the use of pesticides (e.g., slug poison) and herbicides which contaminate snakes, their prey and foraging areas.
- ☑ For lawn maintenance:
  - Leave grass unmowed in places that adjoin wet areas, sunny forest edges or any other known garter snake habitat;
  - If the grass must be cut, walk the lawn and move or direct any snakes to a safe location prior to mowing;
  - Set the mower blades as high as possible, and mow at a slow speed and be ready to use the brake;
  - Alternatively, use a weed-whacker and leave the grass about 15 cm high.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

104 Frogwatch 2013
105 BCMOE 2008c

Desert Night Snake (Hypsiglena chlorophaea)

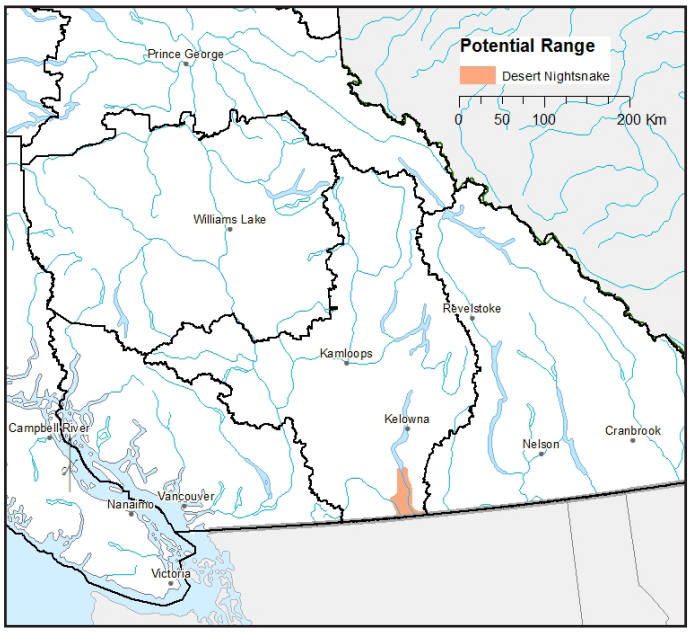

Photo: ©Jared Hobbs

Identification

COSEWIC: Endangered
B.C. Status: Red-listed

- The Desert Night Snake (family *Dipsadidae*) is the rarest snake in B.C.
- Total length of 30–66 cm; small slender body
- Beige, yellowish or grey with dark brown squarish blotches running down the back; a smaller series of blotches runs down the sides; cream or light yellow belly
- Distinct blotches on the back of the neck; sometimes connected
- Upturned eyes with vertical pupils
- Key features distinguishing them from rattlesnakes are the smaller dark band across each eye linking to a dark collar-like marking around the neck and the absence of a rattle
- Hatchlings may range from 134–160 mm in length, snout to vent
- When threatened, coils with head exposed; will strike but rarely bites

Night Snakes are not dangerous to humans. The venom they produce is just strong enough to incapacitate their small prey.

Distribution

The Desert Night Snake is found throughout the western United States, Mexico and Costa Rica. In British Columbia, it is found at a few sites in the southern Okanagan and Similkameen Valleys.

Life History and Habitat Requirements

Desert Night Snake habitats include Ponderosa Pine parkland, coniferous forest, shrub-steppe grasslands, sandy and riparian areas with south-facing talus, and rocky outcrops.[106] They require hibernacula, egg-laying sites, and summer hunting grounds with suitable cover and prey densities to survive within these hot, dry regions.

106 BC MOE 2008d

The Desert Night Snake is very secretive, being most active at night and dusk from late April to October. During the day it hides under rocks, other cover objects or in abandoned mammal burrows. They spend their winters in hibernacula which may be shared with Rattlesnakes. Little else is known about their life history and breeding habitats.

The Desert Night Snake is a rear-fanged (enlarged grooved teeth in the back of their mouth), slightly venomous snake that uses its venom to paralyze its prey. It feeds on small lizards, skinks and their eggs, frogs, and other snakes.[107]

Little is known about their breeding habits. They are egg-layers and some data suggests that females lay 2–9 eggs in June or July which hatch in late summer (August or September).

Ability to co-exist with Urban and Rural Development

The Desert Night Snake is not compatible with urban and rural development primarily because it superficially resembles the Rattlesnake. The species is slightly venomous but is not harmful to humans; nonetheless, it is highly persecuted. Serious threats include fragmentation and degradation of habitat caused by urban and rural development including housing, recreation, agriculture, vineyards, and orchards. Rock removal for road construction, landscaping, burning of shrubs and road mortality are also of concern. The Night Snake shares its habitat with one of the fastest growing human populations in B.C. More than 60% of the grasslands and shrublands in the southern portions of the Okanagan have been lost. The combination of small population size, widespread habitat loss, and restricted potential for re-colonization increase the risk of extirpation for this shy and vulnerable snake.[108]

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Create a 500 m diameter circle around all known sites in suitable habitat to provide for connectivity between required habitats.
- ☑ Protect den sites (e.g., south-facing talus and rocky outcrops) and natural habitats within 1 km of dens (e.g., coniferous forest, shrub-steppe grasslands and riparian areas).
- ☑ Preserve habitat such as grasslands and Ponderosa Pine forests and maintain good range condition for cover and habitat for prey species. Prevent overgrazing by livestock.
- ☑ Avoid introducing new barriers to movement within occupied habitats (e.g., road construction near talus slopes and dispersal routes). Zone for low-density use where development is unavoidable and use drift fences around residential areas to reduce interactions with people.

107 BCMOE 2008d
108 BC MOE 2008d

5.3.5 Family *Viperidae* - Venomous Snakes

Western Rattlesnake (Crotalus oreganus)

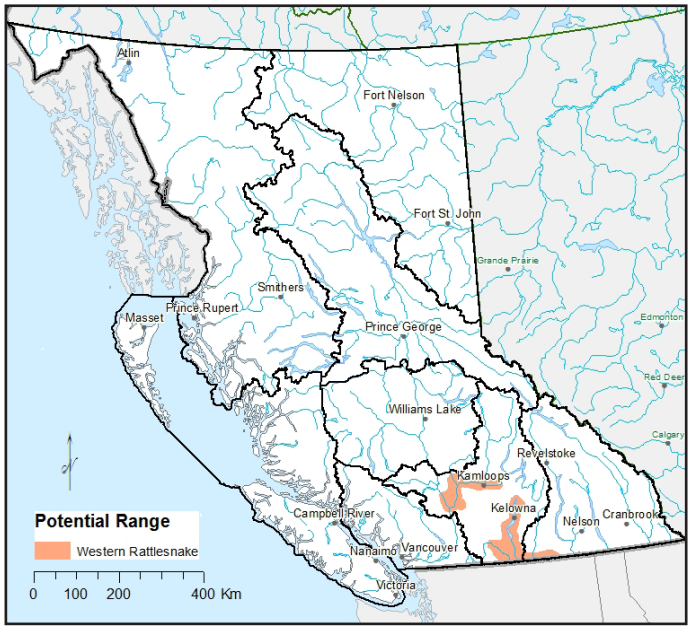

Photo: ©Jared Hobbs

Identification

- The Western Rattlesnake (family *Viperidae*) is the only truly venomous species in B.C. It is generally quiet and non-aggressive unless provoked
- Total length from 60–150 cm; stout body; heavily keeled scales
- Brown, olive or grey with a series of dark blotches surrounded by a lighter-colored halo running down the back; smaller similar markings on the sides; coloration is particularly bright and crisp on juveniles
- Distinguishable by the rattle at the end of the tail; very distinct narrow neck; broad, triangular head
- Large eyes with vertical pupils; long dark cheek patch; deep pits between the nostrils and eyes contain heat-sensing cells
- Newborns average 270 mm in length, snout to vent
- Venom is harmful to humans; attacks rarely occur unless harassed, stepped on or handled

COSEWIC: Threatened
B.C. Status: Blue-listed

If you encounter a dead rattlesnake, don't touch it! The biting reflex remains intact even after death.

Females do not eat while pregnant, and often return to the den to hibernate soon after giving birth. This means a female may go over one year without eating!

Distribution

The Western Rattlesnake is found in the interior of British Columbia and is widespread through western United States. In British Columbia, its range extends from Christina Lake west to Lytton, east to the Cascade Mountains, and north to Kamloops and Cache Creek.

Life History and Habitat Requirements

The Western Rattlesnake is largely restricted to dry habitats. They are often associated with south-facing rock outcrops, talus, shrub-steppe, open forest, and riparian areas.[109] They may also be found in urban and agricultural landscapes provided there are cover objects. The Western Rattlesnake will take shelter under large boulders and rock piles, shrubs, dead trees, bark, rodent burrows, and man-made objects such as pieces of concrete or plywood.[110] Rattlesnakes use habitats seasonally for hibernation, foraging and gestation. They may migrate as far as 3 km between these habitats, so these habitats must be interconnected with travel corridors.[111] Rocky outcrops and deep crevices on exposed south-facing talus slopes function as dens. The Western Rattlesnake may hibernate in groups of a hundred or more, including other species of snakes. They use the same hibernation sites each year. Hibernation occurs from late September to early April when they leave these dens to disperse to summer ranges. Pregnant females typically stay close to the den (within 400 m) and spend the summer basking on south-facing cliffs or slopes that provide heat and shelter while their young develop.[112] This species is mainly active at dawn and dusk, but may be seen during the day if the conditions are right.

The Western Rattlesnake feeds on small mammals such as Deer Mice, voles, pocket gophers, and occasionally large birds or other snakes.[113] The Western Rattlesnake paralyzes its prey with its venom. Juvenile Rattlesnakes mainly eat shrews, Deer Mice and voles.

The Western Rattlesnake mates in the late summer and early autumn. Following a gestation period of 4–5 months, females give birth to up to 12 live young at overwintering dens, usually in September. The young are relatively large and spend their first winter in their mother's hibernacula. Many do not survive their first winter since they do not eat before going into hibernation.[114] In British Columbia, males mature at 3–5 years while females mature at 5–7 years. Females only reproduce every 2–3 years.

Ability to co-exist with Urban and Rural Development

The Western Rattlesnake can co-exist with rural development provided sufficient protected habitats and connectivity is maintained and human caused mortality is not significant. Rattlesnakes are unable to co-exist with urban development. This snake is often persecuted by humans because of its venom and misunderstood aggressiveness. However, the Western Rattlesnakes are beneficial to humans as they prey on rats and other rodents that tend to congregate near human habitations. Habitat loss, degradation and fragmentation from land conversions for urbanization, agriculture, forestry and rangeland management in the arid valleys of the Okanagan are major threats to this species. Other threats include road/rail kill, destruction of

109 COSEWIC 2012
110 BC MOE 2008f
111 BC MOE 2008f
112 BCReptiles 2013
113 COSEWIC 2012
114 COSEWIC 2012

winter dens from machinery, pesticides, fire, and collection for the pet trade. The Western Rattlesnake's low reproductive rate limits population growth and recovery potential. This is further complicated by a late age of maturity for females and small litter size (2–12 per female).

Guidelines for Conservation

- ☑ Preserve an abundance of habitat types (e.g., shrub-steppe, open forest and riparian areas) within this species' range.
- ☑ Maintain habitat connectivity between seasonal habitats to support all life history functions.
- ☑ Preserve important habitat features (e.g., rock piles, talus slopes, vegetation, large woody debris, rodent burrows) used for basking and shelter.
- ☑ Maintain good range condition for cover and habitat for prey species. Prevent overgrazing by livestock.
- ☑ Avoid introducing barriers to dispersal that intersect seasonal habitats or movement corridors (e.g., housing developments, roads or railways, utility corridors). Where developments are unavoidable, zone for low-density and use drift fences around residential areas to reduce interactions with people.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

Western Rattlesnakes denning

Photo: ©Jared Hobbs

5.4 Turtles

5.4.1 Family *Emydidae* - Box and Water Turtles

Painted Turtle (Chrysemys picta)

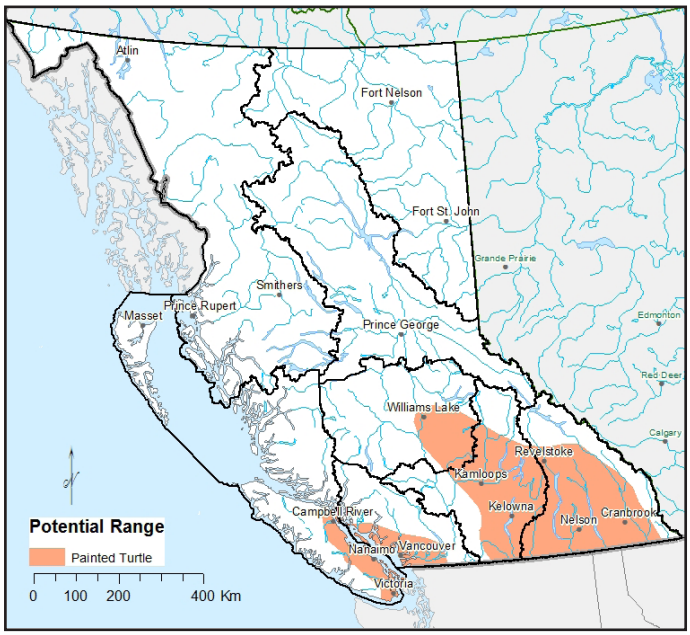

Photo: Trudy Chatwin

Pacific Coast population
COSEWIC: Endangered
B.C. Status: Red-listed

Intermountain - Rocky Mountain Population
COSEWIC: Special concern
B.C. Status: Blue-listed

Identification

- Carapace (back shell) length up to 30 cm
- Bold yellow stripes on head, neck, legs, and tail; red, irregularly shaped markings on the plastron (belly shell) and under-rim of the carapace
- Carapace has flat, smooth appearance; faint yellow lines between scutes (scale-like divisions of a turtle's shell)
- Carapace is black to greenish black; males may have dark worm-like markings
- Webbed hind feet; claws on front feet
- Western Painted Turtle can be distinguished from introduced Sliders (*Trachemys scripta*; various subspecies) by red not yellowish underside of the shell, smoother and less domed carapace, and lack of a red "ear" mark

Distribution

The Western Painted Turtle (family *Emydidae*) is the only native freshwater turtle left in B.C. and is the most northerly occurring turtle in North America. The most widely distributed of the 49 turtle species in North America, the Painted Turtle (*Chrysemys picta*) is found in the southern parts of most Canadian provinces, and as far south as Georgia in the United States. There are four subspecies, of which only one, Western Painted Turtle (*C.p. bellii*), occurs in British Columbia. It consists of two populations: the Pacific Coast population along the southwest coast (including Vancouver Island)

and Intermountain-Rocky Mountain populations in the southern interior and the Kootenays. An observation from Vanderhoof is most likely an escaped pet.

Life History and Habitat Requirements

The Western Painted Turtle inhabits marshy ponds, sloughs, small lakes, slow flowing streams, and back-waters of rivers. It prefers shallow ponds with a muddy bottom and lush emergent vegetation, and spends much time basking on floating logs, tree branches, mud banks, cattail mats, or islets. In addition to aquatic foraging, basking and hibernation areas, the turtles require upland nesting areas. Nesting areas usually have a southern exposure and bare or sparsely vegetated loam substrates free of roots and large stones.[115] Adult Painted Turtles overwinter for 5–6 months in the mud at the bottom of ponds. In the summer, they can be seen basking in the sun on logs and rocks, sometimes stacked one on top of the other reaching for the warmth of the sun.[116] Females undertake regular migrations of varying distance between aquatic habitats and upland nesting areas.

Whether a turtle egg develops into a male or female hatchling (baby turtle) depends on the temperature in the nest as the eggs are developing. Warmer nests will produce female hatchlings while cooler nests will produce male hatchlings.

Painted Turtles eat frogs, insects, snails, earthworms, tadpoles, algae, dead animal matter, and a variety of aquatic plants. Young turtles are quite carnivorous, but are thought to become more herbivorous as they mature.[117]

In early summer, females lay a clutch of up to 18 leathery eggs in pits that they excavate. They can move up to 350 m from water to deposit eggs.[118] Nests have been found on lakeside beaches, flood plains, shrubby fields, road sides, gravel, and pastures. Natural nesting sites are often in short supply, especially along the west coast. Hatching generally takes place in the autumn, but in British Columbia eggs and hatchlings often over-winter in the nest and dig their way out the following spring. Survival of eggs and hatchlings can be low due to freezing and predation.[119] Female Painted Turtles reproduce about every second year, and when they do reproduce, they lay only one clutch. Adult turtles can live 30 years or more.[120]

Fossil records show that turtles have been around for over 200 million years and yet their body plan has stayed essentially the same! They have seen the dinosaurs come and go.

Ability to co-exist with Urban and Rural Development

Painted Turtles can co-exist with urban and rural development provided that suitable aquatic habitat for foraging, basking and hibernation, and adjacent upland nesting sites, still remains. This species is found in urban ponds and shallow lakes throughout its range, and migration across roads or trails to nest sites pose one of the greatest hazards to this species. Other threats include loss, degradation and pollution of wetlands, loss and degradation of upland nesting habitats due to vegetation in-growth and urbanization of waterfronts. Recreational and housing developments, disturbance of nesting and basking turtles by humans and their pets, injuries from motor boats, illegal capture, and release of alien turtle species that can introduce diseases and compete for resources are also problems.

115 Frogwatch 2013
116 Frogwatch 2013
117 Frogwatch 2013
118 BC MOTI 2010
119 BCReptiles2013
120 Frogwatch 2013

Guidelines for Conservation

- ☑ Identify and protect nesting habitats adjacent to wetlands (e.g., sites with good exposure to sun and light soils with little vegetative cover on a southern slope typically within 150 m from water).
- ☑ Preserve or enhance essential habitat features, including basking rocks and logs, in shallow water areas with emergent and floating vegetation.
- ☑ Prevent the introduction and spread of non-native animal species (e.g., introduced turtle species) which may compete for resources and carry diseases; discourage the spread of non-native plants (e.g., grasses, Himalayan Blackberry, Purple Loosestrife, Scotch Broom) which encroach on loose soils in turtle nesting habitat.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

5.4.2 Non-native Turtles

Red-eared Slider (Trachemys scripta)

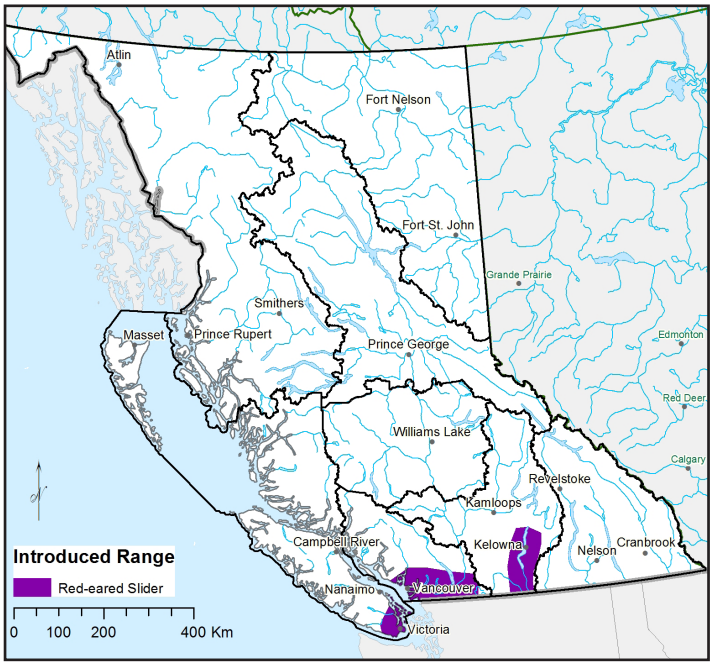

Photo: Kristiina Ovaska

Identification

- Non-native to British Columbia, invasive
- Bright yellow underside with several scattered dark spots
- Red-brown “ear” patch, located just behind the eye; may be dark brown in old turtles
- Yellow stripes on legs and neck
- Smooth, dark shell often covered with darker lines and swirls and patches of white, yellow or red
- Carapace is more domed than the Western Painted Turtle

- Males have long, curved claws used to woo females during courtship
- Maximum length of 28 cm

COSEWIC: Not Assessed

B.C. Status: Exotic

Distribution

The Red-eared Slider is native to the southeastern United States, Mexico, Central America and Brazil. It has become established on Vancouver Island, the Fraser Valley and the Okanagan through the release of pet turtles.[121] Successful breeding has not been confirmed within British Columbia, but the species appears to inhabit an increasing number of permanent wetlands in the southern part of the province.[122]

Life History and Habitat Requirements

Red-eared Sliders rarely venture from water except to lay their eggs. They prefer quiet, freshwater systems such as sluggish, shallow streams, swamps, ponds, and lakes with muddy bottoms and abundant vegetation. Partially submerged logs or rocks are important for basking.[123]

Sliders spend the winter hibernating in muskrat burrows, hollow logs or in mud at the bottom of ponds. When ponds warm in the spring, male Sliders try to attract females with courtship displays, including swimming backwards in front of the female with forelegs stretched out, palm-side out, waving his long claws. If he is accepted, the pair sinks to the bottom where breeding occurs.[124]

Within their natural range, sliders first nest when they are 5–7 years old.[125] Female Red-eared Sliders dig nests close to water in damp soil with sparse vegetation in the summer. After laying 4–23 eggs, the female piles dirt over the nest. Eggs incubate for 60–70 days. More than one clutch may be laid in a single year In B.C., it is thought that eggs do not hatch as it is not warm enough. Red-eared Sliders typically live for 20–40 years.

Immature Red-eared Sliders are carnivorous and prey on small fish, tadpoles, small frogs, and invertebrates. Most of their hunting takes place around sunrise, at a depth of 1–3 m. As adults, Sliders become more omnivorous. They are known to skim for algae and eat other aquatic plants, as well as crayfish, snails, frogs, and dead and decaying matter.[126] Red-eared Sliders are predated upon by crows, river otters, mink, skunks, raccoons, fish, frogs, snakes, large turtles, and wading birds. Because Sliders eat many of the same foods as the native Western Painted Turtle, biologists are concerned that they may out-compete and adversely impact already decreasing populations of Western Painted Turtle and many amphibians. There is also concern about introducing diseases to native turtles.

121 BCReptiles 2013
122 Bunnell 2005
123 Frogwatch 2013
124 Frogwatch 2013
125 Frogwatch 2013
126 BCReptiles 2013

Compatibility with Human Landscapes

Red-eared Sliders can co-exist with urban and rural development in southern British Columbia. To protect native species of amphibians and reptiles, the best course of action is to not release them into local ponds and wetlands.

See **Section 5.7** for Guidelines to Prevent the Introduction and Spread of Non-native Species.

5.5 Lizards

5.5.1 Family *Anguidae* – Alligator Lizards

Northern Alligator Lizard (Elgaria coerulea principis)

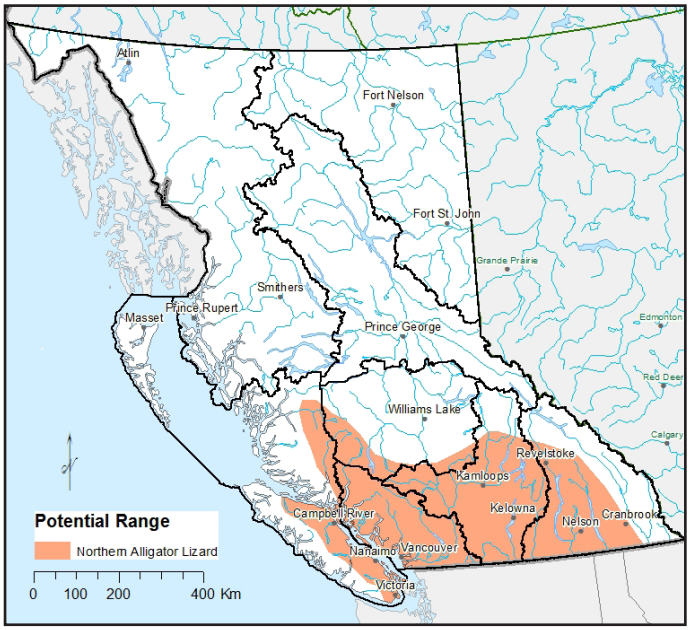

Photo: ©Jared Hobbs

COSEWIC: Not at risk
B.C. Status: Yellow-listed

Identification

- The Northwestern Alligator Lizard (family *Anguidae*) is the most widespread and common lizard in B.C.
- Total length up to 20 cm
- Short-legs, long-body, triangular head
- Brown in colour; pale belly, may have dark blotches or broad bronzy stripe down centre of back
- Obscure fold of skin running down each side; allows body to expand when breathing or full of food or eggs
- Juveniles often are more metallic looking, with black sides and bronze back
- If caught, may release a smelly mixture, bite, or 'release' its tail; tail regenerates over time

Distribution

The Northern Alligator Lizard occurs in southern British Columbia, along the coast to central California in the west, and along the Rocky Mountains south to northwestern Montana in the east. In British Columbia, this species is found in the southern portion of the province, including Vancouver Island.

Life History and Habitat Requirements

The Northern Alligator Lizard is more tolerant of cold, damp conditions than most lizards. Northern Alligator Lizards live in a variety of habitat types, including montane forests, dry Garry Oak woodlands, grasslands, and riparian zones of streams, creeks or ocean habitats.[127] However, they typically inhabit open rocky areas near woods or forest openings. These lizards are known to use abandoned buildings for cover and roadsides for basking. They may be seen basking in the sun on rocky outcrops or talus slope, but will quickly retreat into refuges if disturbed. They are most easily found under the cover of rocks, bark or logs. They spend the winter hibernating in underground dens. They often share their habitat with the Common Garter Snake and Western Terrestrial Garter Snake.[128] In one B.C. study, Northern Alligator Lizards remained near their hibernacula year-round.

Northwestern Alligator Lizards feed on beetles, caterpillars, grasshoppers, spiders, snails, scorpions, and millipedes. Juveniles feed on the same prey species as adults, but choose smaller size prey.[129]

The Northern Alligator Lizard begins mating after emerging from the den in spring. Males actively court females, then breed; the young then develop inside the female's body. Females give birth to approximately seven live young in late summer. Female Alligator Lizards mate every two years on average, as they require a year after breeding to eat, grow, and regain their stores of body fat.[130]

Ability to co-exist with Urban and Rural Development

Northern Alligator Lizards can co-exist with urban and rural development provided that sufficient habitat and abundant cover are available. This lizard is found in rural and residential areas throughout its range and can also be found in urban parks. They are one of the more resilient reptile species in B.C. and unlike other species they can benefit from some level of forest disturbance.[131] Threats in the urban environment include mowing of tall grass, rock removal for road construction or landscaping, human disturbance, and predation by cats. Non-native lizards, such as the Common Wall Lizard in and around Victoria, might also threaten this species by introducing diseases and competing for refuges, basking sites or food. The introduced Cinnabar Moth (*Tyria jacobaeae L.*) was released to control Ragwort on Vancouver Island and has proven to be poisonous to Northern Alligator Lizards. This may pose a threat. The

127 BCReptiles 2013
128 BCReptiles 2013
129 BCReptiles 2013
130 BCReptiles 2013
131 BCReptiles 2013

Northern Alligator Lizard is the main host of young stages of the tick *Ixodes pacificus*, which at high densities can cause anemia and general irritation in wild animals and livestock.

Guidelines for Conservation

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

- ☑ Protect south-facing, rocky slopes, used as basking, hibernation, or nursery sites.
- ☑ Preserve essential habitat features including talus, rocky outcrops with fissures and coarse woody debris, which provide shelter.
- ☑ Prevent the introduction and spread of non-native species (e.g., European Wall Lizard).
- ☑ Keep cats indoors so they do not prey on Northern Alligator Lizards.

5.5.2 Family *Phrynosomatidae* - Horned Lizards

Pygmy Short-horned Lizard (Phrynosoma douglasii douglasii)

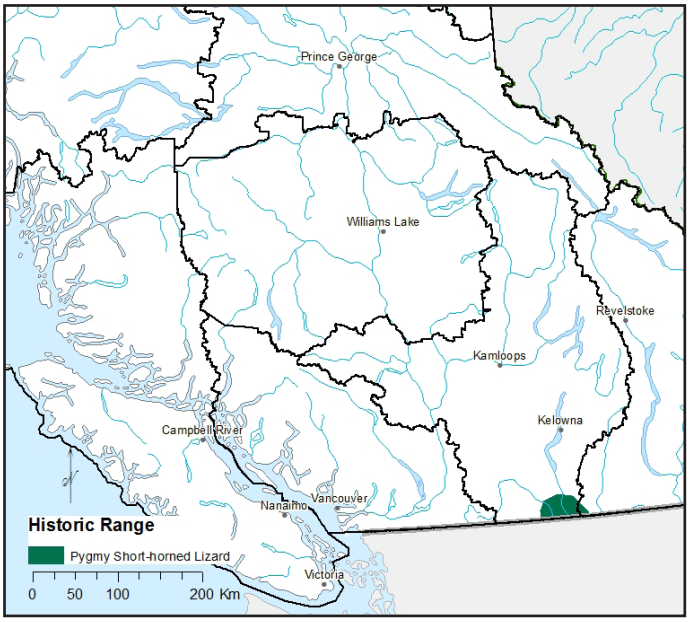

Photo: ©Jared Hobbs

Identification

- Squat lizard with a flattened body, short legs, and a short tail
- Smaller than British Columbia's other lizard species; maximum size is 12 cm from tip of the nose to tip of the tail
- Readily identified by the many spines on its back and side, a row of spines between each front and hind leg, and short stout horns[132]
- Brownish-beige in colour with variable dark markings and a pale belly.

132 BCReptiles 2013

Distribution

The range of the Pygmy Short-horned Lizard consists of the Great Basin and surrounding areas from northern California and Nevada through eastern Oregon and Washington, and most of southern and eastern Idaho. It was once found in the extreme south-central part of British Columbia, in the Okanagan and Similkameen Valleys but is now considered to be extirpated in Canada as no confirmed observations have been made in the last 100 years.[133]

COSEWIC: Extirpated (Apr 2007)
B.C. Status: Red

Life History and Habitat Requirements

Pygmy Short-horned Lizards prefer Bunchgrass, Sagebrush and dry, open forest ecosystems.[134] If too much vegetation is present, it makes it difficult for them to burrow into the soil. South-facing slopes are favoured, as are loose and sandy soils. These lizards do not appear to over-winter in rocky dens (hibernacula); instead, they seem to dig burrows in deep sandy soils.

The Pygmy Short-horned Lizard hunts during the day and their primary prey is ants, especially Harvester Ants. Other invertebrates, such as grasshoppers, beetles and snails are also eaten. Birds, snakes, coyotes, and weasels prey upon Pygmy Short-horned Lizards. The first defense strategy is to remain motionless, to take advantage of their cryptic colouration and texture. If detected, the lizards can run from slowmoving predators or inflate their bodies and make intimidating gestures.[135]

When Pygmy Short-horned Lizards feel threatened, the lizard will inflate its body and open its mouth wide. This makes it look like a puffy, ball of spikes and horns. BCReptiles 2013

Mating occurs in the spring after emerging from the hibernacula. The Pygmy Short-horned Lizard gives birth to live young, rather than laying eggs. Five to 10 young are born between July and September. Males likely reach sexual maturity after their first hibernation; females likely require another year. Females can live five years or perhaps longer.[136] [137]

Compatibility with Human Landscapes

It is unlikely that Pygmy Short-horned Lizards would be able to co-exist with urban and rural development. The dry grassland habitat on which this species depended is one of the rarest habitat types in B.C., making up only 6% of the province's land area. Horned lizards are vulnerable to habitat loss and are not very adaptable to changes in their environment. They evolved a physiology and behaviours that bond them to arid environments; irrigating grasslands produces dense mats of grass and vegetation and destroys the crumbly soils that the lizards need for digging. Changes such as colonization by invasive plants or the planting of agricultural species also renders habitat unsuitable. [138]

See **Section 3** for guidelines that benefit multiple species.

133 COSEWIC 2007
134 BCReptiles 2013
135 COSEWIC 2007
136 CARCNET 2013
137 BCReptiles 2013
138 COSEWIC 2007

5.5.3 Non-native Lizards

European Wall Lizard (Podarcis muralis)

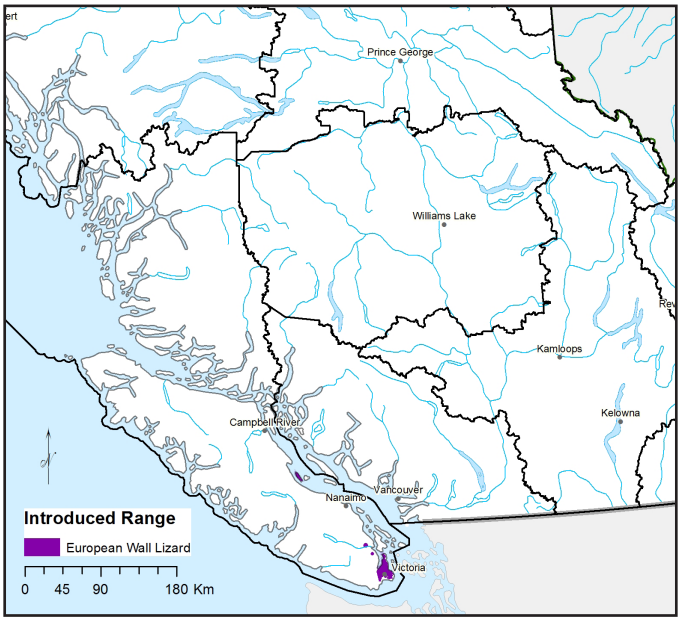

Photo: ©Jared Hobbs

COSEWIC: Not Assessed
B.C. Status: Exotic

Identification

- Non-native, introduced to British Columbia
- Relatively flattened body with long limbs and long toes (distinguishing characteristic from the Northern Alligator Lizard)
- Angular head with a prominent jaw
- Males are 16-23 cm in length; females usually slightly smaller in length and weight
- Tail is twice as long as the body
- Females are grey-brown with light green speckle pattern
- Males have black and green spots across the back; young are coppery gold
- Tail is brown, grey- or rust-coloured; may have light bars on the sides
- Belly region has six rows of larger rectangular scales that are generally red, pink, or orange
- Generally darker and quicker than Northern Alligator Lizards[139]

Distribution

European Wall Lizards are endemic to continental Europe and western Asia. In the 1970s, a few Wall Lizards were released in west Saanich on Vancouver Island when a private zoo closed.[140] They now number in the thousands. European Wall Lizards are very common on the Saanich Peninsula, in Metchosin, and in some other areas of Vancouver Island and Denman Island.

139 Royal BC Museum 2013
140 CARCNET 2013B

Human activity is likely assisting with species dispersal, for example through release of pets or inadvertent transportation on horse trailers and hay bales.

Life History and Habitat Requirements

On Vancouver Island, Wall Lizards are associated with human habitation, horse farms, rock piles, fence rows, and bridges. They are commonly found under cover, and scatter when their shelter is moved.

Females on Vancouver Island lay clutches of 3–8 eggs per summer, and gravid females are found from May to July. Although multiple clutches may be produced elsewhere, there is no evidence of multiple clutches from Vancouver Island.[141] Eggs are deposited under cover, in shallow burrows, and females may nest communally. Up to 65 eggs have been found together in west Saanich and communal nests appear to be re-used each year. Eggs incubate for 9–11 weeks. Hatchlings appear in late July.

On Vancouver Island, European Wall Lizards usually hibernate between November and March. However, they may be seen basking in the open on warm, sunny days during the winter. Mating occurs shortly after the lizards come out of hibernation, usually in mid-March.[142]

Wall Lizards are active predators, feeding on small invertebrates such as spiders and insects.[143] Their predators include garter snakes, crows, gulls, hawks, and house cats. If attacked, a Wall Lizard's tail will break off at a fracture plane, distracting the predator while the lizard escapes. A new tail eventually regenerates.

European Wall Lizards live in some of the same areas as the native Northwestern Alligator Lizard. Little is known about the effects of Wall Lizards on Alligator Lizards. As they share habitat and eat similar prey there is potential for competition.[144]

To prevent the spread of Wall Lizards, it is important to never move them; even a short distance.

Compatibility with Human Landscapes

Wall Lizards readily co-exist with urban and rural development, and tend to be found in association with human habitation. In recent years, Wall Lizards have spread into grassy habitats. It is possible that this is because existing habitats are over-populated and competition within the species is forcing these lizards to explore new environments.[145]

See Section 5.7 for Guidelines to Prevent the Introduction and Spread of Non-native Species.

141 CARCNET 2013B
142 BCReptiles 2013
143 CARCNET 2013B
144 BCReptiles 2013
145 CARCNET 2013B

5.6 Skinks

5.6.1 Family *Scincidae* – Skinks

Western Skink (Plestiodon skiltonianus)

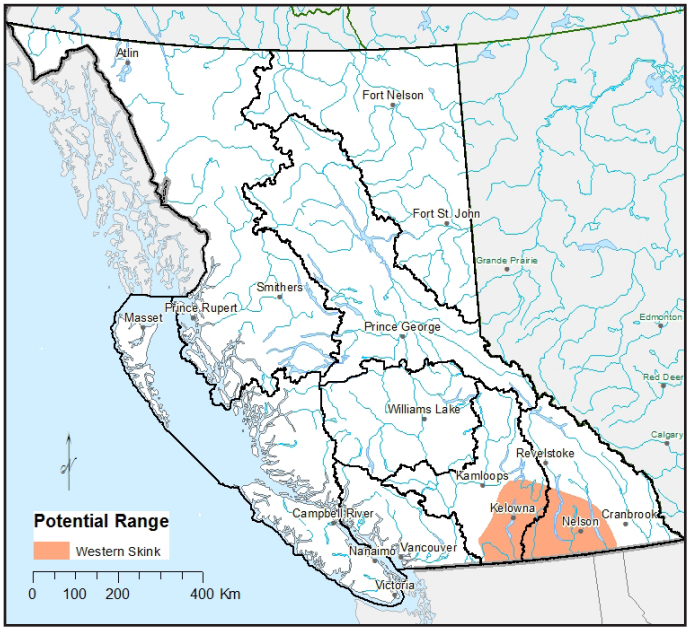

Photo: Jakob Dulisse

COSEWIC: Special concern
B.C. Status: Blue-listed

Identification

- The Western Skink (family *Scincidae*) is B.C.'s only representative from this family
- Total length of up to 20 cm
- Long, narrow pointed head, long body; short legs; smooth, shiny scales
- Brown back; grey sides; four creamy stripes run from head to tail, two along the back, one along each side; colours are most striking on juveniles
- Most striking feature of a juvenile is bright blue tail; normally longer than the body
- Some (e.g., males in breeding season) develop reddish patches on the chin and sides of the head seasonally
- If threatened, will escape under cover
- If grabbed, skink will bite and then release its tail, which regenerates over time

Distribution

The Western Skink is found in south-central British Columbia, south to Baja California, Mexico. Skinks inhabit many of the same habitats as the Northwestern Alligator Lizard and where they coexist, skinks appear to be the less abundant species.[146]

146 BCReptiles 2013

Life History and Habitat Requirements

The Western Skink may be found in Bunchgrass, Ponderosa Pine and Interior Douglas-fir ecosystems.[147] It generally prefers habitats that are moist with plenty of plant cover and are especially common along riverbanks. This species requires rocks, logs, stumps, and bark for foraging and cover. Sunny openings are important for basking, and south-facing slopes and rocks are required for nesting and hibernacula.[148] The Western Skink is active during the day but very secretive. It is rarely seen basking in the sun. During winter, Western Skinks hibernate in communal dens with other skinks, Northwestern Alligator Lizards, Rubber Boas, and possibly Rattlesnakes.[149] The Western Skink typically has a very small home range. They do not travel far from their hibernacula and are often found under rocks, decaying wood or sometimes burrowed into soft soil.

The Western Skink feeds on caterpillars, moths, beetles, grasshoppers, and crickets, as well as spiders.[150] It is also known to eat earthworms and be cannibalistic.

Mating occurs in spring upon emergence from hibernation. Skinks feed and mate within a small area around their dens. Females lay 2–5 eggs in nests under cover usually in July or August. Females care for and defend their eggs until they hatch in mid-August.[151]

Ability to co-exist with Urban and Rural Development

The Western Skink can co-exist with rural and suburban development provided that shelter is available, and the area is in close proximity to wooded hillsides with downed logs and rocks. For example, around Nelson, the Western Skink is found in rural residential areas. It is important to maintain areas with soft soil for egg-laying and to ensure that there is availability of sufficient cover. The main threat to this species is increasing loss of habitat due to urban and agricultural development.[152] Collection for the pet industry and predation by cats might also threaten the species. Skinks are particularly sensitive to human activities and have a low population size.

Guidelines for Conservation

- ☑ Preserve sunny forest openings, riverbanks and adjacent open rocky areas within occupied or suitable habitats
- ☑ Protect south-facing, rocky slopes, used as basking, hibernation, or nursery sites.
- ☑ Preserve essential habitat features including native vegetation, rocks, logs, stumps, and bark for foraging and cover
- ☑ Prevent the introduction and spread of non-native species (e.g., Spotted Knapweed and Dalmatian Toadflax) which reduce skink habitat quality.

See **Section 3** for guidelines that benefit multiple species. Specific guidelines for this species are listed here.

147 BCReptiles 2013
148 BCReptiles 2013
149 BCReptiles 2013
150 BCReptiles 2013
151 BCReptiles 2013
152 BCReptiles 2013

- ☑ Avoid fire suppression in occupied or suitable habitat range as it reduces the number and size of sunny openings required by the skink.
- ☑ Keep cats indoors.

5.7 Introduced Species

Introduced species are those that are non-native to an ecosystem.

In British Columbia, introduced amphibian and reptile species of concern are American Bullfrog, Green Frog, European Wall Lizard, and Red-eared Slider (turtle). These species were accidentally or purposely released into natural environments and have since spread.

The full impact of these introductions is not known. In general, introduced species are much more adaptable to humans and their activities than the more specialized native species and they can quickly become the most prevalent species in an ecosystem. Introduced species interrupt the natural food web process through competition and direct predation. The Bullfrog creates serious ecosystem impacts as it competes with and predates on native amphibians, snakes and even birds. Once established in an area, the Bullfrog is virtually impossible to eliminate as it is a prolific breeder and spreads easily to nearby ponds. Introduced species also bring new diseases and parasites, such as the infective *chytrid* fungus carried by Bullfrogs.

Although some introduced species may not seem be harmful, all must be treated with caution. For example, the Red-eared Slider (a pet that is often released as they are not good pets) likely cannot produce young in B.C. as temperatures are too cold for hatching, however it competes with the Western Painted Turtle for limited basking and nesting areas and may be a disease carrier. The European Wall Lizard has spread rapidly within the Victoria area and there are now reports of this lizard in Duncan and Nanaimo. The European Wall Lizard may compete with the shyer and more vulnerable Northern Alligator Lizard, which is already vulnerable to cat predation and loss of habitat.

5.7.1 Guidelines to Prevent the Introduction and Spread of Non-native Amphibians and Reptiles

The best approach is to prevent both intentional and accidental introductions of alien species into natural environments.

Bullfrog and Green Frogs

- ☑ Never transport Bullfrogs or Green Frogs from one pond to another. While the large tadpoles are tempting "pets" for children or for gardeners who want some life in their backyard pond, this kind of "bucket-brigade" transport seems to be one of the primary ways that Bullfrogs are spreading in B.C. Bullfrogs are considered "wildlife" in B.C., and it is illegal under the Wildlife Act to transport, keep or sell them. However they can be killed humanely (through direct trauma or anesthetic) without a permit.[153]
- ☑ Never move native frogs or frog spawn—this creates a risk of accidentally transporting an introduced species, as well as killing the eggs or accidentally spreading frog diseases.
- ☑ Limit the creation of permanent pond habitats (e.g., backyard ponds, golf courses) and drain such ponds annually. Bullfrog tadpoles are aquatic and take two years to mature into frogs that can hop to new spots.
- ☑ Drain water to avoid pooling at sites where it collects during construction, at gravel pits, or along roadways. These places are often favored by non-native species.

For more information on Bullfrog control see http://www.bullfrogcontrol.com/

Never move ntive frogs or spawn.

Coastal Tailed Frog tadpole.
Photo: Alexis McEwan

153 BC Frogwatch

- ☑ Use only native plant species in human-made ponds .
- ☑ Avoid fish stocking in amphibian habitats, as Bullfrogs are found in association with introduced perch and carp.
- ☑ Display educational signage regarding the illegal capture and release of animals, and the threats that introduced species pose to native biodiversity.
- ☑ Keep a look out and report sightings of non-native species to Frogwatch. If non-native species are detected early on, then techniques such as catching then humanely killing them may be effective.

Red-eared Slider and Common Wall Lizard

- ☑ Display educational signage regarding the illegal capture and release of animals, and the threats that non-native species pose to native biodiversity.
- ☑ Discourage the sale of turtles in pet stores; turtles do not make good pets.
- ☑ Prevent transport of non-native species between habitats. Watch out for Wall Lizards in horse trailers and loads of material where they have already established to make sure that they are not accidentally transported.
- ☑ Restore areas adjacent to development sites to their original natural condition to facilitate native species persistence.
- ☑ Report sightings of Sliders and Wall Lizards to Frogwatch.

Glossary

Aestivation: The lack of or slowing of activity and metabolism during hot, dry season such as summer; summer dormancy. Similar to hibernation, it is characterized by inactivity and a lowered metabolic rate. Some species of amphibians and reptiles burrow into earth or mud and reside in a dormant state until the danger of excessive heat and drying out is passed.

Alien species: Plants, animals and micro-organisms from one part of the world that are transported beyond their natural range and become established in a new area. They are sometimes also called 'exotic', 'introduced', 'non-native', or 'non-indigenous' species. Some alien species are also invasive. These are the species that are of concern.

Biodiversity: The variety of life on earth in all its forms including genes, species, and ecosystems and the natural processes that link and maintain them.

Biomagnification: The increasing concentration of a substance, such as a toxic chemical, in the tissues of organisms at successively higher levels in a food chain. As a result of biomagnification, organisms at the top of the food chain generally suffer greater harm from a persistent toxin or pollutant than those at lower levels.

Buffer: An area of land that surrounds and protects an ecosystem or species from the adverse effects of activities on, or encroachment from, adjacent land.

Due diligence: The level of judgment, care, prudence, determination, and activity that a person would reasonably be expected to undertake under certain circumstances.

Guidelines: A set of recommended or suggested methods or actions that should be followed in most circumstances to assist administrative and planning decisions, and their implementation in the field. Guidelines may consist of policy statements, procedures, or checklists. They are provided as a broad framework of recommended actions to be taken and, therefore, provide some flexibility for decision making. Note that guidelines cannot, by definition, be mandatory; such actions are prescribed by regulations or rules. (Dunster and Dunster 1996).

Ectothermic: Deriving body heat from the environment (as do amphibians and reptiles) rather than through physiological means (as do birds and mammals). Ectothermic animals are sometimes referred to as "cold-blooded"; however, this term is a misnomer, as their blood is not necessary any cooler than that of "warm-blooded" birds and mammals; where suitable temperatures are available in the environment, many reptiles can maintain their body temperature within relatively narrow limits through behavioural means.

Endemism: Organisms that are native to a particular area and found nowhere else.

Endothermic: Able to maintain a constant, warm body temperature, regardless of external temperatures. Endothermic animals must generate their own heat to maintain their body temperature. These animals are commonly referred to as

"warm-blooded." An animal that is endothermic is categorized as an endotherm, and this includes all mammals.

Emergent vegetation: An aquatic plant with stem and leaves above the water.

Fossorial: Adapted to life underground.

Habitat: The place where an organism lives, and/or the conditions of that place, including the soil, vegetation, water, and food.

Herpetologist: A biologist who specializes in the study of reptiles and amphibians.

Hibernaculum: The location chosen by an animal for hibernation. Hibernation sites must be frost-free, humid (but not wet) and safe from flooding and predators. Hibernation usually takes place underground, for example in rodent burrows, rotted tree stumps and crevices in rocky outcrops.

Hibernation: A physiological state characterized by reduced metabolic activity that allows an animal to survive cold seasons with little or no food.

Humus: Organic matter in soil.

Hydrology: The science of water, its properties, and movement (water cycle) over and under land surfaces.

Hydroperiod: Interval of time that an area has water.

Important habitats: All sites, aquatic and terrestrial, that amphibians and reptiles use for essential life-history activities (i.e., food, shelter, reproduction).

Invasive species: Plants, animals, and micro-organisms that colonize and take over the habitats of native species. Most invasive species are also alien (non-native) to the area and can become dominant because the natural controls (e.g., predators, disease) that kept their populations in check in their native environment do not occur in their new location.

Larvae: Free-living aquatic young of amphibians. Larvae of frogs are called tadpoles, whereas those of salamanders are referred to simply as larvae.

Metamorphosis: Transformation of aquatic amphibian larvae into terrestrial forms; larval tissues and organs undergo major reorganization at this time.

Metapopulation: A population that is divided into smaller subpopulations within the landscape; the persistence of the metapopulation depends on some degree of dispersal between these subpopulations; many amphibian populations, in particular, appear to be organized as metapopulations.

Monitoring: The processes and activities that need to take place to characterize and monitor the quality of the habitat.

Philopatry: Affinity to a particular site.

Professional biologist: A biologist registered in B.C. under the College of Applied

Biology Act, and acting under the College's code of ethics and subject to disciplinary action by the college, and who, through demonstrated suitable education, experience, accreditation and knowledge relevant to the particular matter, may be reasonably relied on to provide sound advice within their area of expertise.

Riparian: Relating to or inhabiting the banks of a natural course of water. Riparian zones are ecologically diverse and contribute to the health of other aquatic ecosystems by filtering out pollutants and preventing erosion.

Sink habitats: Habitats that may attract animals but where their reproduction or subsequent survival of young is poor; these habitats contribute few or no immigrants to the surrounding areas.

Thermoregulation: The process of obtaining heat from the environment. Most reptiles thermoregulate by moving to warm sites when cold and to cool sites when hot.

Species at risk: A species that has been defined as 'at risk' [of extirpation] by either the federal or provincial government.

Federally listed: The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) maintains a list of species that are designated as Extirpated, Endangered, Threatened, or of Special Concern. Those species listed by the Species at Risk Act are protected on federal lands.

Extirpated: Locally extinct. The species no longer exists in the wild in that area although it still occurs elsewhere.

Endangered: A species facing imminent extirpation (local extinction) or extinction.

Threatened: A species likely to become endangered if limiting factors are not reversed.

Special Concern: A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

Not at Risk: A species that has been evaluated and found to be not at risk. Not Listed: A species for which there is no present need for evaluation.

Provincially ranked: The British Columbia government maintains a ranking of species considered to be Red-listed, Blue-listed, and Yellow-listed in the province. Yellow-listed species are not at risk. Species at risk can now be listed under the *Wildlife Amendment Act 2004.*

Red-listed: Includes any indigenous species or subspecies that have, or are candidates for, Extirpated, Endangered, or Threatened status in British Columbia. Extirpated taxa no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Not all Red-listed taxa will necessarily become formally designated. Placing taxa on these lists flags them as being at risk and requiring investigation.

Blue-listed: Includes any indigenous species or subspecies considered to be of Special Concern (formerly Vulnerable) in British Columbia. Taxa of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened.

Yellow-listed: Includes species that are apparently secure and not at risk of extinction. Yellow-listed species may have Red- or Blue-listed subspecies.

Vernal pool: A temporary body of freshwater that is filled by spring rains and snowmelt but which dries up during the summer or fall. Many vernal pools are filled again by autumn rains and may persist throughout the winter.

Wetland: Land that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support vegetation that is typically adapted to saturated soil conditions. Types of wetlands include swamps, marshes, bogs, fens, vernal pools, and salt water marshes.

Wildlife corridor: A travel corridor for wildlife. Wildlife corridors range from very wide, natural corridors for large mammals, to 'sky corridors' that offer a safe flight path between feeding and resting places for birds, to smaller man-made corridors (such as urban trails or culverts under roads) that provide safe passage for smaller creatures. These corridors also provide year-round habitat for less mobile species.

Appendix 1. Useful Links

AmphibiaWeb http://amphibiaweb.org/

Amphibian Web. University of Berkley, California. http://elib.cs.berkeley.edu/aw/lists/

Amphibian disease and Interim Hygiene Protocols: http://www.env.gov.bc.ca/wld/frogwatch/ecology/diseases.htm

B.C. Conservation Data Centre. http://www.env.gov.bc.ca/cdc/

B.C. Ministry of Environment Water Quality – Municipal Best Management Practices. http://www.env.gov.bc.ca/wat/wq/nps/BMP_Compendium/Municipal/Municipal_Home.htm

B.C. Ministry of Environment Endangered Species and Ecosystems. http://www.env.gov.bc.ca/atrisk/

B.C. Ministry of Environment Identified Wildlife Management Strategy. http://www.env.gov.bc.ca/wld/frpa/iwms/index.html

B.C. Ministry of Environment Species Inventory Database http://www.env.gov.bc.ca/wildlife/wsi/siwe.htm

B.C. Frogwatch Program. http://www.env.gov.bc.ca/wld/frogwatch/index.htm

B.C. Resources Information Standards Committee (standard inventory methods for elements of British Columbia's biodiversity). http://www.ilmb.gov.bc.ca/risc/

BC Hydro Fish and Wildlife Compensation Program http://www.bchydro.com/toolbar/about/sustainability/environmental_responsibility/compensation_programs.html

Canadian Amphibian and Reptile Conservation Network (CARCNET). http://www.carcnet.ca/english/index.php

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). http://www.cosewic.gc.ca/index.htm

Conservation Covenants http://wcel.org/conservation-covenants

E-fauna B.C. http://www.geog.ubc.ca/biodiversity/efauna/amphibians.html and http://www.geog.ubc.ca/biodiversity/efauna/reptiles.html

Habitat Atlas for Wildlife At Risk. South Okanagan and Lower Similkameen. http://www.env.gov.bc.ca/okanagan/esd/atlas/index.html

Habitat Capability Mapping http://www.ilmb.gov.bc.ca/risc/pubs/teecolo/whrs/whrs-06.htm

NatureServe. http://www.natureserve.org/

Partners in amphibians and reptiles conservation. Habitat Management Guidelines. Available from http://www.parcplace.org/publications/habitat-management-guidelines.html

Recovery Planning http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm

Reptiles of British Columbia website http://www.bcreptiles.ca/

Resource Information Standards Committee http://www.ilmb.gov.bc.ca/risc/about.htm

Salvage permits checklist http://www.env.gov.bc.ca/pasb/applications/docs/salvage-information.pdf

Sensitive Ecosystems Inventories http://www.env.gov.bc.ca/sei/

SARA Species at Risk Public Registry http://www.sararegistry.gc.ca/sar/index/default_e.cfm

TransWild Alliance (protecting wildlife on highway crossings). http://transwildalliance.org/

Wildlife Inventory (holders of Wildlife permits are required to submit data) http://www.env.gov.bc.ca/wildlife/wsi/index.htm

Wildlife Permits: http://www.env.gov.bc.ca/pasb/applications/process/wildlife.html

Wildlife Crossing Toolkit (US National Parks Service) http://www.fs.fed.us/wildlifecrossings/

Legislation

Provincial legislation can be accessed from http://www.bclaws.ca/

B.C. Wildlife Act http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01

B.C. Forest and Range Practices Act http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_02069_01

B.C Community Charter http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/03026_00

B.C. Local Government Act http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/96323_00

Riparian Areas Regulation http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/376_2004

Federal legislation can be accessed from http://laws-lois.justice.gc.ca/eng/acts/

Species at Risk Act http://laws-lois.justice.gc.ca/eng/acts/S-15.3/page-1.html

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