

# Recovery Strategy for the Eastern Yellow-bellied Racer (*Coluber constrictor flaviventris*) in Canada

## Eastern Yellow-bellied Racer



October 2010



Parks  
Canada

Parcs  
Canada

Canada

## About the *Species at Risk Act* Recovery Strategy Series

### What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is “*to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity.*”

### What is recovery?

In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed and threats are removed or reduced to improve the likelihood of the species’ persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

### What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA ([http://www.sararegistry.gc.ca/approach/act/default\\_e.cfm](http://www.sararegistry.gc.ca/approach/act/default_e.cfm)) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. Three to four years is allowed for those species that were automatically listed when SARA came into force.

### What’s next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

### The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

### To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the SARA Public Registry (<http://www.sararegistry.gc.ca/>).

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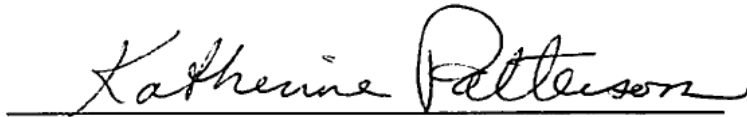
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## RECOMMENDATION AND APPROVAL STATEMENT

Recovery Strategy for the Eastern Yellow-bellied Racer (*Coluber constrictor flaviventris*) in Canada


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Katherine Patterson  
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Date: 04 October 2010

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Date: 19 October 2010

## DECLARATION

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. The *Species at Risk Act* (S.C. 2002, c.29) (SARA) requires that federal competent ministers prepare recovery strategies for listed Extirpated, Endangered and Threatened species.

The Minister of the Environment presents this document as the recovery strategy for the Eastern Yellow-bellied Racer as required under SARA. It has been prepared in cooperation with the jurisdictions responsible for the species, as described in the Preface. The Minister invites other jurisdictions and organizations that may be involved in recovering the species to use this recovery strategy as advice to guide their actions.

The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives.

This recovery strategy will be the basis for one or more action plans that will provide further details regarding measures to be taken to support protection and recovery of the species. Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the actions identified in this strategy. In the spirit of the *Accord for the Protection of Species at Risk*, all Canadians are invited to join in supporting and implementing this strategy for the benefit of the species and of Canadian society as a whole. The Minister of the Environment will report on progress within five years.

## ACKNOWLEDGMENTS

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## STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

In accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals* (2004), a strategic environmental assessment (SEA) is conducted on all *Species at Risk Act* recovery strategies. 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.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond their intended benefits. Environmental effects, including impacts to non-target species and the environment, were considered during recovery planning. The SEA is incorporated directly into the strategy and also summarized below.

This Eastern Yellow Bellied Racer recovery strategy is expected to benefit a suite of species that share the same habitat as the Eastern Yellow-bellied Racer (see Effects on the Environment and Other Species section), and their natural environment. Recovery approaches focus on resolving and/or mitigating threats to Eastern Yellow-bellied Racers and their habitat (habitat loss, road mortality, small population size, human disturbance of individuals, extreme weather variability due to climate change, and farm machinery fatalities – section 1.4). Approaches aimed at meeting the population and distribution objective (section 2.1.2) are expected to benefit the Eastern Yellow-bellied Racer and have overall benefits to the mixes-grass prairie, sagebrush thicket environment, and include habitat protection, outreach, stewardship, inventory, monitoring and research initiatives.

In summary, the overall impacts of the Eastern Yellow-bellied Racer recovery strategy are positive for the Eastern Yellow-bellied Racers, other species that share the same habitat areas, and the natural environment in general. No negative effects on the environment or other species are expected.

## RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* [Subsection 2(1)].

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SARA public registry:

[http://www.sararegistry.gc.ca/sar/recovery/residence\\_e.cfm](http://www.sararegistry.gc.ca/sar/recovery/residence_e.cfm).



## **PREFACE**

The Parks Canada Agency led the preparation of the recovery strategy for Eastern Yellow-bellied Racers in Canada, in cooperation with Environment Canada, Agriculture and Agri-Food Canada, and the provinces of Saskatchewan and Alberta. Other constituencies cooperated in the development of this document via a Herptile Experts Workshop that included representatives from government and academia (see Acknowledgements). Targeted consultations regarding the recovery strategy were conducted with affected stakeholders.

## EXECUTIVE SUMMARY

The Eastern Yellow-bellied Racer (*Coluber constrictor flaviventris*) is a long, smooth scaled, quick moving diurnal snake of the North American Colubrid family. Identifiable by its yellow coloured belly and olive dorsal scales, Eastern Yellow-bellied Racers range from Texas and Louisiana up to Iowa, North Dakota and Montana, with the extreme northern tip extending into southwestern Saskatchewan and southeastern Alberta. Known distributions of Canadian populations are centered around hibernacula located within the boundaries of Grasslands National Park and the Agriculture and Agri-Food Canada (AAFC) Val Marie Community Pasture. Additional Eastern Yellow-bellied Racer sightings have been reported in southeastern Alberta near the area of Onefour and in south central Saskatchewan in the Big Muddy Valley.

Throughout the limited range of the Eastern Yellow-bellied Racer in Canada, suitable habitat consists of mixed-grass prairie and sagebrush thickets, which are likely important for concealment from predators and housing of suitable prey. The species requires suitable hibernacula for over-wintering sites and the area surrounding hibernacula for cover and protection during the vulnerable spring emergence / fall return periods, and potentially for breeding grounds and nesting sites as well.

The Eastern Yellow-bellied Racer is listed as Threatened on Schedule 1 of the Species at Risk Act. The primary threats to the species include habitat loss due to human activities, small population size, road mortality, and human disturbance of hibernacula. Additional threats may include extreme weather variability due to climate change and farm machinery fatalities. Recovery of this species is considered feasible, though recovery planning is hindered by numerous information gaps about the species, such as the full Canadian distribution, population estimates and dynamics, genetic connectivity among populations, and biological and habitat requirements. The objective of this recovery strategy is, therefore, to maintain the current species' distribution within Canada. Key recovery approaches address information gaps (e.g., via inventory, monitoring and research initiatives) and threats (e.g., via habitat protection, outreach, stewardship and research initiatives).

Critical habitat is identified for Eastern Yellow-bellied Racers in Canada as seven currently used hibernacula and the immediate adjacent areas within a 500 metre radius of those hibernacula. These critical habitat areas primarily occur within Grasslands National Park and the AAFC Val Marie Community Pasture in southwestern Saskatchewan. A schedule of studies outlines the steps that will be taken toward a future identification of the critical habitat required for survival and recovery of the species. One or more action plans will be completed by August 2015.

## RECOVERY FEASIBILITY SUMMARY

The recovery of Eastern Yellow-bellied Racers in Canada is considered feasible based on the criteria set outlined by the Government of Canada (2009):

- 1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.**

There are Eastern Yellow-bellied Racer individuals available that are capable of reproduction now or in the foreseeable future to sustain the population or improve its abundance.

- 2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.**

Although there is limited knowledge of habitat requirements for the species and information on connectivity of suitable habitat is not known, it is believed that sufficient Eastern Yellow-bellied Racer habitat is available.

- 3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.**

Threats can be effectively avoided or mitigated through: (1) the use of management and stewardship actions to protect habitat; (2) education, research and monitoring to support conservation and management decisions; (3) public outreach and awareness programs; and (4) cooperative approaches to agricultural, industrial and other anthropogenic development. Further research is needed to determine potential mitigation measures focused on the effects of climate change.

- 4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.**

Recovery techniques to achieve the population and distribution objective either exist and have been demonstrated to be effective in other recovery programs or can be expected to be developed within a reasonable timeframe.

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# 1. BACKGROUND

## 1.1 COSEWIC Species Assessment Information

**Date of Assessment - November 2004**

**Common Name (population):** Eastern Yellow-bellied Racer

**Scientific Name:** *Coluber constrictor flaviventris*

**COSEWIC Status:** Threatened

**Reason for Designation:** This snake is restricted to two small areas in extreme southern Saskatchewan\*. It is at risk due to loss of habitat from agriculture, mortality on roads, loss of den sites and perhaps from effects of small population size. There may be a rescue effect from immigration from the United States, but this effect has not been observed.

**Canadian Occurrence:** Saskatchewan\*

**COSEWIC Status History:** Designated Special Concern in April 1991. Status re-examined and designated Threatened in November 2004. Last assessment based on an update status report.

\*There have also been incidental sightings in southeastern Alberta (see Section 2.1.1). This is recently acquired information not known during the development of the COSEWIC report.

## 1.2 Species Status Information

A Threatened reptile species in Canada, the Eastern Yellow-bellied Racer reaches the northern edge of its range in the southern Saskatchewan and Alberta. The Canadian population represents a very small (likely <1%) proportion of the global abundance of this species.

### Conservation Status Ranks (NatureServe 2009)

Region	Rank	Status
Global:	G5T5	Secure
National (USA):	N5	Secure
National (Canada):	N3	Vulnerable
Sub-national (Saskatchewan):	S3	Vulnerable
Sub-national (Alberta):	S1*	Critically Imperilled*

\*Critically Imperilled rank likely due to the few confirmed occurrences in AB.

(also see Population and Distribution Context – section 2.1.1).

## 1.3 Description of the Species and its Needs

### 1.3.1 Species Description

Eastern Yellow-bellied Racers have long, smooth scaled bodies developed for speed and are capable of reaching speeds of 7 km/hr (COSEWIC 2004, Werler and Dixon 2000). According to COSEWIC (2004), adult Eastern Yellow-bellied Racers have snout to vent lengths of 61 to 94 cm. Individuals in Grasslands National Park (GNP) and the Agriculture and Agri-Food Canada (AAFC) Val Marie Community Pasture have snout to vent lengths of 37 to 95 cm (Martino unpublished data). Mature female Eastern Yellow-bellied Racers are slightly larger than mature males (COSEWIC 2004). Dorsal colouration is olive-green to slate gray with a light to bright yellow coloured underside, being especially bright under the chin (Werler and Dixon 2000). Juveniles have between 65 and 80 dark dorsal bands or saddle patterns that fade as the reptile reaches sexual maturity (COSEWIC 2004). The saddle blotches may be shades of gray, brown or red separated by light grayish bands. Saddles are most prominent at the neck and fade along the body. Their heads are slightly wider than their necks, they have rounded snouts, and their large round eyes have dark pupils.

### 1.3.2 Species Needs

Throughout the limited range of the Eastern Yellow-bellied Racer in Canada, suitable habitat consists of mixed-grass prairie and sagebrush thickets; although in the United States habitat also includes restored prairie, pasture land, old agricultural fields, sloughs and marshlands, juniper clusters and open woods (COSEWIC 2004, Ernst and Ernst 2003, Herptile Experts Workshop 2007). In Canada, mixed-grass prairie and sagebrush thicket habitat are likely important for concealment from predators and housing of suitable prey. Eastern Yellow-bellied Racers tend to be opportunistic hunters and their prey base is generally broad. They may eat crickets, grasshoppers, other insects, spiders, small rodents, lizards (and eggs), and amphibians. In some cases they consume other juvenile snakes. Prey preferences may change as the season progresses (Ernst and Ernst 2003).

Hibernacula are required by Eastern Yellow-bellied Racers as over-wintering sites. Typical emergence from hibernation occurs in April and May and snakes return to hibernacula in September and October based on latitude, elevation and temperature in Canada (Ernst and Ernst 2003, R. Poulin pers. comm. 2009). Suitable hibernation sites occur within stable slump zones, mammal burrows, rock crevices or ledges, deep holes in soft hillside soil and abandoned cisterns (COSEWIC 2004, Ernst and Ernst 2003, Kissner and Nicholson 2003). Previous research indicates a preference for south facing slopes (COSEWIC 2004); however, recent observations suggest that there may be more variation in directionality, although north facing slopes seem to be avoided (R. Poulin pers. comm. 2009). Although hibernacula have not been characterized for Eastern Yellow-bellied Racers, they have been characterized for Western Yellow-bellied Racers (*Coluber constrictor mormon*) in British Columbia. Considering the similarities between the two subspecies, information on the attributes of suitable hibernacula for Western Yellow-bellied Racers is likely applicable to Eastern Yellow-bellied Racers as well. These attributes include: fracturing (maintains constant temperature and prevents freezing), humidity (prevents snake desiccation during hibernation), cover (defined as rocks, boulders, grass, forbs or brush that aids in thermoregulation during emergence), and thermal momentum (the hibernaculum's capacity to absorb and retain heat) (Hobbs and Sarell 2002). Communal hibernacula are a result of limited hibernation sites at high latitudes (Gregory 1982). In southern Saskatchewan Eastern Yellow-

bellied Racers may be found hibernating with Prairie Rattlesnakes (*Crotalus viridis*), Plains Garter snakes (*Thamnophis radix*), and Bullsnares (*Pituophis catenifer*), as well as very rare encounters with Plains Hognose snakes (*Heterodon nasicus nasicus*) (A. Didiuk pers. comm. 2009, Kissner et al. 1996, Secoy 2006, Wright and Didiuk 1998).

Courtship and reproduction data are limited for Eastern Yellow-bellied Racers. In general, males reach reproductive maturity sooner than females, 11 months compared to two or three years, respectively. During May and June, males seek females following emergence, at or near the den, by means of olfactory cues (COSEWIC 2004). A female of reproductive age can produce a clutch of 4 to 20 eggs annually or biennially (COSEWIC 2004). Eggs are laid in loose soil, mammal burrows or under large rocks and left to incubate via environmental heat for about two months. Although research is limited, communal incubation, where several females lay their eggs within the same site, may occur (COSEWIC 2004, Ernst and Ernst 2003). Hatchlings typically emerge from late July to August. Following reproduction, females and males disperse from their hibernacula to summer grounds.

Biologically limiting factors for Eastern Yellow-bellied Racers, based on current scientific knowledge and expert opinion, can be described as specific seasonal and climatic habitat requirements with limited availability. Eastern Yellow-bellied Racers must have suitable hibernacula, egg incubation sites and dispersal corridors that meet their specific reproductive, shelter, forage and moisture requirements (COSEWIC 2004). More specifically, these may include pre-existing mammal burrows, rock crevices or cracks in the soil; soft soil or burrows to lay eggs in; and dense vegetation to maintain concealment from predators and house suitable prey. All currently known active Eastern Yellow-bellied Racer hibernacula are located in GNP and the AAFC Val Marie Community Pasture. Climatic and environmental conditions, such as drought and hibernacula deterioration due to land slumping, can also be biologically limiting for Eastern Yellow-bellied Racers (COSEWIC 2004, Sauchyn and Lemmen 1996).

## 1.4 Threat Identification

The following factors are believed to be threatening the recovery of Eastern Yellow-bellied Racers in Canada.

Table 1. Threat classification table.

1 Habitat loss		Threat Information	
Threat Category	Habitat loss or degradation	Extent	Local
General Threat	Trampling or vandalism of hibernacula, agricultural or industrial activities	Occurrence	Historical
		Frequency	Recurrent
Specific Threat	Habitat conversion, habitat fragmentation, loss of suitable habitat	Causal Certainty	Low
		Severity	Unknown
Stress	Reduced resource availability &	Level of	Unknown

	ability to migrate/return to den, increased mortality	Concern		
2 Road Mortality		Threat Information		
Threat Category	Accidental mortality	Extent	Widespread	
General Threat	Road mortality	Occurrence	Current	
		Frequency	Seasonal (spring/summer/fall)	
Specific Threat	Struck by motor vehicles on roadways	Causal Certainty	Low	
		Severity	Low	
Stress	Reduced population size	Level of Concern	Low	
3 Small Population Size		Threat Information		
Threat Category	Natural processes or activities	Extent	Widespread	
General Threat	Northern extent of population	Occurrence	Unknown	
		Frequency	Unknown	
Specific Threat	Isolation from other populations	Causal Certainty	Low	
		Severity	Unknown	
Stress	Small population size	Level of Concern	Unknown	
4 Human Disturbance of Individuals		Threat Information		
Threat Category	Disturbance or Harm	Extent	Local	
General Threat	Recreational visits and tourist activities, industrial activities	Occurrence	Current	
		Frequency	Seasonal (spring to fall)	
Specific Threat	Behavioural or life cycle disruption, increased mortality	Causal Certainty	Low	
		Severity	Low	
Stress	Behavioural changes, reduced ability to migrate/return to den, reduced population size	Level of Concern	Unknown	
5 Extreme Weather Variability due to Climate Change		Threat Information		
Threat Category	Climate and Natural Disasters	Extent	Short-term	Long-term
			Widespread	Widespread
General Threat	Drought and land slumping	Occurrence	Current	Anticipated
		Frequency	Re-current	Unknown
Specific	Reduced soil moisture and	Causal Certainty	Unknown	Unknown



<b>Threat</b>	available standing water, risk of increased moisture destabilizing hibernacula	<b>Severity</b>	Low	Unknown
<b>Stress</b>	Reduced productivity, reduced population size, loss of habitat	<b>Level of Concern</b>	Low	Unknown
<b>6 Farm Machinery Fatalities</b>		<b>Threat Information</b>		
<b>Threat Category</b>	Accident mortality	<b>Extent</b>	Local	
<b>General Threat</b>	Farm machinery fatalities	<b>Occurrence</b>	Current	
		<b>Frequency</b>	Seasonal (spring/summer/fall)	
<b>Specific Threat</b>	Mortality caused by agricultural equipment	<b>Causal Certainty</b>	Low	
		<b>Severity</b>	Unknown	
<b>Stress</b>	Reduced population size	<b>Level of Concern</b>	Unknown	

### Habitat loss

Loss of Eastern Yellow-bellied Racer habitat is primarily through historic habitat degradation or destruction due to human activities. Brown and Parker (1976) observed high hibernacula fidelity when 93% of Eastern Yellow-bellied Racers studied (n=283) returned to the same hibernaculum and only 7% relocated to a different hibernaculum. Because of this hibernacula fidelity, the disturbance or destruction of hibernacula increases the potential of over-winter mortality for entire sub-populations in the event that they cannot find other suitable hibernacula.

Human visitation to hibernacula may alter the structural integrity of the site over time through erosion or compaction (COSEWIC 2004). Prolonged human activity or ungulate (e.g., livestock, bison) trampling may cause filling in of hibernacula entrances thereby degrading the quality of the site (R. Poulin pers. comm. 2009). Human activity at hibernacula is likely more prevalent within GNP. In addition, ungulates such as livestock and bison tend to avoid slopes, so habitat loss due to ungulates will likely be more prevalent at hibernacula that are in flat areas.

Historically, direct destruction of hibernacula resulted in the loss of Eastern Yellow-bellied Racer habitat (COSEWIC 2004). Willful destruction of hibernacula is prohibited under the Saskatchewan's *The Wildlife Act* (1998) and Alberta's *Wildlife Act* (2000). In Canada, only seven hibernacula are currently known to be used by the Eastern Yellow-bellied Racer, therefore, loss of any one of these sites may pose a significant threat to population sustainability. However, other, currently unknown, hibernacula may exist.

Unsustainable grazing by ungulates (e.g., livestock, bison) may result in habitat loss for Eastern Yellow-bellied Racers (Fitch 1999, Macartney, unpublished observations as cited in Campbell and Perrin 1991). In addition, linear habitat disturbances, such as roadways and cutlines, may disrupt snake movement and reduce habitat connectivity, potentially resulting in population isolation. Roadways can either trigger snake avoidance, causing alterations to their movement patterns, or the tarmac can act as a thermal attractant, which can cause roadway mortalities (Andrews and Whitfield Gibbons 2005). However, given the low density of roads, low traffic

volumes and the relatively remote location of the Eastern Yellow-bellied Racers habitat in southwestern Saskatchewan, linear habitat disturbances are unlikely to pose a large threat to the species in the future.

Industrial activities and anthropogenic developments are minimal within the protected mixed-grass prairie of GNP and the AAFC Val Marie Community Pasture; however, their occurrence in areas adjacent to these areas may result in Eastern Yellow-bellied Racer habitat loss. Historical burning of land (Wright and Wright 1957) may have resulted in habitat alteration that was detrimental to the species. Cultivated monocultures, such as cereal crop production, reduces overall prairie biodiversity thereby reducing available food supply; necessary shelter provided by diverse mixed-grass communities also deteriorates with the presence of uniform plant species (Fitch 1999, Macartney and Weichel 1993). Identified as a threat to other prairie snake species, such as the Prairie Rattlesnake (Macartney and Weichel 1993), it is conceivable that agricultural monocultures could cause similar habitat degradation for Eastern Yellow-bellied Racers.

### **Road mortality**

In general, spatial aggregation of habitat and road systems tends to be the cause of road mortality for reptiles (Langen et al. 2009). Eastern Yellow-bellied Racers may incidentally encounter roads throughout their expected dispersal ranges, or may be attracted to roads for thermoregulatory benefits during basking, resting and coiling (Herptile Experts Workshop 2007, Langen et al. 2009, Rosen and Lowe 1994). When on roads, snakes are highly vulnerable targets for collision because their long bodies span across much of the road surface. In a recent study, Fortney (unpublished data) found that three of 26 (12%) road-killed snakes near GNP and the AAFC Val Marie Community Pasture were Eastern Yellow-bellied Racers. Although frequency of occurrence and severity of threat are currently low due to limited road systems and minimal traffic volume, any evidence of increasing rates of road mortality is a conservation concern (Langen et al. 2007).

### **Small population size**

Eastern Yellow-bellied Racers in Canada are located at the northernmost tip of their North American range. These small populations may be vulnerable to demographic extirpation and genetic isolation, making them more susceptible to environmental stochasticity (COSEWIC 2004). Currently there is no information on current or historic population connectivity among Canadian populations or between Canadian and U.S. populations.

### **Human disturbance of individuals**

Human presence during emergence and return to hibernacula in the spring and fall, respectively, can alter Eastern Yellow-bellied Racer behaviour (Macartney and Weichel 1993). In the spring, this may force some snakes to retreat into their dens as opposed to sunning themselves outside their den entrance before their summer dispersal. Human presence during the fall return may inhibit the normal snake basking behaviour that is required for thermoregulation and proper digestion prior to hibernation. Human presence may also alter dispersal patterns (Macartney and Weichel 1993). Overall, human disturbance of individuals is considered a low threat as visitation to most known hibernacula is low. However, one well known hibernaculum in GNP receives high visitation in the spring that is currently unrestricted and unmonitored. Noise and human activity associated with industrial activities may also pose a disturbance to individuals, as

observed in Sage Grouse (*Centrocercus urophasianus*) (Braun et al. 2002, Lyon and Anderson 2003).

### **Extreme weather variability due to climate change**

Although it is difficult to predict with certainty, general circulation model simulations suggest that the long-term trend for climate throughout the northern Great Plains will be increased mean annual temperatures and more frequent extreme weather occurrences such as heat waves, extensive droughts and intense rainfall (Diffenbaugh et. al. 2005). Whether overall precipitation on the Great Plains is increasing or decreasing is under debate (Gleick 2000, Karl et al. 2009). Vegetation modeling related to climate proposes that southern Alberta and Saskatchewan may become a semi-desert (Rizzo and Wiken 1992). Conversely, a more recent study (Burn and Hesck 2007) indicates that evaporation has shown a decreasing trend in the southern Canadian prairies, resulting in an increase in the amount of moisture in the atmosphere and more rainfall.

Overall, vulnerable species are likely to be affected by climate change as the geographic ranges of species will shift northward and upward in altitude, although many species will be unable to shift their range at the rate that climate is projected to change (Gitay et al. 2002, Hannah et al. 2005). The faster the rate of climate change, the greater the probability of ecosystem disruption and species extinction (Root et al. 2003). These long-term climate changes are anticipated to occur throughout the range of Eastern Yellow-bellied Racers, with the potential to create environmental stresses or habitat that is unsuitable for this species (Parmesan and Yohe 2003). Additionally, the species ability to survive in the surroundings may become limited; predictions for reptiles include changes in their ability to thermoregulate, reduction in activity levels and subsequent reduction in foraging or mate searching time (Inkley et al. 2004). Uncertainty does exist; current evidence is inadequate to accurately predict the effects of long-term climate change on Eastern Yellow-bellied Racer populations.

Short-term climate change, or extreme weather variability, is deemed a current, widespread threat throughout the Eastern Yellow-bellied Racer range. Extreme weather events such as the sudden onset of precipitation to a dry environment or severe drought can cause soil erosion (Karl et al. 2009). Hibernacula, which often occur in stable land slumps influenced by topographical and geomorphological formations (Downey et al. 2004, Kissner and Nicholson 2003, Sauchyn and Lemmen 1996), are susceptible to erosion. Although stable slumps form suitable habitat for Eastern Yellow-bellied Racers, extreme weather events could affect the water table or increase soil erosion, which may reduce slope stability and increase the opportunity for slumping (Sauchyn and Lemmen 1996). Extreme weather events that cause land slumping may wash out or fill in hibernacula, thereby, damaging habitat. These long-term and short-term climatic changes could result in current Eastern Yellow-bellied Racer habitats becoming unsuitable; whether any new habitat would be created is unknown.

### **Farm machinery fatalities**

Mechanized farming activities were identified as a threat to Eastern Yellow-bellied Racers by COSEWIC (2004), citing Fitch (1963). However, the extent of this threat in Canada is minimal and localized to unprotected areas found beyond GNP and the AAFC Val Marie Community Pasture boundaries. It is expected that the threat of direct mortality from farm machinery is low.

However, there are instances where farming equipment is used within GNP for park management.

## **2. RECOVERY**

### **2.1 Population and Distribution**

#### **2.1.1 Population and Distribution Context**

The Eastern Yellow-bellied Racer is widely-distributed across North and Central America, from Maine to southern British Columbia, south to the Florida Keys and northern Guatemala (COSEWIC 2004). Eastern Yellow-bellied Racers are common in the northern states including Montana, North Dakota, and Iowa south to Texas and Louisiana.

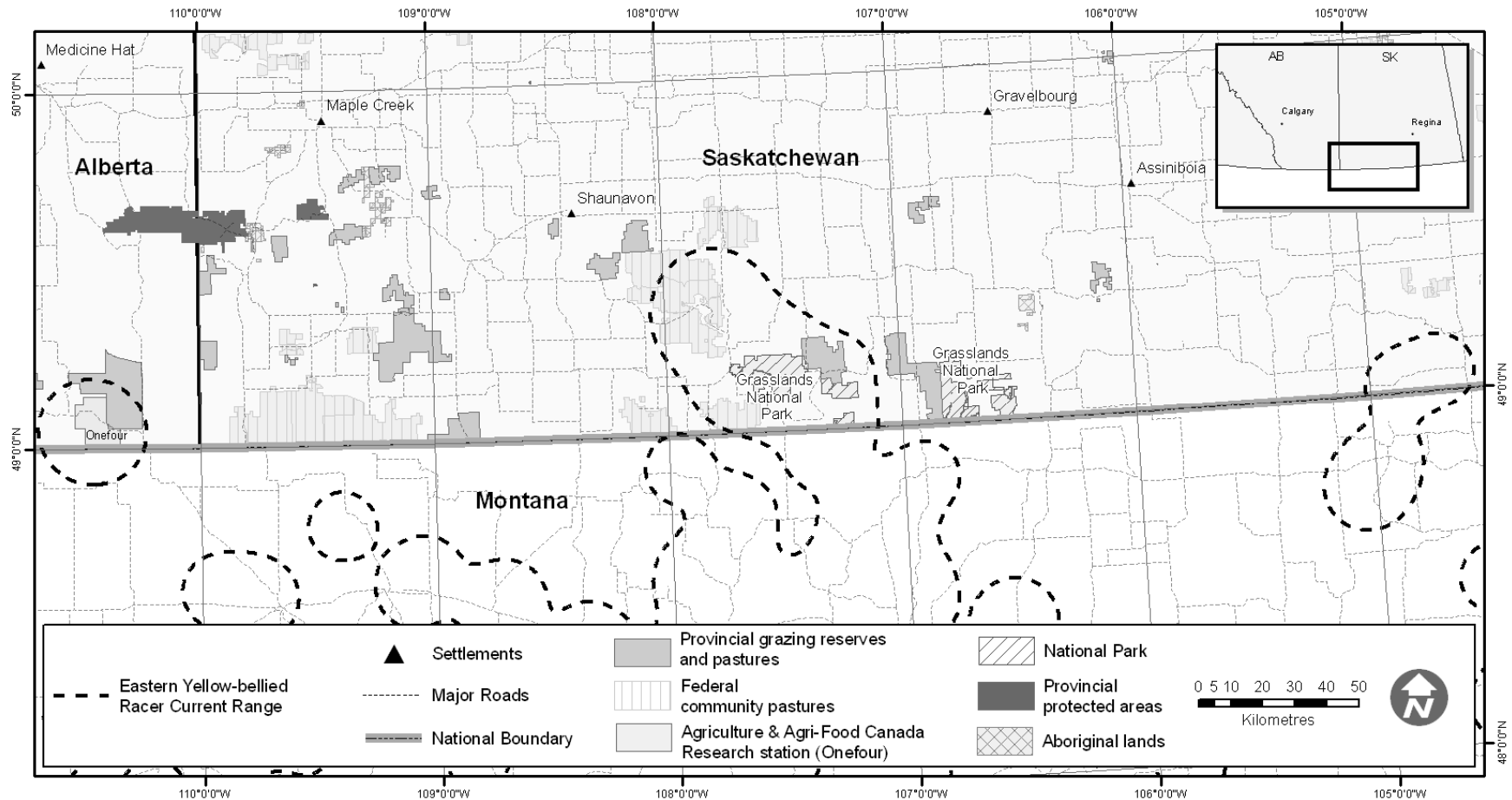
In Canada, Eastern Yellow-bellied Racers are primarily confined to areas of extreme south central Saskatchewan in proximity to GNP and the AAFC Val Marie Community Pasture along the Frenchmen River Valley (COSEWIC 2004, Martino unpublished data, Poulin and Didiuk 2008) (Figure 1). Sightings of individuals outside of extreme south central Saskatchewan are limited, but there have been one probable and four confirmed Eastern Yellow-bellied Racer sightings in extreme southeastern Alberta near Onefour and Lost River and two confirmed sightings near the Big Muddy River Valley in Saskatchewan (Cook and Van Zyll De Jong 1975, Kreba 1978, Morrison 1969, Skiftun 2001, Wallis 2006, Wershler 2001a, Wershler 2001b, Wershler 2001c). Records of current (evidence of use by individual Eastern Yellow-bellied Racers during spring 2008 and 2009 emergence), historic (no evidence of current use by the species and last reported use in 1987 (MacKay) or 1993 (Macartney and Weichel)) and unused (no evidence of current or historic use by the species, but potentially appropriate) hibernacula are presented in Figure 2. No empirical estimates of population size exist for the Canadian population of the Eastern Yellow-bellied Racer.

#### **2.1.2. Population and Distribution Objectives**

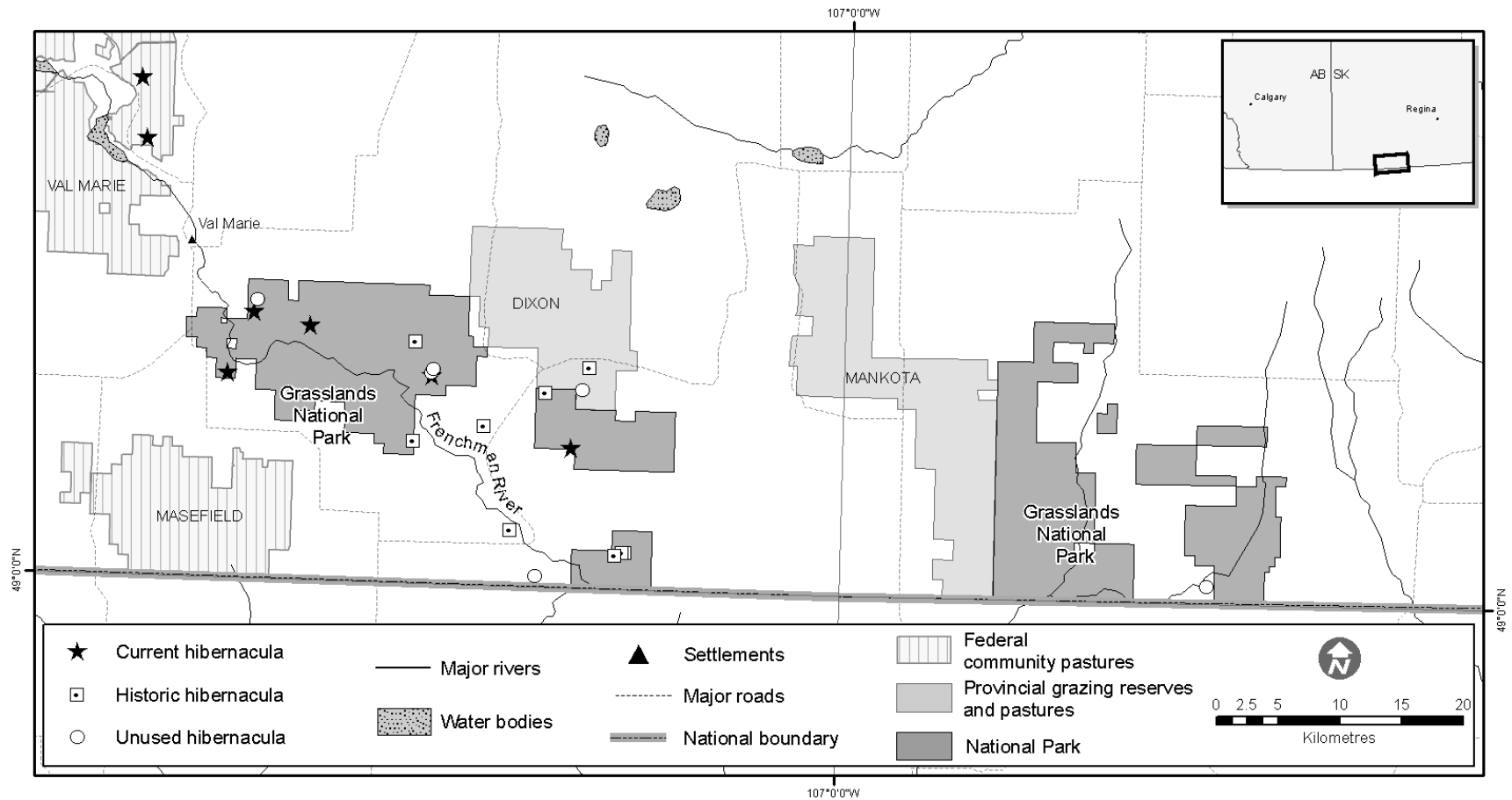
The population and distribution objective for Eastern Yellow-bellied Racers is to maintain the species' distribution within Canada.

Rationale:

- This objective addresses the primary criteria used in COSEWIC status determination, which is loss of habitat (declining area of occupancy).
- Population numbers are not known so it is not possible to establish an objective that targets the number of individuals or populations required to recover the species. In addition, the full Canadian distribution of the species is not known. The recovery planning table (section 2.2) therefore includes approaches towards obtaining additional information on the population and distribution of the species in Canada to the extent possible.
- The species is intrinsically rare in Canada, and is a small northern extension of a stable population in the US. It is therefore recognized that the distribution objective and broad approaches to recovery outlined in this document may never result in delisting.



**Figure 1. Range of the Eastern Yellow-bellied Racer in Alberta and Saskatchewan (Canada) and potential range (Montana Natural Heritage Program 2009) in northern Montana (United States).**



**Figure 2. Known current (evidence of use by individual Eastern Yellow-bellied Racers during spring 2008 and 2009 emergence), historic (no evidence of current use by the species, but evidence of historic use in 1987 or 1993) and unused (no evidence of current or historic use by the species, but potentially appropriate) hibernacula in Canada.**

## 2.2 Broad Strategies and Approaches to Recovery

Recent recovery actions undertaken have been divided between GNP and the AAFC Val Marie Community Pasture monitoring initiatives. GNP has surveyed potential hibernacula throughout the park. A 2007 AAFC Val Marie Community Pasture survey confirmed Eastern Yellow-bellied Racers upstream from GNP (Poulin and Didiuk 2008); this led to an ongoing (2008-2010) research project conducted by the University of Regina and the Royal Saskatchewan Museum in both GNP and the AAFC Val Marie Community Pasture. This research is focusing on individual Eastern Yellow-bellied Racer home ranges, distances traveled from hibernacula in the summer, seasonality of movements and habitat selection, based on both macro and micro-habitat features (R. Poulin, pers. comm. 2009). However, there is much that is unknown about the species and threats to its survival and recovery in Canada, therefore additional inventory, research and monitoring is necessary.

**Table 2. Broad strategies and approaches needed to achieve the population and distribution objective for the Eastern Yellow-bellied Racer**

Priority	Threat(s) addressed	Broad strategies to address threat(s)	Recommended approaches
<b>Necessary</b>	Habitat loss	Stewardship, Habitat protection, Public Outreach	<ul style="list-style-type: none"> <li>• Development of beneficial management practices and stewardship agreements;</li> <li>• Implementation of protection measures for hibernacula and other important habitat areas;</li> <li>• Development of outreach initiatives that increase understanding of threat and foster voluntary stewardship</li> </ul>
<b>Necessary</b>	Road Mortality; Human disturbance of individuals	Public outreach, Stewardship, Research	<ul style="list-style-type: none"> <li>• Implementation of signage at key locations;</li> <li>• Determine the threat significance at the population level;</li> <li>• Guided hibernaculum visitation and education programs (GNP)</li> </ul>
<b>Necessary</b>	Small population	Inventory	<ul style="list-style-type: none"> <li>• Conduct surveys and determine baseline population numbers (e.g., areas with confirmed sightings, areas with historically used or potential hibernacula);</li> <li>• Determine population abundance or densities at currently used hibernacula;</li> </ul>
<b>Necessary</b>	Small population	Monitoring	<ul style="list-style-type: none"> <li>• Development of monitoring program to detect changes in abundance and distribution over time</li> </ul>
<b>Beneficial</b>	Road Mortality; Small population; Extreme weather variability due to climate	Research	<ul style="list-style-type: none"> <li>• Conduct an evaluation of potential mitigations related to road mortality</li> <li>• Conduct an evaluation of genetic relationships and spatial connectivity among individuals in Saskatchewan, Alberta and Montana;</li> <li>• Investigate direct and indirect effects of climate change on long-term demography of the species, including drought and land</li> </ul>

change

slumping

- Investigate potential mitigation measures

## 2.3 Critical Habitat Identification

Critical habitat is defined in section 2(1) of the Species at Risk Act (2002) as the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species. For the Eastern Yellow-bellied Racer in Canada, critical habitat is identified to the extent possible, based on the best available information up to July 15, 2009. The critical habitat identified within this recovery strategy is necessary for the survival and recovery of the species, but is only a part of what will ultimately be identified as required for the survival and recovery of the Eastern Yellow-bellied Racer in Canada. Critical habitat for the species will be revised when additional information becomes available, for example, through the studies outlined in Section 2.5.

### Information used to identify critical habitat locations and attributes

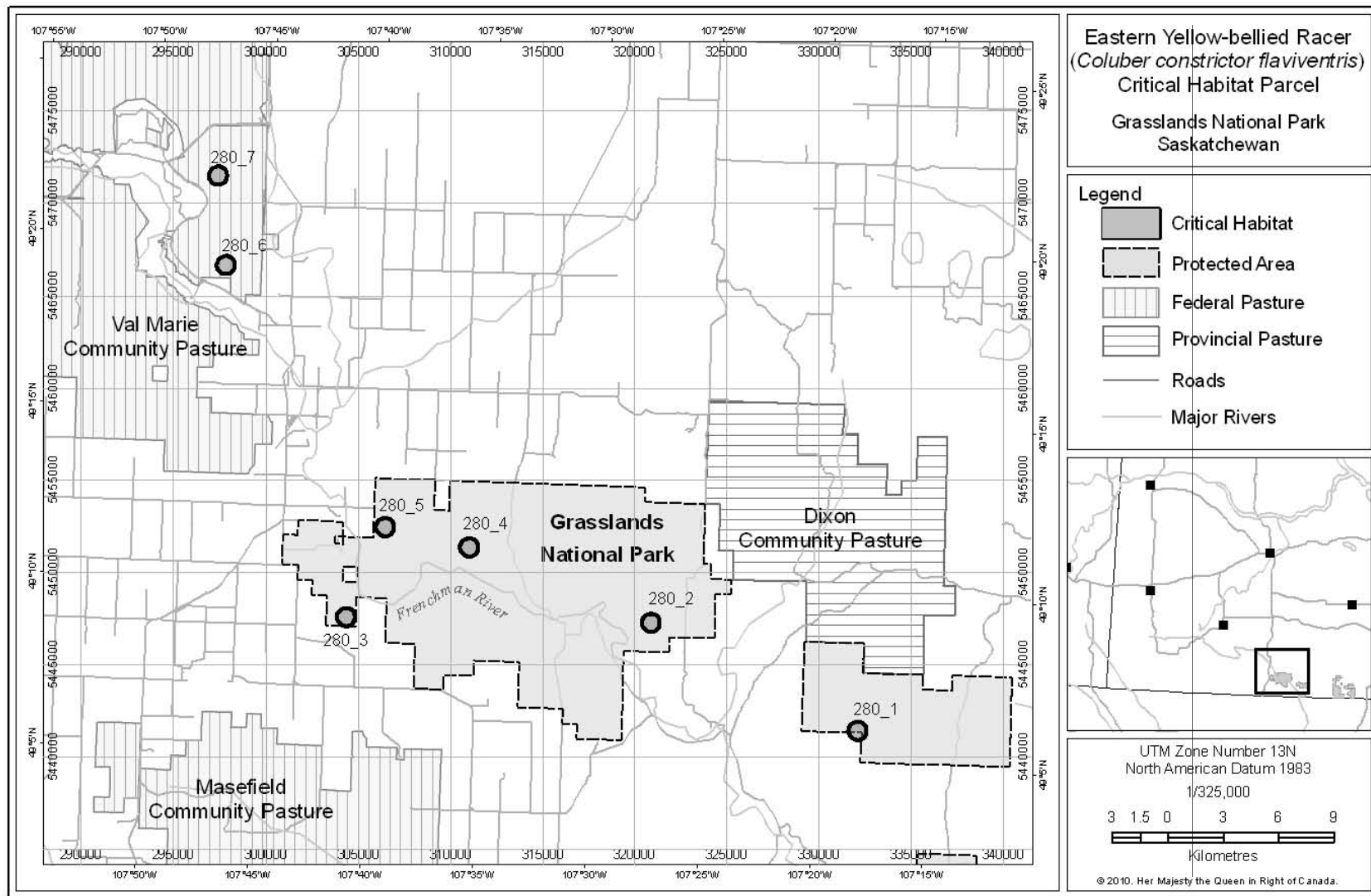
As of July 15, 2009, inadequate information was known about locations of nesting sites, shelter or basking sites, foraging areas or dispersal routes for Eastern Yellow-bellied Racers in Canada. However, the locations of several current hibernacula were known (Figure 2), and this information forms the basis of this critical habitat identification. Hibernacula have high conservation value because they represent a collection of individuals or a sub-population that concentrates at a particular location each year. Current hibernacula are essential to the survival and recovery of Eastern Yellow-bellied Racers because the individuals exhibit high fidelity to them, returning to the same hibernacula each fall (COSEWIC 2004).

Areas immediately adjacent to current hibernacula are also essential to the survival and recovery of the species because they contribute to the structure and attributes of hibernacula. These areas may also meet some of the habitat requirements of the species for a part of their active season. Preliminary telemetry data collected within GNP suggests that at least some individuals remain within 500m of their hibernaculum for at least a week following emergence (Martino unpublished data). In addition, in GNP and the AAFC Val Marie Community Pasture, young of the year have been found 200 – 500m from known active hibernacula (Martino unpublished data), suggesting that at least some individuals use the area immediately surrounding hibernacula for nesting.

### Critical habitat identification

Critical habitat for the Eastern Yellow-bellied Racer therefore includes all hibernacula known to be currently used by the species, as evidenced by observation of individuals at the hibernaculum during spring 2008 or 2009 emergence, and the immediate adjacent areas within a 500m radius of those hibernacula, resulting in seven distinct areas of critical habitat (Figure 3). The number of individuals using these hibernacula is not known, but may range from five to 25 individuals per hibernacula.





**Figure 3. Critical habitat (current hibernacula and the immediate adjacent area within a 500 metre radius) for Eastern Yellow-bellied Racers in Canada.**

Existing anthropogenic features that occur in these areas, such as trails and roads, are excluded from critical habitat areas. Critical habitat areas primarily occur within Grasslands National Park and the AAFC Val Marie Community Pasture in southwestern Saskatchewan, and a small portion of one critical habitat area extends onto privately-owned lands in Saskatchewan. In accordance with section 124 of the Species at Risk Act (2002), and upon the advice of the Committee on the Status of Endangered Wildlife in Canada (J. Hutchings, pers. comm. 2010), the precise locations of hibernacula are not provided to protect them from potential human disturbance.

Within the identified boundaries, the biophysical attributes of critical habitat include the following:

- mammal burrows, rock crevices or ledges, caves or deep holes in soft hillside soil or abandoned cisterns that provide fracturing, humidity, cover and thermal momentum required for suitable hibernation sites, as described in COSEWIC (2004) and section 1.3.2 of this document,
- soft soil or burrows to lay eggs in,
- dense vegetation (mixed-grass prairie and sagebrush thickets) to maintain concealment from predators and house suitable prey,
- large rocks for cover or basking (COSEWIC 2004, Ernst and Ernst 2003).

## 2.4 Activities Likely to Result in the Destruction of Critical Habitat

Destruction of critical habitat would result if any part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from single or multiple activities at one point in time or from the cumulative effects of one or more activities over time.

Examples of activities that are likely to result in the destruction of critical habitat include, but are not limited to, the following (COSEWIC 2004, Ernst and Ernst 2003, Hobbs and Sarell 2002):

Activity likely to destroy critical habitat	Potential effect of the activity	Site(s) where each activity is likely to occur
<ul style="list-style-type: none"> <li>• Filling-in, burning or flooding of hibernacula</li> </ul>	<ul style="list-style-type: none"> <li>• Collapse of hibernacula</li> <li>• Impeded entrance to hibernaculum</li> <li>• Changes to thermal momentum of hibernacula (slope, aspect, position and surface albedo)</li> </ul>	<ul style="list-style-type: none"> <li>• All</li> </ul>
<ul style="list-style-type: none"> <li>• Trampling or substantial foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>• Collapse of hibernacula</li> <li>• Changes to rock fracturing</li> <li>• Changes to thermal momentum of hibernacula (slope, aspect, position and surface albedo)</li> <li>• Soil compaction</li> </ul>	<ul style="list-style-type: none"> <li>• Grasslands National Park (e.g., by bison or uncontrolled visitor activity)</li> <li>• AAFC Val Marie Community Pasture (e.g., by livestock)</li> </ul>
<ul style="list-style-type: none"> <li>• Unsustainable grazing practices or other substantial removal of vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in soil stability</li> <li>• Reduction of cover</li> <li>• Vegetation changes</li> </ul>	<ul style="list-style-type: none"> <li>• All</li> </ul>
<ul style="list-style-type: none"> <li>• Loss of mixed-grass prairie or</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction of cover</li> </ul>	<ul style="list-style-type: none"> <li>• All</li> </ul>

sagebrush thickets	• Vegetation changes	
• Industrial, infrastructure and other anthropogenic development (e.g., roads, buildings, oil & gas)	• Collapse of hibernacula	• AAFC Val Marie Community Pasture (e.g., industrial development)
	• Changes to rock fracturing	• Grasslands National Park (e.g., visitor services infrastructure development)
	• Changes to thermal momentum of hibernacula (slope, aspect, position and surface albedo)	
	• Soil compaction	
	• Reduction in soil stability	
	• Reduction of cover	
	• Vegetation changes	

## 2.5 Schedule of Studies to Identify Critical Habitat

Further knowledge is required to identify additional critical habitat necessary to support the population and distribution objective for the species:

Description of Activity	Timeline
• To the extent possible, determine whether historically used hibernacula still exist over the current distribution and, if they do exist, whether they are currently being used by the species. In addition, conduct inventories to determine locations of any additional hibernacula being used by known populations.	May 2010 to Jan 2013
• To the extent possible, determine the locations of nesting sites for known populations	May 2010 – Jan 2012
• To the extent possible, determine the locations of foraging areas and dispersal routes for known populations	May 2010 – Jan 2012
• To the extent possible, determine factors influencing habitat selection for the species	May 2010 – Jan 2012
• To the extent possible, determine the amount and locations of habitat needed to meet the population and distribution objective	Jan 2012 – Aug 2015

## 2.6 Additional Information Requirements about the Species

Knowledge of the biological and habitat requirements for the Eastern Yellow-bellied Racer population in Canada is sparse. Until recently, work focused on the species has been limited to observations of current hibernacula in GNP and the AAFC Val Marie Community Pasture areas (see section 1.6) and no empirical information has been gained on baseline population numbers and trends. While Eastern Yellow-bellied Racers have been observed in the Big Muddy area in Saskatchewan and in southeastern Alberta, there is no further information on the species in these areas. It is necessary to determine the population status of the species at these observed locations as well as whether there are several separate populations occurring or one population overall.

Information required to aid the recovery of the Eastern Yellow-bellied Racer includes the following: the location of hibernacula, nesting sites, foraging areas and dispersal routes, and an understanding of baseline population numbers and population dynamics. Hibernacula are typically nondescript and snakes occur near the entrances in high densities for only a limited period of time in the spring and fall, limiting one's ability to confirm the locations of hibernacula (Macartney and Weichel 1993). Although confirmation of hibernacula location is important, it is

also necessary to verify whether this species relies exclusively on communal hibernacula or if there are other locations selected as hibernation sites. Protocols must also be established for long-term monitoring of population abundance/density and reproductive success. Additionally, understanding population level effects of threats to this species (Section 1.5), including road mortality, disturbance of hibernacula, habitat loss and fragmentation, is necessary.

## **2.7 Habitat Conservation**

In Canada, Eastern Yellow-bellied Racers may range on to federal lands (managed by the Parks Canada Agency or AAFC), provincial crown lands (Saskatchewan and Alberta) and privately owned lands. Eastern Yellow-bellied Racer habitat in Grasslands National Park is protected under *Canada's National Parks Act*. In addition, the *Alberta Wildlife Act* and *Saskatchewan Wildlife Act* both prohibit destruction of hibernacula (Alberta Wildlife Act 2000, Watson and Russell 1997). Alberta is currently developing land-use guidelines that include a recommended set-back distance of 500m from known hibernacula plus an additional 200m set-back for any known rookeries found beyond 300m of a den (J. Nicholson pers. comm. 2010). Saskatchewan Ministry of Environment recommended land use guidelines state a minimum setback distance of 500m from hibernacula for activities resulting in high / long term disturbance (J. Pepper pers. comm. 2010). The conservation of lands managed by AAFC, including the AAFC Val Marie Community Pasture, is an integral component of their business planning process (AAFC 2007).

## **2.8 Measuring Progress**

Demonstrative progress towards recovering Eastern Yellow-bellied Racers in Canada includes:

- Baseline population information at key hibernacula determined by August 2015
- Baseline range and distribution of the species determined by August 2015
- A monitoring program is implemented to detect changes in population or distribution over time by August 2015
- Maintenance or increase in the number of known current hibernacula by August 2015
- Maintenance of the current distribution by August 2015

## **2.9 Statement on Action Plans**

One or more action plans will be completed by August 2015. Specific actions for the Eastern Yellow-bellied Racer in Saskatchewan will most likely be included in the South of the Divide Multi-Species Action Plan.

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## APPENDIX A

### Effects on the Environment and Other Species

Recovery approaches outlined in this strategy focus primarily on increasing knowledge of Eastern Yellow-bellied Racers and factors influencing their recovery, protecting the species' natural habitat and the ecological processes that sustain it, and maintaining the existing distribution of the species. Negative effects on the environment and other species are not anticipated, however monitoring the potential effects of an increase in Eastern Yellow-bellied Racers on endangered Greater Short-horned Lizard (*Phrynosoma hernandesi*) populations may be warranted (L. Powell, pers. comm. 2009). It is expected that most other species occurring in the same environment as Eastern Yellow-bellied Racers will benefit from this strategy, via increased knowledge gained through inventory, monitoring and research programs, and on-the-ground conservation and recovery initiatives. Other species expected to benefit from this strategy include: Prairie Rattlesnakes (*Crotalus viridis*), Plains Garter snakes (*Thamnophis radix*), Bullsnares (*Pituophis catenifer*), and Plains Hognose snakes (*Heterodon nasicus nasicus*), plus other species that may rely on these prairie snakes. Implementation of recovery actions for Eastern Yellow-bellied Racers in Saskatchewan will be integrated with those for other species at risk in southern Saskatchewan wherever possible, for example, through the South of the Divide Multi-species Action Plan.