

Management Plan for the Western Yellow-bellied Racer (*Coluber constrictor mormon*) in Canada

Western Yellow-bellied Racer



2014

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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 Public Registry (www.sararegistry.gc.ca).

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MANAGEMENT PLAN FOR THE WESTERN YELLOW-BELLIED RACER (*Coluber constrictor mormon*) 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 Racer (*Coluber constrictor*) 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 Yellow-bellied Racer (*Coluber constrictor*) in Canada consists of two parts:

Part 1 - Federal Addition to the “Management Plan for the Racer (*Coluber constrictor*) in British Columbia”, prepared by Environment Canada.

Part 2 - “Management Plan for the Racer (*Coluber constrictor*) in British Columbia”, prepared by the B.C. Ministry of Environment.

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Part 1 - Federal Addition to the “Management Plan for the Racer
(*Coluber constrictor*) 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 Yellow-bellied Racer 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 Racer (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 Yellow-bellied Racer 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 section has been included to address a specific requirement for federal recovery documents, which is not addressed in the “Management Plan for the Racer (*Coluber constrictor*) in British Columbia”.

Common and scientific names for the Western Yellow-bellied Racer in this federal addition (Part 1) follow the naming conventions of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). These names differ from the ones reported in the B.C. management plan (Part 2).

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 conserve and manage habitat for the Western Yellow-bellied Racer (e.g., inventory and monitoring, threat mitigation, habitat conservation, education, research) will promote the conservation of other species using those habitats, including other SARA-listed species (e.g., Western Rattlesnake (*Crotalus oreganus*), Great Basin Gopher Snake (*Pituophis catenifer deserticola*)).

Part 2 - "Management Plan for the Racer (*Coluber constrictor*) in British Columbia", prepared by the B.C. Ministry of Environment

Management Plan for Racer (*Coluber constrictor*) in British Columbia



Prepared by the Racer Management Team Working Group



February 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, or species where management is required to meet population targets for ecosystem management, human uses, or ecological services.

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 or is being managed for use, ecosystem goals, or ecological services. 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 Racer
(*Coluber constrictor*) in British Columbia**

Prepared by the Racer Management Team Working Group

February 2013

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Additional copies

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

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

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Disclaimer

This management plan has been prepared by the Racer Management Team Working Group, as advice to the responsible jurisdictions and organizations that may be involved in managing the species.

This document identifies the management actions that are deemed necessary, based on the best available scientific and traditional information, to prevent Racer 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 Racer.

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We thank the following individuals for their expertise and insights in regard to the ecology of the Racer in British Columbia: Orville Dyer (MFLNRO), John Surgenor (MFLNRO), Christine Bishop (CWS), Jared Hobbs (MFLNRO), Francis Iredale (MFLNRO), Ted Antifeau (MFLNRO), Lisa Tedesco (MFLNRO), and Purnima Govindarajulu (MoE).

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¹ MFLNRO = Ministry of Forests, Lands and Natural Resource Operations

² MoE = Ministry of Environment

EXECUTIVE SUMMARY

The Racer is a relatively thin snake that is typically less than 1 m in length. Adults are uniform grey or olive and have a yellow belly; young have a series of brown, saddle-like cross bands across the back that become fainter as the snakes mature. Racers are harmless to humans and feed mainly on insects. Racers occur in the south and central interior of British Columbia, a range that includes at least 5 discrete areas near Trail, Grand Forks, and Midway; and within the Okanagan/Similkameen and Thompson/Fraser watersheds.

The Racer was designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). It is listed as Special Concern in Canada on Schedule 1 of the *Species at Risk Act* (SARA). In British Columbia, the Racer is ranked S3 (vulnerable) by the Conservation Data Centre and is on the provincial Blue list. The B.C. Conservation Framework ranks the Racer as a priority 2 under goal 2 (prevent species and ecosystems from becoming at risk). It is protected from capture and killing, under the B.C. *Wildlife Act*. It is also listed as a species at risk under the *Forest and Range Practices Act*, which enables habitat management tools as per the Identified Wildlife Management Strategy.

Racers are commonly associated with the Bunchgrass, Ponderosa Pine, Interior Douglas-fir, and dry Interior Cedar–Hemlock biogeoclimatic zones below 900 m elevation. The basic needs of the Racer include nesting and hibernation sites adequately connected to summer foraging areas. Nest sites are known to occur on sparsely vegetated slopes as well as talus slopes. Racers have been found to share communal hibernacula with “Great Basin” Gopher Snake, Western Rattlesnake, Night Snake, and either the Common Garter Snake or the Terrestrial Garter Snake. Communal hibernacula are most often associated with south-facing rocky features. The main threats identified to Racers are road mortality and agriculture.

The population and distribution goal is to maintain the current area of occupancy and distribution of the Racer within British Columbia.

The management objectives are to:

1. Protect³ and conserve suitable Racer habitat within each of the 5 population areas;
2. Reduce roadkill, the main threat to Racer, at 3 priority⁴ sites, ideally within 3 of the 5 population areas; and
3. Quantify Racer habitat needs, population demographics, and viability within all 5 population areas, as well as investigate less understood threats to Racer (e.g., pollution and agriculture).

³Protection and management can be achieved through various mechanisms including the implementation of wildlife habitat areas, conservation covenants, voluntary stewardship agreements, and application of best management practices.

⁴Priority sites are those where road-kill observations are clustered and will be identified based on available information (e.g., inventory data, habitat modeling, and genetic work). Priority sites should consider habitat elements such as important hibernacula, foraging and egg-laying habitat, and travel corridors.

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1 COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: November 2004
Common Name:** Western Yellow-bellied Racer
Scientific Name:** *Coluber constrictor mormon*
COSEWIC Status: Special Concern
Reason for Designation: This snake occurs in five valleys in south-central British Columbia. It is susceptible to habitat loss and fragmentation from agriculture and urban development, especially as this species is particularly intolerant of urbanization. The ongoing expansion of the road network and traffic volumes increases mortality and further fragments the habitat. Pesticide applications in agricultural areas may impact the snakes both directly and via contamination of their insect prey. It is unlikely that there is a significant rescue effect because of extensive loss of habitat contiguous to the United States border.
Canadian Occurrence: British Columbia
COSEWIC Status History: Designated Not at Risk in April 1991. Status re-examined and designated Special Concern in November 2004. Last assessment based on an update status report.

* Committee on the Status of Endangered Wildlife in Canada.

** Common and scientific names reported in this recovery strategy follow the naming conventions of the British Columbia Conservation Data Centre, which may be different from names reported by COSEWIC.

2 SPECIES STATUS INFORMATION

Racer^a	
Legal Designation:	
FRPA : Species of Risk ^b	B.C. <i>Wildlife Act</i> : ^c Schedule A
OGAA : Species of Risk ^b	SARA Schedule : 1- Special Concern (2006)
Conservation Status^d	
B.C. List: Blue	B.C. Rank: S3 (2007) National Rank : N4 (1998) Global Rank: G5 (2006)
Other Subnational Ranks : ^e AB: S1; ON: S1; SK: S3; ID: S5; MT: S5; WA: S5; OR: S4?	
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: 2 (2009)
Goal 3: Maintain the diversity of native species and ecosystems.	Priority: 3 (2009)
CF Action Groups :	Compile Status Report; Planning; Send to COSEWIC; Habitat Protection; Habitat Restoration; Private Land Stewardship; Species and Population Management

^a Data source: B.C. Conservation Data Centre (2011) unless otherwise noted.

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

^c Schedule A = Designated as wildlife under the B.C. *Wildlife Act*, which offers it protection from direct persecution and mortality (Province of British Columbia 1982).

^d S = subnational; N = national; G = global; 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 (2011).

^e Data source: NatureServe (2011).

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

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

3 SPECIES INFORMATION

3.1 Species Description

The Racer (*Coluber constrictor*) is adapted to an active, diurnal lifestyle. It is an agile snake, able to quickly find cover and climb small shrubs. The Racer has a long, thin body that typically measures less than 100 cm from the snout to the vent (Matsuda *et al.* 2006). The dorsal colour of adults is uniform grey or olive and the belly is yellow. Young have a series of brown, saddle-like cross bands across the back that become fainter as the snake matures (Matsuda *et al.* 2006). The eyes are relatively large and the head is often held off the ground while traveling (Gregory and Campbell 1984). When this non-venomous snake is encountered, it typically flees to cover or aggressively strikes and vibrates its tail.

Due to the secretive nature of snakes, shed skins are often encountered in the field more often than the animals themselves. A Racer's shed can be distinguished from other sympatric snakes by its long whip-like tail, smooth scales, divided anal plate, and number of scute rows (< 21) at mid-body (Gregory and Campbell 1984).

3.2 Populations and Distribution

The Racer is widely distributed in western North America and reaches its northern limits in British Columbia and southern limits in California (Figure 1).

Racers occur in the south and central interior of British Columbia, a range that includes at least 5 discrete areas (Figure 2). The 4 southern areas are potentially contiguous with Washington State populations and occur near Trail, Grand Forks, and Midway; and within the Okanagan/Similkameen watersheds. It is possible that immigration from stable populations in the United States could occur and immigrants would be able to survive in British Columbia; however, it is not known whether suitable habitat to support immigrants exists (COSEWIC 2004). The fifth area occurs within the Thompson / Fraser watersheds and represents the northern extent of the species range. These 5 areas have been tentatively identified for management planning and are referred to as "population areas" in this document.

In British Columbia, its extent of occurrence is approximately 8300 km² and area of occupancy is less than 210 km², if only hibernacula are considered (COSEWIC 2004). The percent of the global distribution of Racers currently found in Canada is probably < 5% (value based on a similar result for the "Great Basin" Gopher Snake, *Pituophis catenifer deserticola*), hereafter referred to as Gopher Snake; SIRART 2008a).

An accurate population size of the Racer within British Columbia is currently unknown. Though historical data are unavailable, the number of Racers in British Columbia has likely declined as a result of declining extent and quality of habitat. Percent loss of native grassland cover assessed at the ecosection level within the southern interior of British Columbia has revealed the following trends: the Northern Okanagan Basin has experienced a 52% loss in native grassland cover; Southern Okanagan Basin, 29%; and the Thompson Basin, 23% (Grassland Conservation

Council, unpubl. data, 2009). Given the inability of Racers to persist without this habitat, it is reasonable to expect that declines of up to 45% have occurred (COSEWIC 2004).

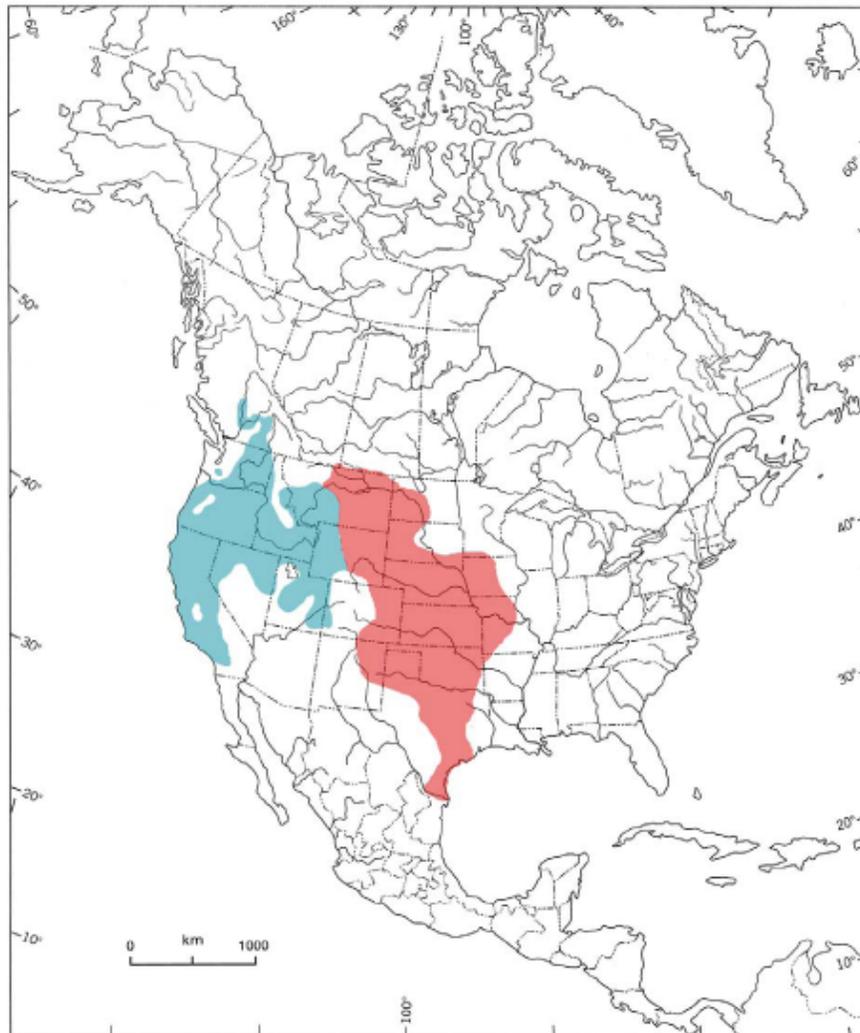


Figure 1. Global distribution of *Coluber constrictor mormon* outlined in blue; *Coluber constrictor flaviventris* outlined in pink (COSEWIC 2004).

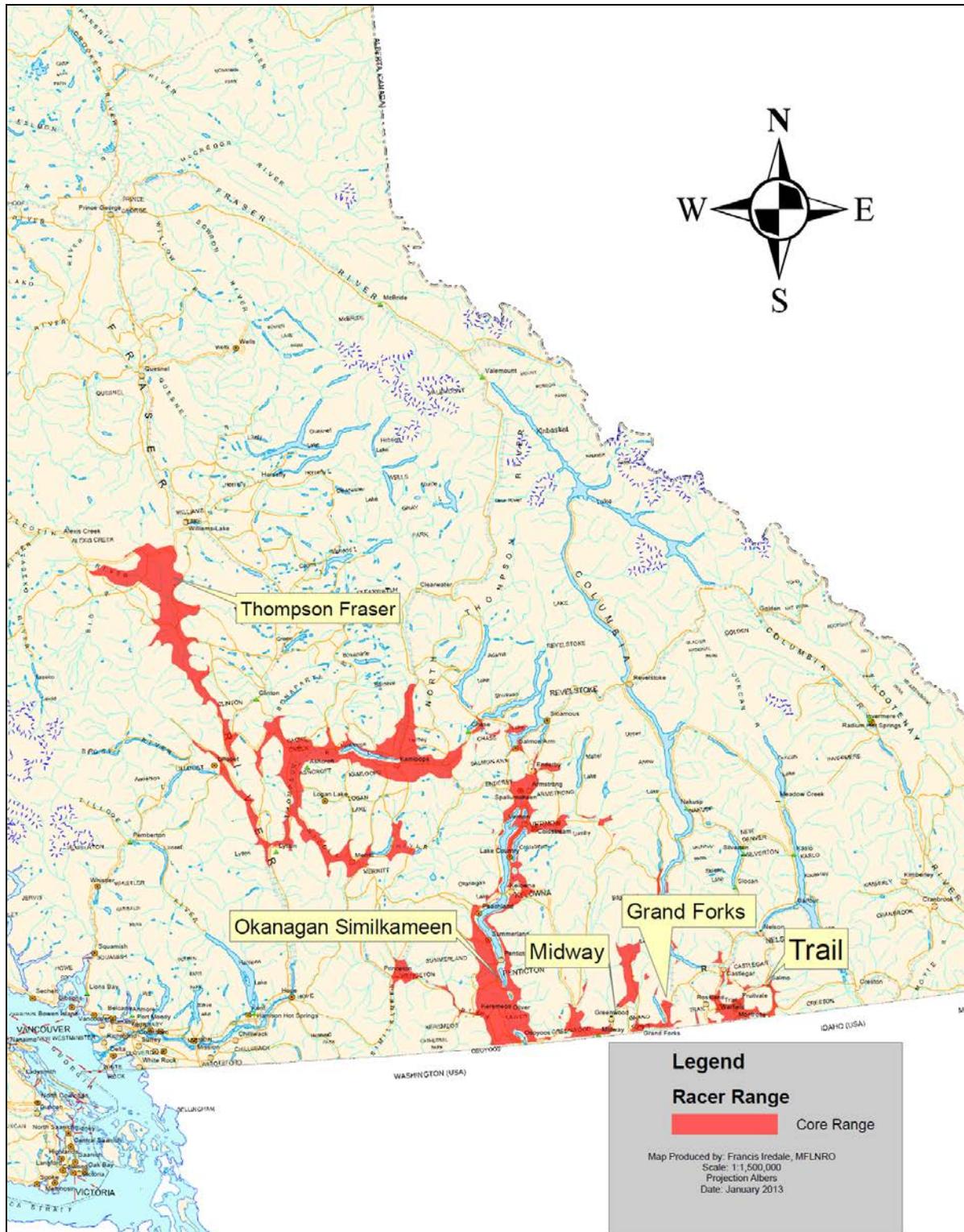


Figure 2. Racer distribution in British Columbia. (Grassland Conservation Council, unpubl. data, 2010).

3.3 Needs of the Racer

3.3.1 Habitat and Biological Needs

In British Columbia, Racers are commonly associated with the Bunchgrass, Ponderosa pine, Interior Douglas-fir, and dry Interior Cedar–Hemlock biogeoclimatic zones below 900 m elevation. Within these ecosystems, Racers have been found in a wide variety of habitat types that include wet valley bottoms and riparian areas, rocky slopes, and sandy terraces at or below 900 m elevation (COSEWIC 2004).

The basic needs of the Racer include nesting and hibernation sites adequately connected to summer foraging areas. Nest sites are known to occur on sparsely vegetated slopes as well as talus slopes (COSEWIC 2004; M. Sarell, pers. comm., 2010). In Osoyoos, one communal nest was found in an abandoned rodent burrow on a sandy hill with sparse vegetation cover. The nest site was used by Racers and Gopher Snakes, which indicates an overlap in the nesting requirements of the two species (COSEWIC 2004).

Racers have been found to share communal hibernacula with Gopher Snake, Western Rattlesnake (*Crotalus oreganus*), Night Snake (*Hypsiglena chlorophaea*), and either Common Garter Snake (*Thamnophis sirtalis*) or the Terrestrial Garter Snake (*Thamnophis elegans*) (COSEWIC 2004). Communal hibernacula are most often associated with south-facing rocky features containing fractures that provide access below the frost line (Hobbs and Sarell 2002).

In Utah, Racers hibernate communally in rock piles where each stone averages 30 cm diameter (Brown and Parker 1976). The overwintering habitats of juveniles may differ from those of adults. Hatchling and yearling *Coluber constrictor foxii* often overwinter in widely dispersed habitats rather than with adults (Rosen 1991). Summer foraging habitats must contain sufficient prey suitable for all age classes as well as adequate cover for protection from predators. Racers are generalist predators (see Ecological Role). Burrows of small mammals are used as retreat sites for Racers in Utah (Brown and Parker 1976).

3.3.2 Limiting Factors

Racers in British Columbia exist at the northern periphery of their global distribution and their occurrence is limited by a host of biological factors. Females are thought to mature at 3–4 years; frequency of reproduction is either annual or bi-annual depending on body condition; clutch size may range from 4 to 12 eggs, and egg and hatchling mortality is thought to be high (COSEWIC 2004). Racers are limited to habitats that provide the resources needed for both winter and summer survival and resources must be distributed within an area accessible during the short active season. Racers may have limited dispersal ability and possess specific microhabitat requirements that are limited in availability. Communal hibernation suggests that suitable overwinter sites may be limited (Gregory 1984). High fidelity to hibernacula occurs in populations of Racers in Utah and is an example of a rigid behaviour pattern that could have conservation implications (Brown and Parker 1976).

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.⁵ Threats presented here do not include biological features of the species or population such as inbreeding depression, small population size, and genetic isolation; or likelihood of regeneration or recolonization for ecosystems, which are considered limiting factors.⁶

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 Racer were assessed for the entire province (Table 1).

Table 1. Threat classification table for Racer.

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
2	Agriculture & aquaculture	Low	Pervasive	Slight	High
2.1	Annual & perennial non-timber crops	Low	Small	Extreme	High
2.3	Livestock farming & ranching	Low	Pervasive	Slight	High

⁵ 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).

⁶ 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
4	Transportation & service corridors	High	Large	Serious	High
4.1	Roads & railroads	High	Large	Moderate	High
5	Biological resource use	Negligible	Negligible	Negligible	High
5.1	Hunting & collecting terrestrial animals	Negligible	Negligible	Negligible	High
6	Human intrusions & disturbance	Low	Large	Slight	High
6.1	Recreational activities	Low	Large	Slight	High
7	Natural system modifications	Negligible	Negligible	Unknown	High
7.1	Fire & fire suppression	Negligible	Negligible	Unknown	High
7.2	Dams & water management/use	Negligible	Negligible	Negligible	Moderate
8	Invasive & other problematic species & genes	Unknown	Pervasive	Unknown	High
8.1	Invasive non-native/alien species	Unknown	Pervasive	Unknown	High
9	Pollution	Unknown	Restricted	Unknown	High
9.3	Agricultural & forestry effluents	Unknown	Restricted	Unknown	High
11	Climate change & severe weather	Unknown	Pervasive	Unknown	High
11.1	Habitat shifting & alteration	Unknown	Pervasive	Unknown	High

^a **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each stress 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).

^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%).

^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.

^e **Stress** – The condition or aspect (key ecological, demographic, or individual attribute) of the conservation target that is impaired or reduced by a threat (e.g., directly or indirectly results from human activities).

4.2 Description of Threats

The overall province-wide Threat Impact for this species is High.⁷ The greatest threat is transportation and service corridors (Table 1). Details are discussed below under the Threat Level 1 headings.

4.2.1 Threat Impact: High

IUCN Threat 4: Transportation & service corridors (High Impact)

The ongoing expansion of the road network and traffic volumes within the southern interior of British Columbia alters both the demographic and gene flow among reptile populations through direct mortality and by creating a barrier to movement and dispersal (COSEWIC 2004; Row *et al.* 2007). As ectotherms, snakes used road services for thermoregulation, and are highly vulnerable targets for collision because their long bodies span across much of the road surface

⁷ The overall threat impact was calculated following Master *et al.* (2009) using the number of Level 1 Threats assigned to this species where Timing = High. This includes 1 High, 3 Low, and 3 Unknowns (Table 1). The overall threat considers the cumulative impacts of multiple threats.

(Parks Canada Agency 2010). Recruitment of the Racer may be limited by road mortality, which most strongly affects dispersing juveniles and reproducing females during egg-laying migrations (Bonnet *et al.* 1999). Reptile roadkill has been documented in many areas (Hobbs and Sarell 2002; Dulisse 2006a, 2006b; Davis and Wise, unpublished data, 1990–2009; Machmer, unpublished data, 2006–2011; M. Machmer, pers. comm., 2012). Amphibian and reptile road mortality data from the West Kootenay support the value assigned to severity for this threat. Amphibians and reptiles showed a five-fold increase in roadkill mortality when comparing pre-construction (2006–2009) and construction (2011) phases of major project development (while traffic rates doubled), with listed snakes including Racer being the most susceptible species (M. Machmer, pers. comm., 2012). Overall, roads and volume of traffic have increased over the last few years in the south Okanagan and this trend is expected to continue (MWLAP 2004a). Further, road traffic along the Fraser River within the Cariboo portion of the Racer's range is experiencing an increase in vehicle volume due to mining and logging; no baseline information is currently available to determine associated snake mortality (J. Steciw, pers. comm., 2012). This threat may have significant impacts on local populations and is widespread and increasing.

4.2.2 Threat Impact: Low, Negligible or Unknown

IUCN-CMP Threat 1.0 Residential & commercial development (Low Impact)

A significant amount of suitable Racer habitat has been lost to urban and rural development, especially in the Okanagan Valley, where the core population is located (COSEWIC 2004). However, upon assessment of the Racer's current range in British Columbia and overlapping municipal boundaries and corresponding future development, the impact of development upon local Racer populations was considered low. Urbanization will primarily focus on densification due to rising infrastructure, presence of unsuitable steep terrain, and environmental costs associated with development (City of Kamloops 2004; City of Vernon 2008). The presence of the Agricultural Land Reserve, of which 20% of Penticton's land base is within, will also dampen urban sprawl (City of Penticton 2002). Further, under the *Local Government Act* municipalities are using development permit areas and establishing Environmentally Sensitive Areas (Environmental Law Centre 2007). When urban and commercial development does occur, it will be localized although extreme in severity resulting in habitat fragmentation and alienation with a loss of Racer habitat and individuals.

IUCN-CMP Threat 2.0 Agriculture & aquaculture (Low Impact)

The majority of suitable habitat for Racers is not protected from agricultural activities (COSEWIC 2004). A significant amount of suitable Racer habitat has been lost to agricultural development, particularly in the Okanagan Valley due to the increased number of recent vineyard developments (COSEWIC 2004). Ongoing vineyard development is expected to continue within private lands and First Nation reserves within the Okanagan along with small vineyard ventures being established in Lillooet (City of Penticton 2002; F. Iredale, pers. observation, 2011).

Intensive agriculture practices likely result in the loss of essential habitats that include egg laying and foraging sites. Further, Racers often forage in agricultural habitats and are frequently killed by farm machinery including mowers and hay balers (COSEWIC 2004). Mechanized farming activities have the potential to reduce populations by removing breeding adults.

Livestock grazing has a rich history in British Columbia and is a ubiquitous land use practice within the Racer's current range. Grazing can exert a great impact on animal populations, usually due to indirect effects on habitat structure and prey availability (Szaro *et al.* 1985). Intensive livestock grazing reduces vegetation cover and can compact the soil; control of woody regrowth and grazing intensity is an important component of maintaining suitable thermal attributes of habitat for reptiles (Michael *et al.* 2008). For example, high soil compaction and below target grass stubble heights were significant within the Okanagan-Shuswap Forest District during the 2004 Range Effectiveness Evaluations conducted by range agrologists (Fraser 2005). Loss of residual grass cover and habitat alteration may have direct fitness costs on Racers, trampling and reduced movements during critical foraging periods, but the effect of livestock grazing on the Racer population is currently considered slight due to lack of causal information (COSEWIC 2004; MWLAP 2004a).

IUCN Threat 5: Biological resource use (Negligible Impact)

Under the B.C. *Wildlife Act*, native snakes are protected from capture and killing without a sundry permit. However, human persecution of snakes is particularly noted towards Western Rattlesnakes (SIRART 2008b). Juvenile Racers resemble Western Rattlesnakes in colour and defensive behaviour and could theoretically be misidentified and killed (COSEWIC 2004). Persecution has the potential to reduce populations by removing juveniles and adults and is likely localized in areas of high human density. For example, at Batchelor Heights residential complex within the City of Kamloops, direct persecution of Western Rattlesnakes, Racers and Gopher Snakes was a concern so snake fencing was installed along the exterior of the complex to mitigate this threat (F. Iredale, pers. comm., 2012). Overall, the extent and severity of this localized threat are unknown but are estimated to be negligible in both scope and severity. The use of expert opinion to estimate causal certainty indicates that this threat has a negligible impact.

IUCN Threat 6: Human intrusions & disturbance (Low Impact)

Intensive recreational activities, including the use of all-terrain vehicles, have the potential to cause direct mortality, damage habitat, and disturb snakes (SIRART 2008a, 2008b). A study on Pine Snake (*Pituophis melanoleucus*), an oviparous species, noted direct impact on reproduction as a result of off-road vehicles (ORV) driving over sensitive egg-laying sites (Burger *et al.* 2007). However, considering the Racer's range in British Columbia, this impact is likely dampened, but further research in regard to impacts near egg-laying sites is warranted. The southern interior is experiencing a rapid increase of public participation in regard to ORV use (F. Iredale, pers. observation, 2012). ORV use generally starts in early April and runs through the spring and into late fall in the hunting season. This correlates with spring emergence and egression towards summer foraging and egg-laying sites and fall ingressions towards communal hibernacula. Vulnerability and exposure of Racers to ORV may depend on individual dispersal abilities and movement patterns. Regulated ORV use within the Tunkwa-Duffy Management Project will be restricted to existing trail networks away from sensitive grasslands and wetlands. ORV use continues to exploit open grassland areas outside of designated roads and trails. However, these activities are limited near identified communal Western Rattlesnake and Gopher Snake hibernacula, which are often shared with Racers (MWLAP 2004a). The large extent and slight severity of this threat currently present a low impact to the Racer.

IUCN Threat 7: Natural system modifications (Negligible Impact)

High intensity forest fires may have detrimental effects on Racers, but these effects have never been documented (COSEWIC 2004). Fire suppression alters habitat, promotes tree encroachment into grasslands, and increases the likelihood of high-intensity fires that are thought to be detrimental to snake populations (Smith *et al.* 2001). In the 100 Mile House Forest District, open grasslands are being lost to forest encroachment, thus restricting grazing pressure on remaining grasslands leading to overgrazing, short stubble heights, and early-seral plant communities (Fraser 2005). Removal of artificially high fuel loads to reduce the intensity of fires may help reduce snake mortality (Smith *et al.* 2001). Prescribed fires reduce vegetation cover, which could increase predation rates on Racers in the short term. There were significantly more predation attempts on artificial snakes in recently burned grassland systems than in unburned grasslands (Wilgers and Horne 2007). However, given the negligible extent and unknown severity of this plausible threat, it is considered to have a negligible impact.

Dam projects such as the Waneta Dam and Brilliant Dam in the Kootenay Region may have direct impacts on habitat availability. Dam projects have impacted occupied sites of Western Skinks, a species with a similar range to the Racer in the Kootenays (Dulisse 2006c). The development of the Waneta Dam will result in the loss of suitable Racer habitat (J. Dulisse, pers. comm., 2012). Dam footprint may alienate suitable foraging, egg laying, and hibernation sites, but overall is thought to have a negligible impact on Racer at this time.

IUCN Threat 8: Invasive & other problematic species and genes (Unknown Impact)

The impact of invasive species with respect to Racer populations in British Columbia is not clearly understood at this time. The introduction of non-native forbs and grasses, such as spotted knapweed (*Centaurea maculosa*), Dalmatian toadflax (*Linaria dalmatic*), and brome grass (*Bromus* spp.), has displaced native vegetation but the severity of this threat at the population level remains unclear. It can only be hypothesized that changes to vegetation at the stand scale may alter prey base, such as insects, an important component of the Racer's diet.

We suspect pets, especially cats, may predate upon Racers, in particular near urban and rural centres. However, this threat may be partially mitigated due to the Racer's excellent vision, speed, large size of the adult, and blotched colouration of the young (COSEWIC 2004). The severity of this threat is unknown, but may be insignificant.

IUCN Threat 9: Pollution (Unknown Impact)

The use of strychnine within agriculture areas merits special attention and could pose a threat to the Racer population. Pesticide use in agricultural areas may reduce food availability and contaminate insect and rodents; yet, the effects on populations of ingesting pesticide via contaminated prey have never been assessed for the Racer (COSEWIC 2004). Agriculture areas primarily consist of vineyards and orchards within the Okanagan basin. The application of strychnine is commonly used to control Northern Pocket Gophers (*Thomomys talpoides*) (White 2009), thus protecting important grape vines and trees from associated damage caused by gophers as they eat young roots and tree bark. Strychnine does not bio-accumulate, and biodegrades in the environment, thus non-target exposure of strychnine to Racer snakes is accomplished through secondary exposure of ingested poisoned Northern Pocket Gophers in which strychnine was stored in the Northern Pocket Gophers intestine following consumption

(White 2009). As rodents comprise a small portion of the Racer diet, this threat may be limited to larger adults capable of ingesting larger prey items.

Since all snakes are secondary, tertiary, and top predators, they are susceptible to the bioaccumulation of environmental contaminants (Campbell and Campbell 2001). Uptake of toxic substances through soft-shelled reptile eggs is known to occur and impact embryo survival in other reptiles (Marco *et al.* 2004). The use of expert opinion to estimate causal certainty suggests that the impact of this threat is unknown and represents an important knowledge gap.

IUCN Threat 11: Climate change & severe weather (Unknown Impact)

It is difficult to predict with certainty the long-term forecast for climate change that encompasses the Racer's current range in British Columbia. We acknowledge endemic species that feature restricted ranges, such as the Racer, will likely be impacted; however, to what extent is currently unknown. As the Racer is an ectotherm, it is plausible that changes in solar patterns may interrupt key thermoregulatory requirements that could inhibit foraging ability (Inkley *et al.* 2004). As insects comprise the majority of their diet, long-term droughts may result in lower insect abundance and thus reduce the fitness of Racers, possibly impeding reproduction. Further, geographic ranges of species will shift northward and upward in altitude, although many species will be unable to shift their range at that rate, including prey species (Hannah *et al.* 2005). Overall, given the complex nature of this threat and lack of adequate evidence in regard to severity and impact, it is currently not possible to accurately predict the effects of long-term climate change on the Racer in British Columbia.

5 MANAGEMENT GOAL AND OBJECTIVES

5.1 Population and Distribution Goal

The population and distribution goal is to maintain the current area of occupancy and distribution of the Racer within British Columbia.

5.2 Rationale for the Population and Distribution Goal

This population and distribution goal is set to, at a minimum, prevent the Racer's conservation status (Special Concern) from worsening. At this time, it is not feasible to quantify the Racer's population and distribution goal in British Columbia due to the paucity of the following information: accurate population estimate, lack of suitability mapping, dispersal and re-colonization capabilities, quantification of habitat thresholds within a Racer's home range, and lack of a formal population viability analysis. Management and protection of habitat and the occupation of Racer hibernacula within steep south-facing talus slopes combined with the reduction of identified threats are likely sufficient to maintain the Racer's current area of occupancy and distribution within British Columbia.

5.3 Management Objectives

The management objectives over the next 5 years (2012–2017) are:

1. Protect⁸ and conserve suitable Racer habitat within each of the 5 population areas;
2. Reduce roadkill, the main threat to Racer, at 3 priority⁹ sites, ideally within 3 of the 5 population areas; and
3. Quantify Racer habitat needs, population demographics, and viability within all 5 population areas, as well as investigate less understood threats to Racer (e.g., pollution and agriculture).

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

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

Compile Status Report (complete)

- COSEWIC report completed (COSEWIC 2004).

Send to COSEWIC (complete)

- Racer assessed as Special Concern (COSEWIC 2004).

Planning (in progress)

- BC Management Plan completed (this document, 2012).

Habitat Protection and Private Land Stewardship (in progress)

- Several inventories have been successfully completed within the Okanagan Similkameen population area (Sarell 1993; Sarell *et al.* 1996, 1997; Sarell and Alcock 2000; Hobbs and Sarell 2001). Less survey effort has occurred within the Thompson Fraser (Hobbs and Sarell 2002; Iredale and Ferguson 2007; Gomez 2008) and Trail population areas (Dulisee 1999, 2005, 2006a, 2006b, 2007).

⁸ Protection and management will be achieved through the implementation of wildlife habitat areas, conservation covenants, voluntary stewardship agreements and application of best management practices.

⁹ Priority sites are those where road-kill observations are clustered and will be identified based on available information (e.g., inventory data, habitat modeling, and genetic work). Priority sites should consider habitat elements such as important hibernacula, foraging and egg-laying habitat, and travel corridors.

- Existing Habitat Protection:¹⁰
 - In 2006 Racer was listed as a species at risk under the *Forest and Range Practices Act*, (FRPA), which enables habitat management tools as per the Identified Wildlife Management Strategy (MWLAP 2004b).
 - Wildlife Habitat Areas (WHA)¹¹ established for snakes in Racer habitat in the Thompson Region includes 16 Western Rattlesnake and two Gopher Snake WHAs covering an approximate area of 3623 hectares (Ministry of Environment 2010c). These management designations also account for the sympatric range overlap with the Racer.
 - WHAs established for snakes in Racer habitat in the Okanagan Region include 10 Gopher Snake, 2 Western Rattlesnake, and 1 Racer WHAs covering an approximate area of 2349 hectares (Ministry of Environment 2010c).
 - Three Wildlife Management Areas¹² (WMAs): Dewdrop, Rosseau, and Tranquille WMAs in Kamloops and the South Okanagan WMA protect approximately 4882 hectares of Racer habitat.
 - In British Columbia there are 13 protected areas¹³ within Racer habitat (e.g., provincial parks: White Lake, Lac du Bois, and Churn Creek). This accounts for 80 732 hectares of habitat that is afforded protection through legal provisions such as the *BC Park Act*.
 - Teck Cominco has established a 40-hectare reptile conservation. This covenant was established to protect sensitive reptile habitat.
 - To accommodate all-terrain vehicles while maintaining the ecological integrity of sensitive grasslands, the Ministry of Forests, Lands and Natural Resources has implemented section 58 (1) (b) under the FRPA within the Tunkwa Lake Area that will prohibit unregulated off-road vehicle use in sensitive grassland and wetland habitat. Similar FRPA designation exists for Bear Creek ORV area.
 - Best management practices for amphibians and reptiles in urban and rural environments in British Columbia report completed (Ovaska *et al.* 2003).

Species and Population Management: in progress

- Best management practices (BMPs) for amphibians and reptiles in urban and rural environments in British Columbia report completed (Ovaska *et al.* 2003). BMPs promote the development of housing away from potential denning sites and sensitive south-facing rock outcrops, installation of snake fencing, and outreach. This will reduce urban interface interactions and dampen localized Racer mortalities.

¹⁰ Summation of Racer habitat protection does not account for overlapping protection or management designations.

¹¹ Wildlife habitat areas (WHAs) are mapped areas that are necessary to meet the habitat requirements of an identified wildlife element, e.g. snake den. WHAs designate critical habitats in which activities are managed to limit their impact on the Identified Wildlife element. Refer to Racer account in Province of British Columbia (2004; http://www.env.gov.bc.ca/wld/frpa/iwms/documents/Reptiles/r_racer.pdf)

¹² Wildlife Management Area (WMA) is an area of land designated for the benefit of regionally to internationally significant fish and wildlife species or their habitats. Conservation and management of fish, wildlife and their habitats is the priority in a WMA but other compatible land uses may be accommodated.

¹³ Protected areas are Crown Lands designated under the *Parks Act* or by the *Protected Areas of British Columbia Act* whose management and development is constrained by the *Parks Act*.

- Shewchuck and Austin (2001) documented forage habits of Racer. Identification of important prey items will enable the application of management actions that will protect associated habitat.

6.2 Recommended Management Actions

Table 2. Recommended management actions.

Objective	Conservation Framework action group	Management action	Threat ^a or concern addressed	Priority ^b	Start
1	Habitat Protection; Land Stewardship	Develop and implement an inventory and population monitoring strategy: <ul style="list-style-type: none"> • Use suitability modeling to develop an inventory strategy to clarify distribution and abundance within discrete population areas 	Knowledge Gap	Essential	2013
1		<ul style="list-style-type: none"> • Inventory population areas according to inventory strategy. 	Knowledge Gap	Essential	2014
1		<ul style="list-style-type: none"> • Determine priority sites for habitat protection based on inventory data. 	Knowledge Gap	Essential	2016
1	Habitat Protection; Land Stewardship	Secure priority sites: <ul style="list-style-type: none"> • on provincial Crown land through application of appropriate tools (e.g., WHAs or <i>Land Act</i> Section 16) 	1.1, 1.2, 2.1, 2.3, 4.1, 6.1	Essential	2014
1		<ul style="list-style-type: none"> • on private lands by providing information on priority sites to landowner contact and habitat acquisition programs; encourage voluntary stewardship, implementation of BMPs, and conservation acquisitions on private land. 	1.1, 1.2, 2.1, 2.3, 4.1, 6.1	Essential	2014
1		<ul style="list-style-type: none"> • by working with municipal and regional governments to conserve habitat by using legislative tools, zoning, and planning guidelines. 	1.1, 1.2, 2.1, 2.3, 4.1, 6.1	Necessary	2013
1	Habitat Protection; Land Stewardship	<ul style="list-style-type: none"> • Protect priority Racer sites from ORV through application of FRPA section 58 (1) (b) where applicable. 	6.1	Beneficial	2017
3	Habitat Protection	<ul style="list-style-type: none"> • Clarify seasonal movement patterns (all spatial scales), identify home range size, dispersal ability, and characteristics of hibernation and nesting sites. 	Knowledge Gaps; All	Essential	2014
3	Habitat Projection	<ul style="list-style-type: none"> • Develop monitoring program in each of the five population areas to detect changes in population abundance and distribution through time. 	Knowledge gap	Necessary	2015
2	Species and Population Management	<ul style="list-style-type: none"> • Identify high road mortality sites and apply appropriate mitigation strategy. 	Knowledge Gap; 4.1	Essential	2014

Objective	Conservation Framework action group	Management action	Threat^a or concern addressed	Priority^b	Start
3	Species and Population Management	<ul style="list-style-type: none"> Assess population level impacts of exposure to agriculture effluent, strychnine. 	Knowledge Gap; 9.3	Essential	2015

^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).

7 MEASURING PROGRESS

The following performance indicators provide a way to define and measure progress toward achieving the population and distribution goal and management objectives. Overall success will be indicated if ongoing monitoring indicates that suitable habitat occupation by Racer is stable. Performance measures are listed below for each objective.

Objective 1:

- Suitability modeling for Racer within each of the 5 population areas complete by 2014.
- Racer inventory plan developed and implemented by 2014.
- Priority Racer sites identified within each of the 5 population areas by 2016.
- Conservation of 10 750 ha of Racer habitat on Crown land by 2017 through development of WHAs and/or *Land Act* applications.
- Establishment of three conservation covenants for Racer on Private land by 2017.
- Adoption of municipal BMPs within urban centres through incorporation into development permits within two cities by 2017.

Objective 2:

- Three high mortality Racer sites identified within 3 of the 5 population areas by 2014 and implement mitigation strategy by 2015.

Objective 3:

- Radio-telemetry studies complete at occupied locations to better understand movement patterns and assess protected and managed areas for Racer by 2017.
- Masters student started thesis to assess population level impacts of exposure to agriculture effluent strychnine by 2015.
- Monitoring program initiated by 2014.

8 EFFECTS ON OTHER SPECIES

Managing for a diversity of suitably connected habitats at the landscape scale and addressing site-specific threats should benefit species with life-histories and/or ecological requirements similar to the Racer. There appears to be a substantial amount of overlap in the habitats used by Racers, Western Rattlesnakes, and Gopher Snake throughout most of the Racer's range in British Columbia, and habitat protection and stewardship activities outlined in this management plan are likely to benefit these species. Conservation and management of Racer foraging habitat will also benefit Bighorn Sheep.

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