PROPOSED

Species at Risk Act
Management Plan Series
Adopted under Section 69 of SARA

Management Plan for the Western Skink (*Plestiodon skiltonianus*) in Canada

Western Skink

2014

Canada

Recommended citation:

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

Cover illustration: Elizabeth Vincer

Également disponible en français sous le titre
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MANAGEMENT PLAN FOR THE WESTERN SKINK (*Plestiodon skiltonianus*) IN CANADA

2014

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

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

The federal management plan for the Western Skink (*Plestiodon skiltonianus*) in Canada consists of two parts:

Part 1 - Federal Addition to the "Management Plan for the Western Skink (*Plestiodon skiltonianus*) in British Columbia", prepared by Environment Canada

Part 2 - "Management Plan for the Western Skink (*Plestiodon skiltonianus*) in British Columbia", prepared by the B.C. Western Skink Working Group

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Part 1 - Federal Addition to the “Management Plan for the Western Skink (*Plestiodon skiltonianus*) in British Columbia”, prepared by Environment Canada

PREFACE

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

The Minister of the Environment is the competent minister under SARA for the Western Skink and has prepared this management plan (Part 1) as per section 65 of SARA. It has been prepared in cooperation with the B.C. Ministry of Environment. SARA section 69 allows the Minister to adopt all or part of an existing plan for the species if it meets the requirements under SARA for the content. The B.C. Ministry of Environment led the development of the attached management plan for the Western Skink (part 2) in cooperation with Environment Canada.

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

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

ADDITIONS AND MODIFICATIONS TO THE ADOPTED DOCUMENT

The following sections have been included to address specific requirements for federal recovery documents that are not addressed in the "Management Plan for the Western Skink (*Plestiodon skiltonianus*) in British Columbia" (Part 2).

Species Status Information

This section augments the "Species Information" (section 3) provided in the B.C. Ministry of Environment management plan.

COSEWIC (2002) does not provide an estimated percentage for the global range of this species in Canada. According to the B.C. Western Skink Working Group (2013), the Western Skink is restricted to B.C. in the Columbia, Shuswap, Kettle, Okanagan, and Similkameen drainages.

Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or achievement of any of the Federal Sustainable Development Strategy's (FSDS) goals and targets.

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

Negative impacts to the environment and other species are not anticipated. Actions to manage and protect Western Skink (e.g., inventory, education, threat mitigation, habitat conservation) will promote the conservation of other species using those habitats, including other SARA-listed species (e.g., Desert Nightsnake [*Hypsiglena chlorophaea*], Western Rattlesnake [*Crotalus oreganus*], Great Basin Gopher Snake [*Pituophis catenifer deserticola*], Rubber Boa [*Charina bottae*], Western Yellow-bellied Racer [*Coluber constrictor mormon*]).

REFERENCES

B.C. Western Skink Working Group. 2013. Management Plan for the Western Skink (*Plestiodon skiltonianus;* formerly *Eumeces skiltonianus*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 28 pages.

COSEWIC. 2002. COSEWIC Assessment and Status Report on the Western Skink (*Eumeces skiltonianus*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. vi + 19 pages.

Part 2 - **“**Management Plan for the Western Skink (*Plestiodon skiltonianus*) in British Columbia”, prepared by the B.C. Western Skink Working Group

Management Plan for the Western Skink (*Plestiodon skiltonianus*) in British Columbia

Prepared by the B.C. Western Skink Working Group

BRITISH COLUMBIA | Ministry of Environment

June 2013

About the British Columbia Management Plan Series

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

What is a management plan?

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

What's next?

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

For more information

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

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

Management Plan for the Western Skink (*Plestiodon skiltonianus*) in British Columbia

Prepared by the B.C. Western Skink Working Group

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Cover illustration/photograph

The Western Skink cover photograph was provided by Elizabeth Vincer.

Additional copies

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

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

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Disclaimer

The B.C. Western Skink Working Group has prepared this management plan, as advice to the responsible jurisdictions and organizations that may be involved in managing the species. The British Columbia Ministry of Environment has received this advice as part of fulfilling its commitments under the *Accord for the Protection of Species at Risk in Cana*da, and the *Canada–British Columbia Agreement on Species at Risk*.

This document identifies the management actions that are deemed necessary, based on the best available scientific and traditional information, to prevent Western Skink populations in British Columbia from becoming endangered or threatened. Management actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and management approaches may be modified in the future to accommodate new objectives and findings.

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

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

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EXECUTIVE SUMMARY

The Western Skink (*Plestiodon skiltonianus;* formerly *Eumeces skiltonianus*) was designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2002. It was listed as Special Concern in Canada on Schedule 1 of the *Species at Risk Act* (SARA) in 2005. The reasons for listing included the species' small area of occupancy, apparently small population size, population fluctuations, and habitat loss due to agriculture and urban development. In British Columbia (B.C.), the Western Skink is ranked S3 (special concern, vulnerable to extirpation or extinction) by the Conservation Data Centre (CDC) and is on the provincial Blue list. The B.C. Conservation Framework ranks the Western Skink as Priority 1 under Goal 2 (prevent species and ecosystems from becoming at risk) and Priority 2 under Goal 3 (maintain the diversity of native species and ecosystems).

The Western Skink is a medium-sized (~16 cm) lizard with smooth shiny scales, a pointed head, and short legs. It has three brown stripes bordered by cream-coloured stripes that extend from the head to the base of the tail. The tails of juveniles are bright cobalt blue, which often fade in colour or become grey in older adults.

The species has a wide distribution in western North America from southern B.C. south to Baja California. In Canada, it occurs only in the Southern Interior of B.C. in the Okanagan, Shuswap, Kettle, Columbia, and Similkameen drainages. The species range extends from Creston west to Princeton and from the U.S. border north to Enderby, and possibly Sicamous, in the Shuswap drainage, and to Kootenay Lake Park in the Columbia Region. The species occupies grasslands, talus slopes, and forest openings below 1080 m elevation within its Canadian range. Important habitat attributes include forest canopy openings along south-facing slopes for solar warming of nest sites; loose soil for burrow excavation; herbaceous vegetation cover for foraging and predator avoidance; and, perhaps most important, an abundance of rocks or coarse woody debris for cover. Threats include urban and agricultural development, energy production and mining, transportation and service corridors, and natural system modifications. Although individual threats are rated as having a low impact to the species, the overall (cumulative) Threat Impact for this species is Medium.

The management goal is to maintain stable or increasing populations of the Western Skink, throughout the species' range in B.C.

The objectives are to:

1. clarify the distribution and abundance of Western Skinks throughout their range in B.C., especially in the Shuswap, Similkameen, and Kettle drainages.
2. identify regionally significant sites for habitat protection and threat mitigation.
3. address key knowledge gaps, including movement patterns, habitat trends, population trends, and habitat suitability, especially related to climate change.

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1 COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: May 2002
Common Name: Western Skink**
Scientific Name: *Eumeces skiltonianus***
COSEWIC Status: Special Concern
Reason for Designation: This species has a very small area of occupancy, apparently in low numbers, and undergoes large fluctuations in numbers. The species' Canadian range is undergoing extensive development, and habitat loss is occurring due to agriculture and urbanization. No quantitative studies have been conducted on this species; however, its restricted range, low densities, population fluctuations, and loss of habitat make it a species of concern.
Canadian Occurrence: British Columbia
COSEWIC Status History: Designated Special Concern in 2002. Assessment based on a new status report.

* Committee on the Status of Endangered Wildlife in Canada.
** Common and scientific names reported in this plan follow the naming conventions of the British Columbia Conservation Data Centre, which may be different from names reported by COSEWIC.

2 SPECIES STATUS INFORMATION

Western Skink[a]		
Legal Designation:		
FRPA:[b] No OGAA:[b] No	B.C. *Wildlife Act*:[c] Schedule A	SARA Schedule: 1– Special Concern (2005)
Conservation Status[d]		
B.C. List: Blue B.C. Rank: S3 (2012)	National Rank: N3 (2011)	Global Rank: G5 (2005)
Other Subnational Ranks:[e] AZ: S1; CA: S5; ID: S5; MT: S3; NV: S4; OR: S5; UT: S4; WA: S5		
B.C. Conservation Framework (CF)[f]		
Goal 1: Contribute to global efforts for species and ecosystem conservation.		Priority:[g] 6 (2009)
Goal 2: Prevent species and ecosystems from becoming at risk.		Priority: 1 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.		Priority: 2 (2009)
CF Action Groups:	Compile Status Report; Monitor Trends; Planning; Send to COSEWIC; Habitat Protection; Habitat Restoration; Private Land Stewardship; Species and Population Management	

[a] Data source: B.C. Conservation Data Centre (2013) unless otherwise noted.
[b] No = Not listed in one of the categories of wildlife which require special management attention to address the impacts of forest and range activities on Crown land under the *Forest and Range Practices Act* (FRPA; Province of British Columbia 2002) and/or the *Oil and Gas Activities Act* (OGAA; Province of British Columbia 2008).
[c] Schedule A = designated as wildlife under the B.C. *Wildlife Act*, which offers it protection from direct persecution and mortality (Province of British Columbia 1982).
[d] S = subnational; N = national; G = global; T = refers to the subspecies level; B = breeding; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure; NA = not applicable; NR = unranked; U = unrankable. U.S. data from NatureServe (2012).
[e] Data source: NatureServe (2012).
[f] Data source: Ministry of Environment (2010).
[g] Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Species Description

The Western Skink (*Plestiodon skiltonianus*) is one of only two extant lizards that are native to B.C. The other species is the Northern Alligator Lizard (*Elgaria coerulea*) (CDC 2013). The Western Skink is a mid-sized lizard (up to 83 mm snout–vent length or about 16 cm including the tail) with smooth shiny scales, a thick neck, small head, and short legs that are characteristic of skinks (Gregory and Campbell 1984; Tanner 1988). Western Skinks have a wide brown stripe down the middle of the back, and a brown stripe on each side of the body. The brown stripes are bordered by four light cream-coloured stripes that extend from the head to the base of the tail. Two light stripes are visible from above, one on each outer side of the back. The other two stripes run along the base of each side of the body. The tail is bright cobalt blue in juveniles and fades to grey or brown as the individual ages (see cover photo). Aside from a more faded tail, adult Western Skinks have a similar colour pattern to that of juveniles (Stebbins 1985). Males and females do not exhibit strong sexual dimorphism and are similar in appearance (Rodgers and Fitch 1947), but males may develop a reddish-orange colour under the neck and chin during the breeding season in May and June. Older males often develop a broader, wedge-shaped head, which may be heavily scarred (J. Dulisse, pers. comm., 2012). Gravid females may be distinguished by a slightly fatter abdomen before laying eggs in the late summer. Western Skinks reach sexual maturity around two years of age but begin to breed actively at three years (Rodgers and Fitch 1947). They live up to approximately nine years in the wild (Hopkins 2008) in more southern areas of their North American range (e.g., Idaho).

Western Skinks are most likely to be observed during the early spring (late March and April) and into the breeding season in May and June (COSEWIC 2002). In the Okanagan Valley, during the hotter summer months (June to August depending on the year), Western Skinks are most likely to be seen in the cooler morning and evening hours as they tend to seek refuge during the hottest parts of the day (M. Sarell, pers. comm., 2012; E. Vincer, pers. comm., 2012). Although Western Skinks have been observed during the hottest parts of the day in Creston Valley (P. Rutherford, pers. comm., 2011), Dulisse and Boulanger (2008) found that detection rates drop significantly with the onset of hotter weather and Western Skinks may not be detected if an occupied site is surveyed after June.

3.2 Populations and Distribution

The Western Skink has a large range in western North America, extending from B.C. south to Baja California (Figure 1). In the United States, the species occurs west of the Rocky Mountain range in Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, and Washington. Population size is currently unknown. No research has been conducted on the population trends of this species, but Nature Serve (2012) estimates that global short term trends will remain stable or a ± 10% fluctuation in the population size, area of occupancy, range, and/or number of occurrences. The predicted long-term global trend is relatively stable or a ± 25% fluctuation in the previous metrics.

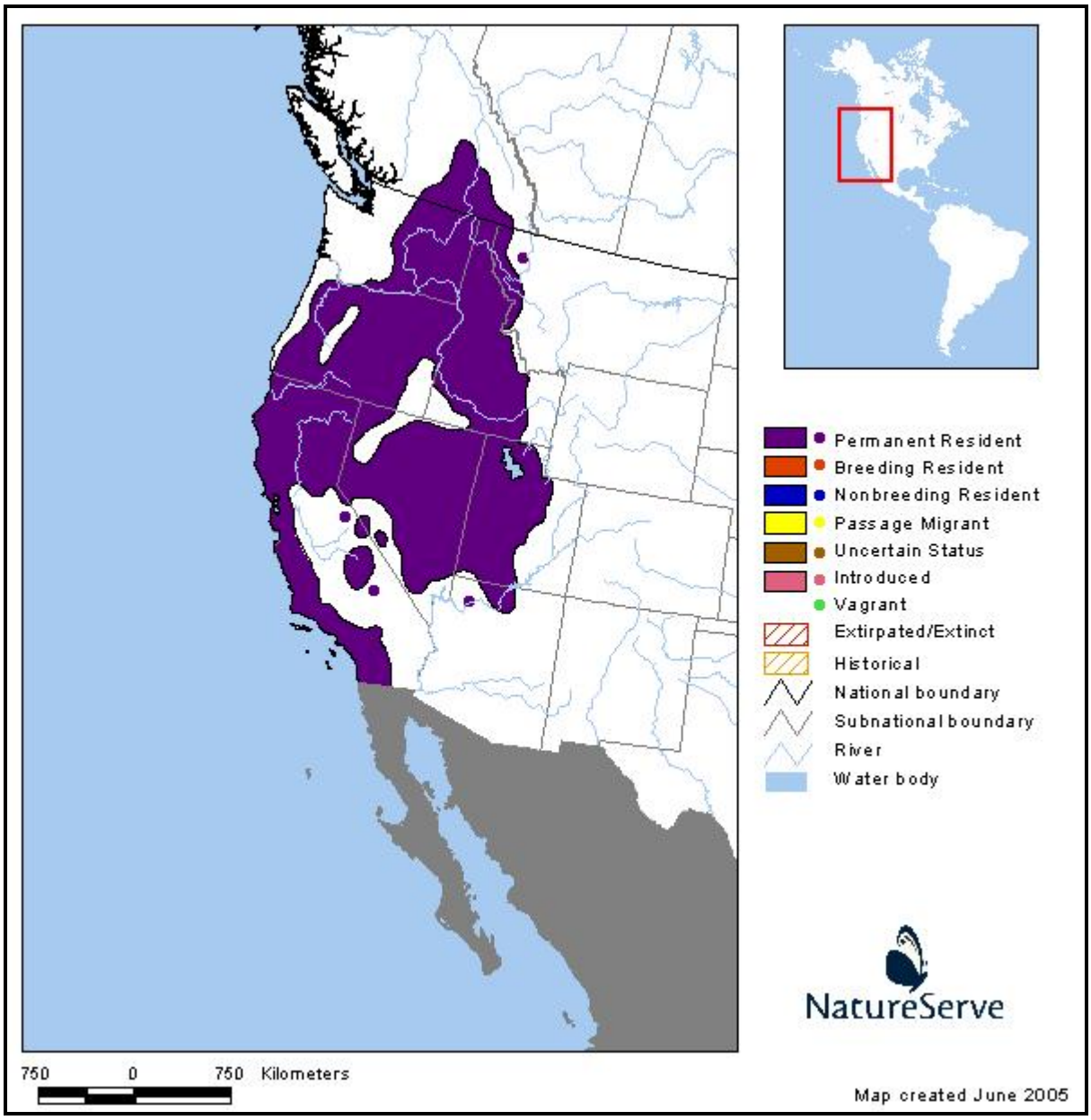

Figure 1. Western Skink distribution in North America (NatureServe 2005).

In its Canadian range the Western Skink is restricted to B.C. in the Columbia, Shuswap, Kettle, Okanagan, and Similkameen drainages. The historic range extends from Creston west to Princeton and from the U.S. border north to Enderby, and possibly Sicamous, in the Shuswap drainage and to Edgewood and Kootenay Lake Park in the Columbia drainage (Figure 2). The current distribution in the Similkameen drainage is unclear. There is one published, historic sighting at Princeton (Matsuda *et al.* 2006) and older (before 1993) anecdotal reports for the Princeton area (M. Schouten, pers. comm., 2011), Chopaka area (M. Sarell, pers. comm., 2011) and southwest of Penticton (C. Lacey, pers. comm., 2010). However, numerous field surveys for snakes in the west Okanagan and Lower Similkameen Valleys over the past 20 years in habitats suitable for Western Skinks have not detected Western Skinks to the west of the Okanagan

drainage (M. Sarell, J. Hobbs, K. Larsen, pers. comm., 2011). No formal surveys for Western Skinks have been conducted in the Princeton area to detect the presence of the species.

Reports of sightings from Vancouver Island, far from the known range of the species, are unconfirmed and considered to be errors or escaped pets (COSEWIC 2002) and therefore not included in the management plan.

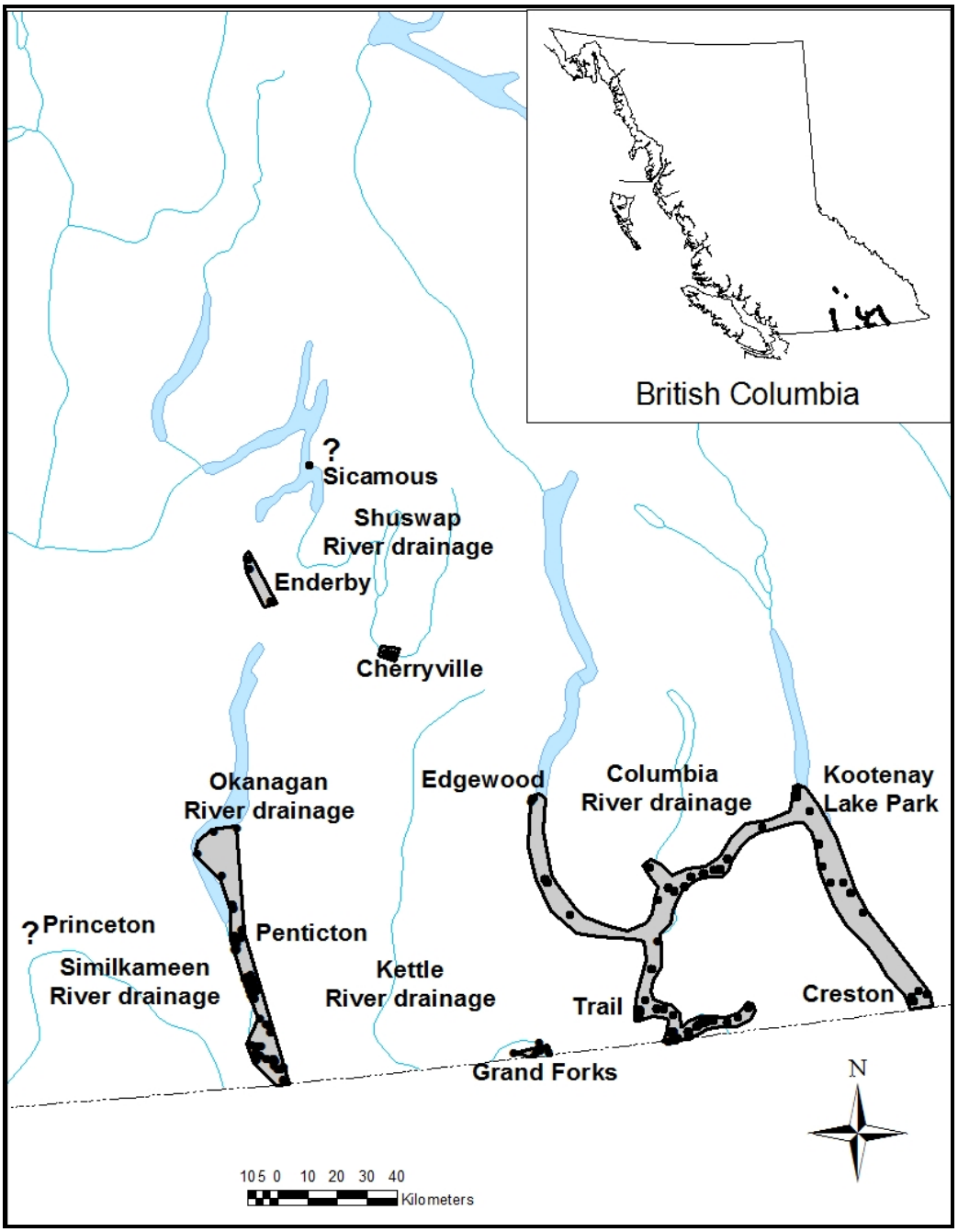

Figure 2. Distribution of Western Skink in British Columbia (MFLNRO 2011).
Shaded areas indicate the maximum known range based on sightings (black circles) reported from 1939-2002.

Population estimates and trends for B.C. are not available at this time. The CDC (2013) estimates the number of Western Skinks in B.C. to be 2500 to 100,000 individuals, if potential habitat is also considered. Minimum population density estimates were derived in two areas of B.C. In two surveyed sites of the same size near Creston, the average density of Western Skinks was approximately 17 Western Skinks per hectare (Rutherford and Gregory 2003). Vincer (2010, unpublished data) surveyed several sites near Vaseux Lake and found the average density of Western Skinks to be 7 Western Skink per hectare. Density estimates may vary in part due to detectability issues. Dulisse (2006a) found that detection probabilities of Western Skinks in the Kootenay Region were 0.2 to 0.25. Western Skink population densities are highly variable and dependent on local ecosystem features and therefore a mean number per hectare cannot be accurately applied across the landscape (M. Sarell, pers. comm., 2012). In addition, COSEWIC (2002) reported large fluctuations in populations and reported that Tanner (1957) "attributed such fluctuations to vegetation succession that altered habitat suitability and to adverse weather conditions, such as droughts, that affected reproductive success in a given year."

3.3 Needs of the Western Skink

3.3.1 Habitat and Biological Needs

Western Skinks live in various habitat types throughout their North American range. Habitat includes desert canyons, open woodlands, grasslands, forests, and warm dry hillsides up to 2100 m in elevation (Nussbaum *et al.* 1983). Western Skinks have been sighted at elevations up to 1080 m in B.C. (COSEWIC 2002). The B.C. range of the Western Skink includes the Bunchgrass, Ponderosa Pine, Interior Douglas-Fir, and Interior Cedar–Hemlock biogeoclimatic zones (COSEWIC 2002). The species appears to be confined to areas of warm, dry, open or sparsely treed habitat with loose soils and abundant cover objects such as talus, rocks, and coarse woody debris lying on the substrate (Dulisse 2004). Occupied sites in the Okanagan tended to be on slopes with a southwest aspect (Vincer 2012). Cover objects, in association with open areas, are preferred if they are flat (shale-like) and embedded in the ground on at least one side (Rutherford and Gregory 2003; Hallock and McAllister 2005; M. Sarell, pers. comm., 2012; Vincer 2012). Occupied, cover rocks in the Okanagan tended to be thicker and more imbedded in the substrate than other available rocks and these had cooler temperature profiles in the heat of the day than other rocks (Vincer 2012). Cover objects were the most important microhabitat component for the Prairie Skink (*Plestiodon septentrionalis*) (Larkin 2011) and are likely very important for the Western Skink as well. Larkin (2011) noted that the Prairie Skink did not select for thermal characteristics, leafy spurge, percent vegetation, exposed soil, gravel, or leaf litter.

South aspect and associated higher temperatures are important at the northern limit of the species' range as relatively short summers limit the time available for embryonic development and juvenile growth (COSEWIC 2002). Western Skinks are known to co-occur with other reptile species in B.C., such as Northern Alligator Lizard, Rubber Boa (*Charina bottae*), Northwestern Garter Snake (*Thamnophis ordinoides)*, Racer (*Coluber constrictor*), Desert Nightsnake (*Hypsiglena chlorophaea*), Gophersnake (*Pituophis catenifer*), and Western Rattlesnake (*Crotalus oreganus*) (Rutherford and Gregory 2003; Dulisse 2004; M. Sarell, pers. comm., 2012; E. Vincer, pers. obs., 2010). However there are no apparent interdependencies between Western Skink and most of the above reptiles, other than they are a preferred diet item for Desert Nightsnakes (Weaver 2010).

The home range size for the Western Skink in B.C. is not known. Rutherford and Gregory (2003) found that 25 recaptures of tagged Western Skinks in the Creston Valley Wildlife Management Area in B.C. had a mean of 8 m distance from the previous capture in the same year. This suggests that an average home range is small, roughly 0.01 ha (a circle with a 10 m diameter is 78 m^2 or approximately 0.01 ha). Rutherford and Gregory (2003) also reported a maximum movement of 61.4 m during a season suggesting some home ranges may be larger than 0.01 ha. Site fidelity was high over 3 years. These data suggest that dispersal capabilities are relatively low.

Fitch (1954 in Fitch and von Achen 1977) reported home ranges of about 0.06 ha for a similar skink, *Plestiodon fasciatus*, in Kansas. The home range was calculated using average movements as a radius to estimate a home range area. Fitch and von Achen (1977) reported home range sizes for *P. fasciatus* and *Scincella laterale* of between 0.01 and 0.16 ha depending on species, sex, and season. This method used minimum convex polygons and compared reasonably to the radius method used by Fitch in 1954. Home ranges were generally larger for males than females, were larger in the spring than summer, overlapped with other individuals, and varied seasonally in shape.

Hibernation sites are important habitat features for Western Skink and may be a limiting factor for this species in B.C. (Gregory and Campbell 1984). Skinks appear to use the same general habitat (talus and rock outcrop) for hibernation and for summer activities such as basking, foraging and nesting (Rutherford and Gregory 2003). The hatchlings, juveniles, and adults all overwinter in hibernacula located in bedrock outcrops, possibly communally with other species of reptiles such as the Western Rattlesnake (Columbia NWR 1989; M. Sarell, pers. comm., 2012).

After emerging from hibernation sites in the spring, they mate during May-June and females lay eggs in June-July (Tanner 1957; Stebbins 1985; COSEWIC 2002). Females excavate a burrow under a cover object (usually a rock) located in an open, south-facing area with adequate sun exposure (Dulisse 2004) and stay with the eggs until they hatch, providing protection from predators (Noble and Mason 1933). Studies on other species of lizards show that females nonrandomly select nest sites that have optimal thermal profiles compared to other available nest sites (Pike *et al.* 2010; Telemeco *et al.* 2010). Females lay approximately 2–6 eggs per clutch (Stebbins 1985) and lay one clutch per year (Gregory and Campbell 1984). The eggs hatch in August and early September (Tanner 1957; Stebbins 1985; COSEWIC 2002).

Western Skinks consume eggs, larvae, and adults of butterflies, moths, beetles, grasshoppers, crickets, spiders, and isopods (COSEWIC 2002). In the Okanagan, they appear to prefer termites as a main staple to their diet (M. Sarell, pers. comm., 2012). Skinks are diurnal and tend to be very secretive. When they are not foraging, mating, or basking, they hide under rocks and in crevices or burrows as a way to thermoregulate and avoid predators (COSEWIC 2002). Skinks generally are found under cover objects by themselves rather than with other individuals (Dulisse 2004), and tend to visit the same rock repeatedly; this indicates that some retreat sites are more favourable and important than others (Rutherford and Gregory 2003). In areas where food is not

a limiting factor, the upper limit of population size may depend critically on the availability of optimal retreat sites at a local scale (Bustard 1970).

3.3.2 Ecological Role

Western Skinks are an important component of the food chain. They prey on invertebrates and are preyed upon by larger predators such as snakes and larger birds. In central Washington State, Western Skinks were found to be the most abundant prey item in the diet of the Desert Nightsnake; at one location, Western Skinks were the sole prey item. This implies that the Desert Nightsnake may specialize on Western Skinks in parts of its range (Weaver 2010). Understanding and conserving Western Skink populations is integral for the survival of the Desert Nightsnake and all other species that depend on the skink as a food source (Humboldt County Herpetological Society 2009). Western skinks also are eaten by Racers in the southern Columbia Valley near Trail B.C. (J. Dulisse, pers. comm., 2012). Since populations of the Western Skink in B.C. are at the northern extremity of their global range, they may also have an important role as reservoirs of genetic variation, which could enable the species to adapt more effectively to changing environmental conditions (Scudder 1980).

3.3.3 Limiting Factors

Western Skinks reach the northern limit of their global distribution in B.C. The dependence of this species on warm and dry conditions likely restricts its distribution and range expansion in the province (COSEWIC 2002). Skinks have limited dispersal ability, with a maximum documented movement of 61.4 m in one year (Rutherford and Gregory 2003), which may mean that populations are physically and genetically isolated at both the site and landscape levels. The Western Skink displayed decreased genetic diversity between habitat patches in a highly fragmented urban area in California (Delaney *et al.* 2010). Loss of genetic diversity was found to be the highest in habitat patches that were subject to the densest levels of urbanization, which implies that high levels of development can become an impenetrable barrier to gene flow between subpopulations (Delaney *et al.* 2010). Low genetic diversity can limit the ability of the species to adapt to changing environmental conditions (Reed and Frankham 2003), especially when the loss of genetic diversity occurs over a short period of time and environmental conditions become rapidly less favorable for species persistence.

4 THREATS

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (Salafsky *et al.* 2008). For purposes of threat assessment, only present and future threats are considered.[1] Threats presented here do not include biological features of the species or population such as inbreeding depression, small population size, and genetic isolation; or

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

likelihood of regeneration or recolonization for ecosystems, which are considered limiting factors.[2]

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

4.1 Threat Assessment

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre and the B.C. Conservation Framework. For a detailed description of the threat classification system, see the CMP website (CMP 2010). Threats may be observed, inferred, or projected to occur in the near term. Threats are characterized here in terms of scope, severity, and timing. Threat "impact" is calculated from scope and severity. For information on how the values are assigned, see Master *et al.* (2009) and table footnotes for details. Threats for the Western Skink were assessed for the entire province (Table 1).

Table 1. Threat classification table for the Western Skink in British Columbia.

Threat#	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
1	Residential & commercial development	Low	Small	Extreme	High
1.1	Housing & urban areas	Low	Small	Extreme	High
1.2	Commercial & industrial areas	Low	Small	Extreme	High
1.3	Tourism & recreation areas	Low	Small	Extreme	High
2	Agriculture & aquaculture	Low	Small	Extreme	High
2.1	Annual & perennial non-timber crops	Low	Small	Extreme	High
2.3	Livestock farming & ranching	Low	Large	Slight	High
3	Energy production & mining	Low	Small	Extreme	High
3.2	Mining & quarrying	Low	Small	Extreme	High
4	Transportation & service corridors	Low	Small	Extreme	High
4.1	Roads & railroads	Low	Small	Extreme	High
4.2	Utility & service lines	Low	Small	Slight	High
5	Biological resource use	Negligible	Negligible	Not Scored	High
5.1	Hunting & collecting terrestrial animals	Negligible	Negligible	Not Scored	High

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

Threat#	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
7	Natural system modifications	Low	Small	Slight	High
7.1	Fire & fire suppression	Low	Small	Slight	High
7.2	Dams & water management/use	Low	Small	Slight	Moderate
8	Invasive & other problematic species & genes	Unknown	Small	Unknown	High
8.1	Invasive non-native/alien species	Unknown	Small	Unknown	High
11	Climate change & severe weather	Unknown	Pervasive	Unknown	Moderate
11.2	Droughts	Unknown	Pervasive	Unknown	Moderate

[a] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.
[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).
[c] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or 3-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit $\geq$ 0%).
[d] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of the Threats

The overall threat considers the cumulative impacts of multiple threats. It was calculated following Master *et al.* (2009) using only the number of Level 1 Threats assigned to this species where Timing = High (Continuing). This includes 5 Low Impact threats (Table 1). The overall province-wide Threat Impact for this species is Medium. The most significant threats are from residential and agricultural development. Details are discussed below listed under the IUCN Level 1 headings.

IUCN #1. Residential and commercial development (low impact)

Residential and commercial development is the primary threat to the Western Skink in B.C. due to habitat loss and fragmentation (Dupuis and Ramsay 2003). The southern Okanagan Valley is one of the regions in the province most heavily impacted by development, and this trend of increasing development is expected to continue. Most of the published Western Skink records in the Okanagan are in protected areas, on other Crown land, or on Indian Reserves where residential development is less likely to occur. However, Western Skink inventory has not focused on private land despite extensive suitable habitat. A substantial number of Western Skink records in the Columbia drainage occur on private land. Residential development of riparian areas along Kootenay Lake has decreased the amount of available Western Skink habitat. This development activity has been associated with local extinctions of Western Skinks from previously occupied areas (Dulisse 2006a). In addition to habitat loss, fragmentation could significantly impact metapopulation processes and cause loss of genetic diversity, due to the species' apparently poor dispersal abilities and large population fluctuations (Ovaska and Engelstoft 2002). Although a low impact, the threat from residential and commercial development remains for the Okanagan and Kootenay areas which contain most of B.C.'s Western Skinks, based on sighting records.

IUCN #2. Agriculture and aquaculture (low impact)

Conversion of natural land to agricultural use can contribute to loss and fragmentation of Western Skink habitat (COSEWIC 2002). Agricultural development, such as vineyards and orchards, can directly destroy or may fragment habitat, limiting dispersal between populations. Edge effects caused by fragmentation may make skinks more vulnerable to predation along the boundaries between natural and anthropogenic habitats (Barrows *et al.* 2006). However, most of the known records in the Okanagan are in protected areas and Crown land with low risks from agricultural development. In addition, the rocky nature of Western Skink habitat may reduce potential threats from agriculture. Private and Indian Reserve lands in the Okanagan have ongoing development of vineyards on or adjacent to Western Skink habitat so a low impact threat remains for the Okanagan. Agricultural crop development in the Kootenay area is less of an issue in Western Skink habitat. Livestock grazing is extensive throughout the Western Skink range and may impact vegetation (COSEWIC 2002) but to what extent this impacts Western Skink is unclear and likely insignificant across the range. However, livestock may dislodge cover rocks on some steep slopes, which may cause direct injury to Western Skinks underneath the cover object or make the cover unusable in the short term (M. Sarell, pers. comm., 2012).

IUCN #3. Energy production and mining (low impact)

The extent of gravel and talus rock extraction activities in the Interior of B.C. has not been explicitly quantified. This activity has occurred at a few locations in the past and is expected to occur in the future. Rock and talus mining in the Okanagan Region may be negatively impacting available habitat for Western Skink populations at a few sites. Since Western Skinks are highly dependent on talus and rocks for cover, any disturbance or removal of this resource could be detrimental to the species (Rutherford and Gregory 2003; Pike *et al.* 2010). Large extraction projects may also fragment populations if they occur in areas of previously undisturbed habitat. It currently is considered to be a low impact but needs additional assessment of the scope to improve confidence.

IUCN #4. Transportation and service corridors (low impact)

Road construction within Western Skink habitat was identified by Ovaska and Engelstoft (2002) as a low impact threat to the species. Road densities in the Interior of B.C. are expanding rapidly to accommodate human population growth in urban and rural areas and to service industries such as forestry, mining, and potentially wind farming in the future. Roads can destroy habitat directly and alter both demographic and genetic structures of reptile populations through direct mortality and by creating a barrier to movement and dispersal (Row *et al.* 2007).

Road kill is not a significant concern for Western Skink, unlike many other reptile species. Rutherford and Gregory (2003) found that Western Skinks have high site fidelity, do not travel long distances between summer basking sites and winter hibernacula, and are not attracted to roads as heat sources. This reduces the potential for ongoing road kill mortality after the initial habitat loss.

Rock blasting and other associated activities of utility line construction throughout portions of the Western Skink's range may cause direct mortality. These activities also may cause indirect effects including the destruction of important basking sites, nesting sites, or hibernacula.

Conversely, road and other corridor construction may enhance skink habitat through the creation and maintenance of open areas. Also, blast rock pieces that are created from the construction of roads, power lines, or pipelines may also increase available cover for skinks. Utility right-of-ways that are cleared periodically to remove shrub and brush cover may benefit skinks because this activity prevents forest and shrub encroachment into suitable habitat (Dulisse 2006b).

Overall these impacts are not quantified in skink habitat but have occurred in the past and will continue to occur. They are currently thought to be a low impact.

IUCN #5. Biological resource use (negligible)

Illegal collecting of individuals and eggs for the pet trade is identified as a threat by Seburn (2010) for the Five-Lined Skink (*Plestiodon fasciatus*), which is a similar species of skink that occurs in Ontario (Howes and Lougheed 2007). This activity may pose a similar threat for Western Skinks in B.C. Illegal collecting also poses a concern because collectors likely disturb microhabitat when they search for lizards by flipping rocks or other cover objects. A single alteration to a cover object can reduce microhabitat suitability (Howes and Lougheed 2007; Pike *et al.* 2010). In a population of Five-Lined Skinks in southern Ontario, several clutches of skink eggs disappeared during a field study and the disappearance corresponded with the movement and destruction of the nesting site cover material (Seburn and Seburn 1998). While collection activities have been found to have a significant impact on other skink species, impacts have not yet been documented or assessed for the Western Skink. The impact is unknown but likely insignificant (< 1% population impact in the next 10 years).

IUCN #7. Natural system modifications (low impact)

High intensity, stand-level fires are increasingly prevalent in the arid B.C. Interior as a result of past fire suppression, augmented by climate change. Fires can cause direct mortality to skinks. One Western Skink was found dead after a fire at Haynes Lease Ecological Reserve in the 1990s (M. Sarell, pers. comm., 2012). However, fires are not expected to have a high impact on Western Skinks through direct mortality because most reptiles are known to seek refuge in burrows or other unburned refugia during fires (Russell *et al.* 1999). Reptile abundance has been demonstrated to be positively affected by prescribed burns. These burns create more bare ground, which makes movement easier, and also increase light levels, which facilitates thermoregulation (Russell *et al.* 1999). Since Western Skinks prefer more open habitats (COSEWIC 2002), fires may benefit this species.

Fire control measures often include the use of heavy equipment to create bare soil fireguards, which may remove or damage cover objects that are important for Western Skinks. This causes habitat loss, and may directly harm individuals.

Fire suppression in the B.C. Interior has led to forest ingrowth and encroachment. In the Okanagan Region, forest ingrowth due to fire suppression may be a factor contributing to habitat loss or degradation by increasing canopy closure (M. Sarell, pers. comm., 2012). Forest ingrowth in the Kootenay Region is negatively impacting Western Skink habitat, particularly in the Interior Cedar–Hemlock zone (J. Dulisse, pers. comm., 2012). The potential impacts of forest encroachment are not clearly quantified but are thought to be a low impact threat.

Dam projects have impacted occupied Western Skink sites (Dulisse 2006b) in the past. Recent dam expansion projects such as Brilliant and Waneta in the Kootenay Region have had direct impacts on Western Skink habitat. Western Skinks are found in riparian areas in the Kootenay Region and future impacts from dam expansion may have negative impacts in this area, due to flooding of habitat. Additional impacts are considered to be unlikely in the next 10 years based on announced dam development projects.

IUCN #8. Invasive and other problematic species and genes (unknown impact)

The impact of invasive species on the Western Skink is not clearly understood at this time. Invasive plant species may have reduced habitat quality for Western Skinks throughout much of their range. In Australia, the main threat to the endangered Slater's Skink (*Elgaria slateri*) is habitat encroachment and degradation caused by the invasive buffel grass (*Cenchrus ciliaris*) (Pavey 2004). In B.C., native vegetation has been displaced by non-native species such as spotted knapweed (*Centaurea maculosa*), Dalmatian toadflax (*Linaria dalmatica*), and brome grasses (*Bromus* spp.) in some areas. Some newly established invasive plants in the South Okanagan, such as puncture vine (*Tribulus terrestrus*) and long-spine sand bur (*Cenchrus longispinus*), may cause injury and possibly death to skinks (M. Sarell, pers. comm., 2012). Some studies have shown that the removal of non-native plants from riparian, forest, and shrub habitat is associated with an increase in lizard abundance (Litt *et al.* 2001; Pilliod *et al.* 2006; Bateman *et al.* 2008). Removal of non-native trees and plants may increase lizard abundance by creating more open areas, which help to facilitate thermoregulation and dispersal movements (Bateman *et al.* 2008). Feral pets, especially cats, predate on Western Skinks (COSEWIC 2002; Dulisse 2006b) particularly near urban areas but the impact is unknown and considered to be insignificant (< 1% population impact over 10 years). Dulisse (2006b) also reported that some cats brought only Western Skink tails to their owners, suggesting that Western Skinks may survive attacks by cats, at least in some cases. Western Skink can separate (autotomize) the tail from the body, leaving the wriggling tail to attract the predator while the Western Skink escapes (Matsuda *et al.* 2006). Some native species, such as ravens and crows, have abnormally high densities around human centres, due to concentrated food sources (garbage). A crow was observed catching and eating a Western Skink near Christina Lake (M. Sarell, pers. comm., 2012) and ravens likely take Western Skinks occasionally as well. These native species were thought to be an insignificant threat.

IUCN #11. Climate change and severe weather (unknown impact)

Climate change is most likely to severely affect endemic species that have a restricted range distribution (Ohlemuller *et al.* 2008), especially where the species occur in fragmented pockets surrounded by altered landscapes (Parmesan 2006). Changing climate conditions are predicted to negatively impact other at-risk species of lizard that have low dispersal abilities by restricting the amount of suitable habitat that is available in terms of favourable climatic conditions (Rodder

and Schulte 2010). Climate change in southern B.C. may impact the Western Skink by further fragmenting suitable habitat, which would lead to genetic isolation of populations, and loss of or alteration to the thermal regime of potentially critical habitat features such as nesting sites, which has been documented in other lizard species (Sinervo 2010). Increased frequency and intensity of severe weather events such as droughts and heat waves may also threaten lizard species. These events may erode the species' ability to recover from these occurrences and decrease the size of their ecological niche (Barrows *et al.* 2010). Severe droughts may directly decrease the amount of vegetated habitat available for protection from predators and prey foraging (Calsbeek *et al.* 2009). Climate change impacts are expected but the degree of impact on Western Skinks is not known.

5 MANAGEMENT GOAL AND OBJECTIVES

5.1 Management Goal

The management goal is to maintain stable or increasing populations of the Western Skink throughout the species' range in B.C.

5.2 Rationale for the Management Goal

The management goal for the Western Skink supports Goal 2 (prevent species and ecosystems from becoming at risk) and Goal 3 (maintain the diversity of native species and ecosystems) of the B.C. Conservation Framework.

There is no accurate estimate of numbers or comprehensive habitat suitability mapping for Western Skinks in B.C. Therefore, quantifying population and habitat targets is not feasible at this time. If habitat protection is provided at strategic sites, sites are linked with habitat corridors, and threats are reduced, the present number of localities and mature individuals are likely sufficient to maintain stable populations, at least in the Columbia and Okanagan drainages. Information for the Shuswap, Kettle, and Similkameen drainages is insufficient to estimate population stability. Implementing the objectives below should prevent this species from becoming more at risk (e.g., designated as Threatened by COSEWIC).

5.3 Management Objectives

1. Clarify the distribution and abundance of Western Skinks throughout their range in B.C., especially in the Shuswap, Similkameen, and Kettle drainages.
2. Identify regionally significant sites for habitat protection and threat mitigation.
3. Address key knowledge gaps, including movement patterns, habitat trends, population trends, and habitat suitability, especially related to climate change.

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

Actions have been categorized by the action groups of the Conservation Framework. Status of the action group for this species is given in brackets.

Compile Status Report (complete)
- COSEWIC report completed (COSEWIC 2002). Update due 2012.

Send to COSEWIC (complete)
- Western Skink designated Special Concern (COSEWIC 2002). Re-assessment due 2012.

Planning (complete)
- B.C. Management Plan completed (this document, 2013).

Habitat Protection and Private Land Stewardship (in progress)
- Inventory to identify sites for protection has been done in the Okanagan (Sarell 1996, 1999, 2004, 2008; Vincer 2012); Shuswap (Davis and Weir 2008); and the Kootenay (Sarell 2002; Rutherford and Gregory 2003; Dulisse 2004, 2006a, 2006b, Dulisse and Boulanger 2008).
- Best management practices for urban development (Ovaska *et al.* 2004).
- Several occupied sites are protected within the Vaseux-Bighorn National Wildlife Area, Vaseux Protected Area, Okanagan Mountain Provincial Park, Skaha Bluffs Park, Haynes Lease Ecological Reserve, Anarchist Protected Area, Pilot Bay Park, Kootenay Lake Park, Midge Creek Wildlife Management Area, Creston Valley Wildlife Management Area, Fort Shepherd, and private conservation lands owned by The Nature Trust of BC and The Nature Conservancy of Canada.
- Research into habitat requirements and movement patterns in the Kootenay Region (Rutherford and Gregory 2003) and microhabitat requirements in the Okanagan Region (Vincer, unpublished data).

Habitat Restoration and Private Land Stewardship (in progress)
- Ecosystem and habitat restoration activities (forest thinning) at Fox Tree Hill south of Creston in the Kootenay Region (Dulisse and Boulanger 2008).
- Monitoring of restoration project in Kootenay (Dulisse 2004–2006).

Species and Population Management (in progress)
- Outreach information through the Reptiles BC Website (http://www.bcreptiles.ca/lizards/westskink.htm)

6.2 Recommended Management Actions

Table 2. Recommended management actions and suggested implementation schedule for the Western Skink in British Columbia.

Objective	Conservation Framework action group	Recommended management action	Threat[a] or concern addressed	Priority[b]	Timeline start date
1, 2, 3	Planning	Coordinate Western Skink management actions with actions for snakes (e.g., Western Rattlesnake, Gopher Snake, Desert Nightsnake) and among regions to effectively use resources and ensure actions are completed through a formal working group, under the existing Amphibian and Reptile Working Group.	Knowledge gap	Essential	2013
1, 2	Habitat Protection and Private Land Stewardship	Develop an inventory strategy to clarify distribution and abundance. This should include a habitat suitability model to target inventory. Priorities should focus on clarification of Western Skink distribution in the Similkameen, Kettle, Shuswap, and Arrow drainages, where data are most limited and population connectivity can be assessed.	Knowledge gap	Essential	2013
1, 2		Implement the inventory strategy.	Knowledge gap	Essential	2013
1, 2		Increase public awareness of Western Skinks including encouraging the public to report any sightings to the Conservation Data Centre.	Knowledge gaps	Beneficial	
2	Habitat Protection and Private Land Stewardship	Identify regionally significant sites and habitats in need of protection through analysis of existing distribution data, new field surveys, habitat mapping, and overlap with important sites for other listed species and ecosystems.	Knowledge gap	Essential	2013
2		Integrate consideration of the species' needs into land use planning, best management practices, and other planning documents.	All threats	Essential	2013
2		Protect regionally significant sites using existing protection tools such as best practices, Land Act Tenures, private land stewardship agreements, covenants, etc.	1.1, 1.2, 1.3, 2.1, 2.3, 3.2, 4.1, 7.1, 7.2	Essential	2013
1, 2, 3		Develop, validate, and refine a habitat suitability model, incorporating climate change scenarios, for the species throughout its range in B.C.	Knowledge gaps 11.1	Necessary	2013

Objective	Conservation Framework action group	Recommended management action	Threat[a] or concern addressed	Priority[b]	Timeline start date
3		Clarify seasonal movement patterns, home range size, and dispersal ability to inform habitat protection priorities and improve best management practices.	Knowledge gaps	Beneficial	
3	Monitor Trends	Compile and update existing information on Western Skink distribution throughout its range in B.C. as a baseline to assess future trends.	Knowledge gap	Essential	2013
3		Develop and implement a Western Skink monitoring strategy at strategic sites throughout B.C. to assess habitat and population trends.	Knowledge gaps	Necessary	2013

[a] Threat numbers according to the IUCN-CMP classification (see Table 1 for details).
[b] Essential (urgent and important, needs to start immediately); Necessary (important but not urgent, action can start in 2–5 years); or Beneficial (action is beneficial and could start at any time that was feasible).

6.3 Narrative to Support Management Actions Table

6.3.1 Planning

It is necessary to establish a working group to implement this management plan effectively by coordinating actions and resources. The most effective model is to establish a sub-group within the existing Southern Interior Reptile and Amphibian Recovery Team to oversee management planning and action plan implementation for all listed reptile species with range overlap (e.g., Southern Interior Reptile and Amphibian Recovery Team 2008a, 2008b, 2008c). Additional planning is also required to address knowledge gaps.

6.3.2 Habitat Protection and Private Land Stewardship

Inventory is limited for this species. The Similkameen, Kettle, and Shuswap drainages have very few confirmed or anecdotal records. It is unclear how large these populations may be or if they are connected to other populations. The Okanagan and Columbia drainages have many documented sites but inventory is patchy and remains incomplete. Additional inventory is required to clearly establish the current distribution of the species, to more accurately estimate population abundance and clearly identify important habitats for conservation. Threats should be assessed during these baseline surveys at each site to document present and potential development pressure, presence of invasive plant species and other types of disturbance.

Regionally significant sites need to be identified to inform habitat protection priorities, particularly in areas of high fragmentation or threat between existing protected areas. Important areas for ecosystem and multi-species protection should receive priority. Best management practices should be better integrated into land use planning, particularly at significant sites. Additional habitat protection may be required at significant sites, using existing protection tools.

A habitat suitability model would facilitate selection of inventory and habitat protection priorities. Potential climate change impacts are not well understood for this species. Incorporation of basic climate change data into a suitability model would help to clarify climate change vulnerability for the Western Skink and identify potential adaptations, if necessary. Clarification of movement patterns and dispersal capabilities will assist with designing resilient habitat protection strategies and climate adaptations. Increasing awareness of the Western Skink, its habitats, and options for protection will assist with habitat protection.

6.3.3 Monitor Trends

Occurrence records need to be updated and maintained to identify long-term monitoring priorities at the site level. A comprehensive population, habitat, and population monitoring program is required to detect any changes to populations and occupied sites. Long-term monitoring sites should be established at several locations throughout the species' range to assess impacts from climate change. This monitoring should be considered as part of a multi-species strategy, including snakes specifically, and other species.

7 MEASURING PROGRESS

The following performance measures provide a way to define and measure progress toward achieving the management goal and objectives. Performance measures are listed below for each objective.

Objective 1: Baseline information on distribution and abundance is documented, especially in the Kettle, Similkameen, and Shuswap, by 2016.

Objective 2: Research to address knowledge gaps, including habitat trends, population trends, and habitat suitability are initiated by 2013.

Objective 3: Regionally significant sites are identified by 2015 and additional protection is initiated by 2016 if needed.

8 EFFECTS ON OTHER SPECIES

The Western Skink occupies areas and habitats where other listed species at risk are known to occur including the Desert Nightsnake, Western Rattlesnake, Gopher Snake, Rubber Boa, and Racer. Any inventory, habitat protection, or threat mitigation for the Western Skink likely will have benefits for other reptile species that occur in the same ecosystems.

9 REFERENCES

Barrows, C.W., M.F. Allen, and J.T. Rotenberry. 2006. Boundary processes between a desert sand dune community and an encroaching suburban landscape. Biol. Conserv. 131:486–494.

Barrows, C.W., M.F. Allen, and J.T. Rotenberry. 2010. Assessing sensitivity to climate change and drought variability of a sand dune endemic lizard. Biol. Conserv. 143:731–736.

Bateman, H.L., A. Chung-MacCoubrey, and H.L. Snell. 2008. Impact of non-native plant removal on lizards in riparian habitats in the southwestern United States. Restor. Ecol. 16(1):180–190.

B.C. Conservation Data Centre (CDC). 2013. BC Species and Ecosystems Explorer. B.C. Min. Environ., Victoria, BC. <http://a100.gov.bc.ca/pub/eswp/> [Accessed January 24, 2013]

B.C. Ministry of Environment. 2010. Conservation framework. Victoria, BC. <http://www.env.gov.bc.ca/conservationframework/index.html> [Accessed August 15. 2010]

B.C. Ministry of Forests, Lands and Natural Resource Operations (MLFNRO). 2011. Sightings databases presented in ArcMap. Penticton, BC.

Bustard, H.R. 1970. The population ecology of the Australian gekkonid lizard *Heteronotia binoei* in an exploited forest. J. Zool. 162:31–42.

Calsbeek, R., W. Buermann, and T.B. Smith. 2009. Parallel shifts in ecology and natural selection in an island lizard. BMC Evol. Biol. 9(3):1–12.

Columbia NWR. 1989. Ecology of the Northern Pacific Rattlesnake on Columbia NWR – 1989 Progress Report. U.S. Fish and Wildlife, Othello, WA.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2002. COSEWIC assessment and status report on the Western Skink *Eumeces skiltonianus* in Canada. Ottawa, ON. vi + 19 pp.

Conservation Measures Partnership (CMP). 2010. Threats taxonomy. <http://www.conservationmeasures.org/initiatives/threats-actions-taxonomies/threats-taxonomy> [Accessed September 14, 2012]

Davis, H. and R. Weir. 2008. Western Screech-Owl Conservation along the Shuswap River. BCRP Project # 07.W.SHU.01. B.C. Hydro, Vancouver, BC.

Delaney, K.S., S.P.D. Riley, and R.N. Fisher. 2010. A rapid, strong and convergent genetic response to urban habitat fragmentation in four divergent and widespread vertebrates. PLOS One 5(9):e12767.

Dulisse, J. 2004. Columbia Basin Western Skink (*Eumeces skiltonianus skiltonianus*) survey and assessment: 2004 results. Columbia Basin Fish and Wildlife Compensation Program Report, Nelson, BC.

Dulisse, J. 2006a. 2006 Columbia Basin western skink inventory. Report prepared for Columbia Basin Fish & Wildlife Compensation Program, Nelson, BC.

Dulisse, J. 2006b. Western skink in southeastern British Columbia. Wildl. Afield 3(2):95–105.

Dulisse, J. and J. Boulanger. 2008. Response of Western Skinks to ecosystem restoration at Fox Tree Hill. Report prepared for Fish & Wildlife Compensation Program, Nelson, BC.

Dupuis, L. and L. Ramsay. 2003. British Columbia Conservation Data Centre: 2003 Conservation status report: Western Skink, *Eumeces skiltonianus.* Victoria, BC.

Fitch, H.S. and P.L. von Achen. 1977. Spatial relationships and seasonality in the skinks *Eumeces facsciatus* and *Scincella laterale* in northeastern Kansas. Herpetologica 33:303–313.

Gregory, P.T. and R.W. Campbell. 1984. The reptiles of British Columbia. B.C. Provincial Museum, Victoria, BC. Handbook 44.

Hallock, L.A. and K.R. McAllister. 2005. Western Skink. Washington Herp Atlas. <http://www1.dnr.wa.gov/nhp/refdesk/herp/html/4eusk.html> [Accessed August 18, 2010]

Hopkins, H. 2008. *Eumeces skiltonianus*, Western Skink. <http://idahoherps.pbworks.com/Eumeces+skiltonianus,+Western+skink> [Accessed August 18, 2010]

Howes, B.J. and S.C. Lougheed. 2004. The importance of cover rock in northern populations of the five-lined skink (*Eumeces fasciatus*). Herpetologica 60(3):287–294.

Humboldt County Herpetological Society. 2009. *Plestiodon* (formerly *Eumeces*). <http://www.humboldtherps.com/plestiodon.html> [Accessed August 20, 2010]

Larkin, J. 2011. Microhabitat preferences of the prairie skink (*Plestiodon septentrionalis*) in southwestern Manitoba. Master's thesis. Univ. Manitoba, Winnipeg, MB.

Litt, A.R., L. Provencher, G.W. Tanner, and R. Franz. 2001. Herpetofaunal responses to restoration treatments of longleaf pine sandhills in Florida. Restor. Ecol. 9:462–474.

Master, L., D. Faber-Langendoen, R. Bittman, G.A. Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. NatureServe conservation status assessments: factors for assessing extinction risk. NatureServe, Arlington, VA. http://www.natureserve.org/publications/ConsStatusAssess_StatusFactors.pdf [Accessed August. 15, 2010]

Matsuda, B.M., D.M. Green, and P.T. Gregory. 2006. Amphibians and reptiles of British Columbia. Royal B.C. Museum, Victoria. BC. Royal B.C. Museum Handbook.

NatureServe. 2005. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.1. Arlington, VA. <http://www.natureserve.org/explorer> [Accessed January 23, 2013]

NatureServe. 2012. NatureServe explorer: an online encyclopedia of life [web application]. Version 7.1. Arlington, VA. <http://www.natureserve.org/explorer> [Accessed January 23, 2013]

Noble, G.K. and E.R. Mason. 1933. Experiments on the brooding habits of the lizards *Eumeces* and *Ophisaurus*. Am. Mus. Novit. 619:1–29.

Nussbaum, R.A., E.D. Brodie Jr., and R.M. Storm. 1983. Amphibians & reptiles of the Pacific Northwest. Northwest Univ. Press of Idaho, Moscow, ID.

Ohlemuller, R., B.J. Anderson, M.B. Araujo, S.H.M. Butchart, O. Kudrna, R.S. Ridgley, and C.D. Thomas. 2008. The coincidence of climatic and species rarity: high risk to small-range species from climate change. Biol. Lett. 4:568–572.

Ovaska, K., S. Lennart, C. Engelstoft, L. Matthias, E. Wind, and J. MacGarvie. 2004. Best management practices for amphibians and reptiles in urban and rural environments in British Columbia. B.C. Min. Water Land and Air Protection, Ecosystems Standards and Planning, Biodiversity Branch, Victoria, BC.

Ovaska, K.E. and C. Engelstoft. 2002. COSEWIC status report on the western skink *Eumeces skiltonianus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON.

Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. Annu. Rev. Ecol. Evol. Syst. 37:637–669.

Pavey, C. 2004. Recovery plan for Slater's Skink (*Egernia slateri*), 2005–2010. Northern Territory Department of Infrastructure, Planning and Environment. Darwin, Australia.

Pike, D.A., B.M. Croak, J.K. Webb, and R. Shine. 2010. Subtle – but easily reversible – anthropogenic disturbance seriously degrades habitat quality for rock-dwelling reptiles. Anim. Conserv. 13(4):411–418.

Pilliod, D.S., E.L. Bull, J.L. Hayes, and B.C. Wales. 2006. Wildlife and invertebrate response to fuel reduction treatments in dry coniferous forests of the Western United States: a synthesis. U.S. Dep. Agric. For. Serv., Fort Collins, CO. Gen. Tech. Rep. GTR-173.

Province of British Columbia. 1982. Wildlife Act [RSBC 1996] c. 488. Queen's Printer, Victoria, BC. <http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01> [Accessed September 14, 2012]

Province of British Columbia. 2002. Forest and Range Practices Act [RSBC 2002] c. 69. Queen's Printer, Victoria, BC. <http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_02069_01> [Accessed September 14, 2012]

Province of British Columbia. 2008. Oil and Gas Activities Act [SBC 2008] c. 36. Queen's Printer, Victoria, BC. <http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_08036_01> [Accessed September 14, 2012]

Reed, D.H. and R. Frankham. 2003. Correlation between fitness and genetic diversity. Conserv. Biol. 17:230–237.

Rodder, D. and U. Schulte. 2010. Potential loss of genetic variability despite well established network of reserves: the case of the Iberian endemic lizard *Lacerta schreiberi*. Biodivers. Conserv. 19:2651–2666.

Rodgers, T.L. and H.S. Fitch. 1947. Variation in the Skinks (Reptilia: Lacertilia) of the Skiltonianus Group. University of California Publications in Zool. 48(4) 169–220.

Row, J.R., G. Blouin-Demers, and P.J. Weatherhead. 2007. Demographic effects of road mortality in black ratsnakes (*Elaphe obsoleta*). Biol. Conserv. 137:117–124.

Russell, K.R., D.H. Van Lear, and D.C. Guynn Jr. 1999. Prescribed fire effects on herpetofauna: review and management implications. Wildl. Soc. Bull. 27:374–384.

Rutherford, P.L. and P.T. Gregory. 2003. Habitat use and movement patterns of northern alligator lizards (*Elgaria coerulea*) and western skinks (*Eumeces skiltonianus*) in southeastern British Columbia. J. Herpetol. 37(1):98–106.

Salafsky, N., D. Salzer, A.J. Stattersfield, C. Hilton-Taylor, R. Neugarten, S.H.M. Butchart, B. Collen, N. Cox, L.L. Master, S. O'Connor, and D. Wilkie. 2008. A standard lexicon for biodiversity conservation: unified classifications of threats and actions. Conserv. Biol. 22:897–911.

Sarell, M.J. 1996. Skaha Bluffs wildlife inventory. Habitat Conservation Trust Fund, Victoria, BC.

Sarell, M.J. 1999. Inventory of snakes within Forest Development Plans of the Boundary, Merritt, Penticton and Vernon Forest Districts. Forest Renewal BC, Kamloops, BC.

Sarell, M.J. 2002. Bats and reptiles. *In* L. Shaeffer, S. Bennett, and M.J. Sarell, eds. Biodiversity of Fort Shepherd, British Columbia. Prepared for the Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC.

Sarell, M.J. 2004. Reptile survey on the Vaseux Bighorn National Wildlife Area: 2003–2004. Can. Wildl. Serv., Delta, BC.

Sarell, M.J. 2008. Reptile inventory at Gillies Creek: unpublished data. The Nature Conservancy of Canada, Penticton, BC.

Scudder, G.G.E. 1980. The Osoyoos-arid biotic area. Pages 49–55 *in* R. Stace-Smith, L. Johns, and P. Joslin, eds. Threatened and endangered species and habitats in British Columbia and the Yukon. B.C. Min. Environ., Fish and Wildlife Branch, Victoria, BC.

Seburn, C.N.L. and D.C. Seburn. 1998. COSEWIC status report on the five-lined skink *Eumeces fasciatus* in Canada. Ottawa, ON. 41 pp.

Seburn, D.C. 2010. Recovery strategy for the Common Five-lined Skink (*Plestiodon fasciatus*) – Carolinian and Southern Shield populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, ON. vi + 22 pp.

Sinervo, B., F. Mendez de-la-Cruz, D.B. Miles, B. Heulin, E. Bastiaans, M. Villagran-Santa Cruz, R. Lara-Resendiz, N. Martines-Mendez, M.L. Calderon-Espinosa, R.N. Meza-Laza, H. Gadsden, L.J. Avila, M. Morando, I.J. De la Riva, P.V. Sepulveda, C.F.D. Rocha, N. Ibarguengoytia, C.A. Puntriano, M. Massot, V. Lepetz, T.A. Oksanen, D.G. Chapple, A.M. Bauer, W.R. Branch, J. Clobert, and J.W. Sites Jr. 2010. Erosion of lizard diversity by climate change and altered thermal niches. Science 328:894–899.

Southern Interior Reptile and Amphibian Recovery Team. 2008a. Recovery strategy for the Gopher Snake, *deserticola* subspecies (*Pituophis catenifer deserticola*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 20 pp.

Southern Interior Reptile and Amphibian Recovery Team. 2008b. Recovery strategy for the Western Rattlesnake (*Crotalus oreganus*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 21 pp.

Southern Interior Reptile and Amphibian Recovery Team. 2008c. Recovery strategy for the Night Snake (*Hypsiglena torquata*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 13 pp.

Stebbins, R.C. 1985. A field guide to western reptiles and amphibians. Houghton Mifflin Company, Boston, MA. 2nd edition.

Tanner, W.W. 1957. A taxonomic and ecological study of the western skink. Great Basin Naturalist 17:59–94.

Tanner, W.W. 1988. *Eumeces skiltonianus*. Cat. Am. Amphibians and Reptiles 447:1–4.

Telemeco, R.S., R.S. Radder, T.A. Baird, and R. Shine. 2010. Thermal effects on reptile reproduction: adaptation and phenotypic plasticity in a montane lizard. Biol. J. Linnean Soc. 100:642–655.

Vincer, E. 2012. Microhabitat Selection of the Western Skink (*Plestiodon skiltonianus*) in the Okanagan Region of British Columbia. Masters of Resource Management Thesis. Simon Fraser University, Burnaby, B.C.Weaver, R.E. 2010. Diet and reproductive ecology of the desert nightsnake (*Hypsiglena chlorophaea*) in Central Washington State. J. Herpetol. 44(1):148–152.

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