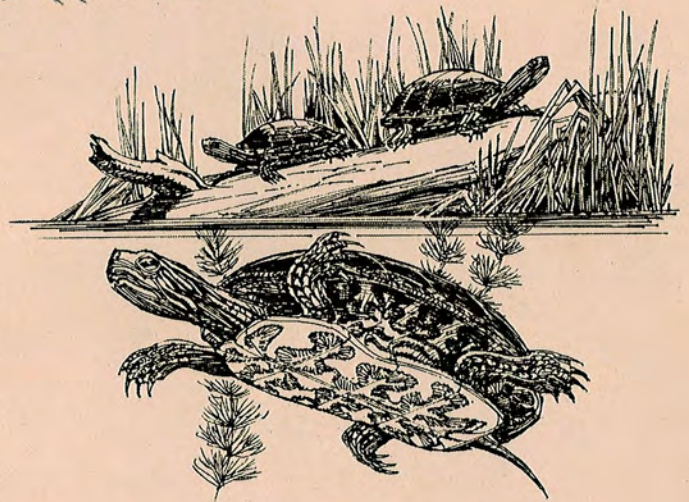
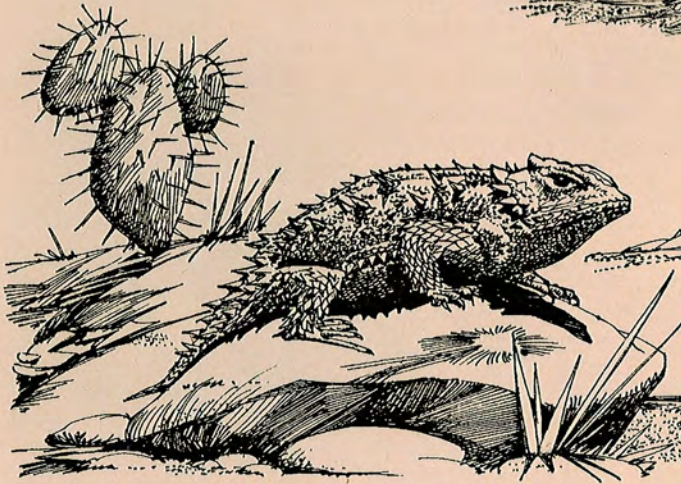
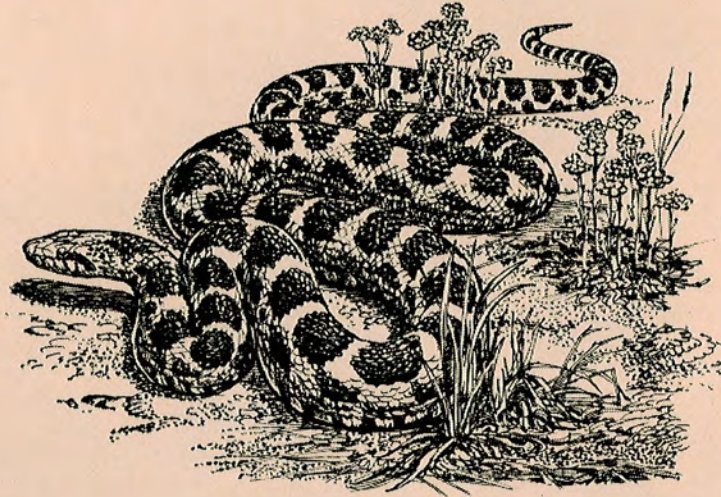


# Alberta's Reptiles:

Lend a helping hand (or two or three)



*Teacher's Guide*  
*for*  
*Grade Seven Science*  
Interactions & Ecosystems



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First printing: November 2003



Publication No.: I/134  
ISBN No. 0-7785-2946-0 Printed Edition  
ISBN No. 0-7785-2947-9 On-Line Edition

This teacher's guide has been developed to support Alberta's Grade Seven Science Curriculum. Educators have permission to photocopy pages for educational use but the source must be identified as Alberta Conservation Association.

This guide is supported and accompanied by the *Snakes of Alberta* poster. The poster not only shows Alberta's six snake species but two other reptiles, the Painted Turtle and the Mountain Short-horned Lizard. This program goes into the life histories of Alberta's eight reptile species and supplies teachers with classroom activities.

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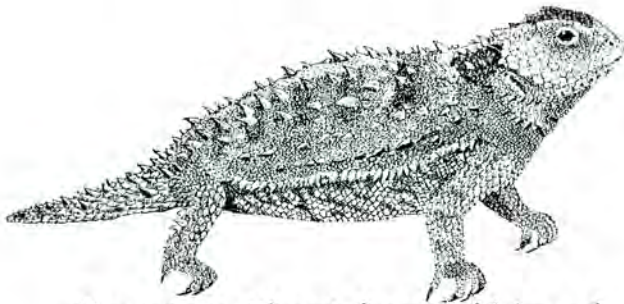
An electronic version of this guide is available from the Alberta Conservation Association's web site: [www.ab-conservation.com](http://www.ab-conservation.com)

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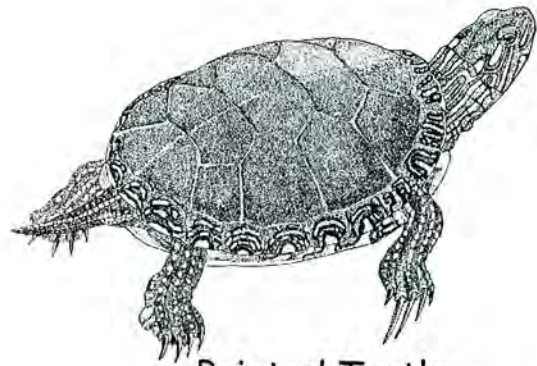
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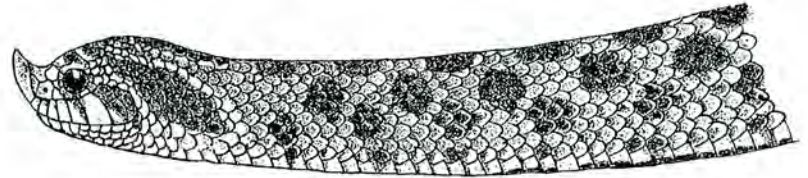
# Featuring...



Mountain Short-horned Lizard



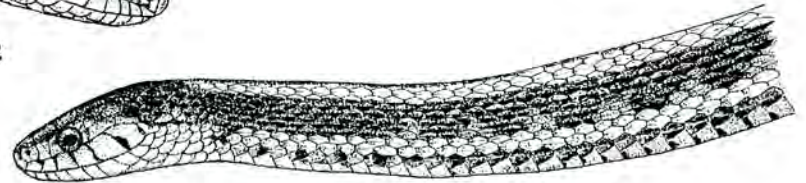
Painted Turtle



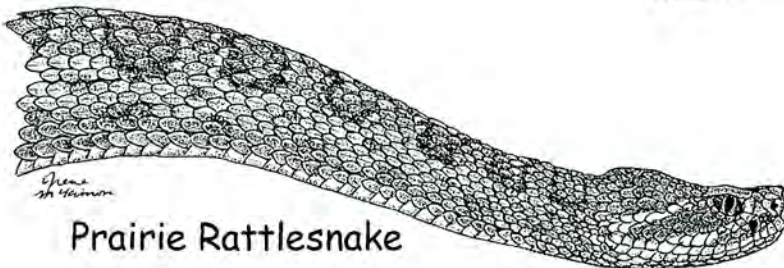
Western Hog-nosed Snake



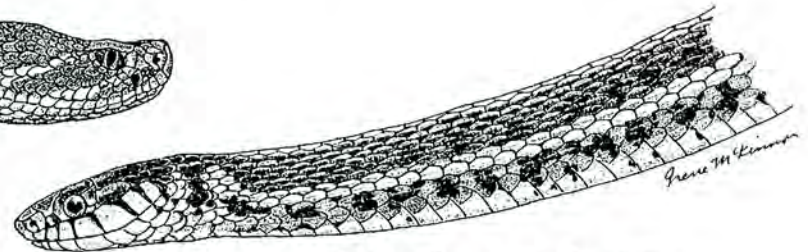
Wandering Garter Snake



Red-sided Garter Snake



Prairie Rattlesnake



Plains Garter Snake



Bullsnake

Graphics used with permission from the book: Russell, A. P., and A. M. Bauer. 2000. The amphibians and reptiles of Alberta. A field guide and primer of boreal herpetology, second edition. University of Calgary Press, Calgary and Edmonton, AB. 279 pp.

## NOTE:

- Teachers may find it useful to make transparencies and copies of student sheets in advance so they are ready to use when needed.
- Individual *words* that are shown in both *italic and bold*, throughout this document, are defined in the **Glossary**.
- Many of the line drawings and illustrations used in this teacher's guide are from the book: Russell, A. P., and A. M. Bauer. 2000. **The amphibians and reptiles of Alberta**. A field guide and primer of boreal herpetology, second edition. University of Calgary Press, Calgary and Edmonton, AB. 279 pp. Used with permission.

## Introduction

**Alberta's Reptiles: Lend a Helping Hand (or two or three) Teacher's Guide** is a tool for grade seven teachers to teach the science unit *Interactions and Ecosystems*. It is an exciting guide full of information and activities that will get students thinking about their attitudes towards reptiles (especially snakes), learning about Alberta's eight reptile species and becoming familiar to the needs of reptiles. When you learn about reptile adaptations and the uniqueness of a *hibernaculum* (snake den), you may be awestruck at their distinctiveness. Reptiles are truly awesome! And reptiles all over the world need a helping hand. The Alberta Conservation Association has taken a lead in educating citizens about reptiles. This Teacher's Guide is part of their reptile education and awareness initiative.

### Alberta Conservation Association

The Alberta Conservation Association (ACA) is a nonprofit, nongovernment association working collaboratively to conserve, protect and enhance Alberta's *wildlife*, fisheries, and habitat. It is governed by a Board of Directors; represented by conservation groups, industry, science, and the public. ACA is nonpartisan and nonregulatory. The Government of Alberta is responsible for managing the province's natural resources. The ACA's business is conservation and the products are conservation activities and information.

### Alberta Snake Hibernacula Inventory

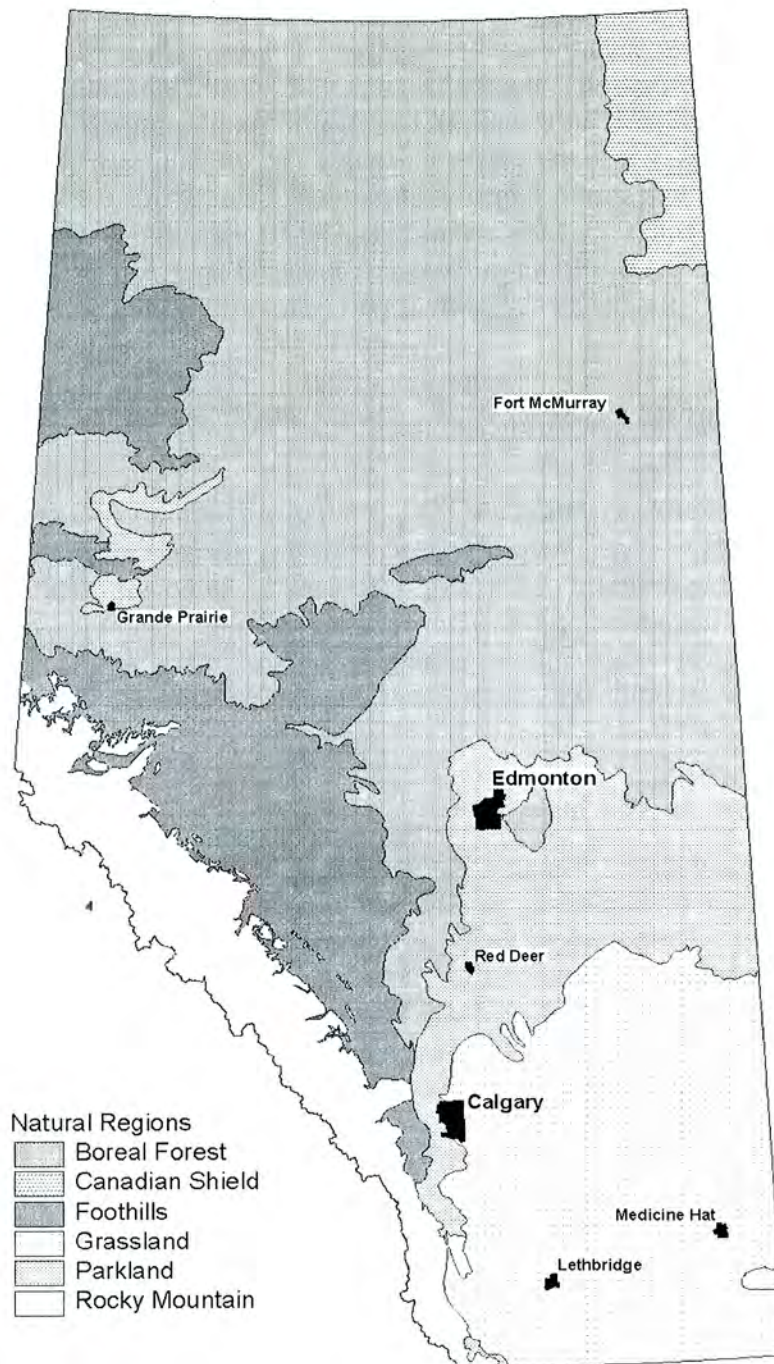
All of our snake species are declining, so Alberta biologists are entering observations into a provincial database to keep track of them. A *hibernacula* inventory database is underway to better understand these crucial overwintering sites. This central database contains information on the location, features, and longevity of hibernacula occupied by all snake species in Alberta. This information, which is obtained from interested landowners, naturalists, and biologists, is intended to increase our understanding of snake distribution and relative abundance within the province.

### Variety is the Spice of Life

So far, about 1.4 million species of plants and animals have been identified on Earth. It has been estimated that there may be as many as 100 million species. Conserving *biodiversity* is essential to the health of the planet. Diversity breeds diversity. Having a diverse array of living organisms allows other organisms to take advantage of the resources provided, making ecosystems more stable. Biodiversity also enriches the quality of our lives in many ways that are not easy to quantify. We depend on the Earth's biodiversity for food, shelter, and health – we are dependent on it. Reptiles are a part of our local biodiversity, and are an example of the amazing variety of life around us.



## Alberta's Six Natural Regions



There are a variety of natural regions in Alberta: Canadian Shield, Rocky Mountains, Foothills, Boreal Forest, Parkland, and Grassland. Different species live in each region, where they play a unique role in the *ecosystem*. For more information and to view a current map of the six natural regions, visit the Alberta Natural Heritage Information Centre (ANHIC) at [www.cd.gov.ab/preserving/parks/anhic/natural\\_regions\\_map.asp](http://www.cd.gov.ab/preserving/parks/anhic/natural_regions_map.asp)

## The Diversity of Alberta's Wildlife Species<sup>1</sup>

Vertebrate Groups	Approximate number of species in Alberta
Mammals	95
Birds	402 <sup>2</sup>
Amphibians	10
Reptiles	8
Fish	63
<b>Invertebrate Groups</b>	
Clams	27
Butterflies and skippers	170
Dragonflies and damselflies	72
Beetles, ants, wasps, flies, lacewings, cockroaches, spiders, and other "bugs"	20,000
<b>Nonvascular Plants and Fungi</b>	
Mosses and liverworts	627
Lichens	645
Fungi	454
<b>Vascular Plants</b>	
Trees	28
Shrubs	162
Forbs <sup>4</sup>	1,222
Grasses and sedges	411

<sup>1</sup> From: Alberta Sustainable Resource Development. 2001. The General Status of Alberta Wild Species 2000. Alberta Sustainable Resource Development, Fish and Wildlife Service, Edmonton, Alberta. 46 pp.

<sup>2</sup> 40 of the 402 birds are not seen regularly and are outside their normal range i.e., accidental/vagrant.

### Did you know?

Alberta's *wildlife* includes approximately 95 mammal, 402 bird, 10 amphibian, 8 reptile and 63 fish species? And did you know Alberta's wildlife also includes approximately 1,823 vascular plants, 1,272 mosses and lichens and 20,000 insect species that have been identified?

## Curriculum Connection

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### Grade Seven

### Science Unit A: Interactions and Ecosystems

#### Overview of Unit

Ecosystems develop as a result of natural processes, and are maintained by similar natural processes. These processes can be affected by human actions. To foster an understanding of ecosystems, this unit develops student awareness of ecosystem components and interactions, as well as natural cycles and processes of change. Building on this knowledge, students investigate human impacts and engage in studies that involve environmental monitoring and research. By reflecting on their findings, students become aware of the intended and unintended consequences of human activity, and recognize the need for responsible decision-making and action.

The purpose of this teacher's guide is to provide an opportunity for teachers and students to gain a better understanding and respect for snakes and other reptiles that will lead to a reduction in the senseless killing of these valuable animals or destruction of their *habitat*.

#### Key Concepts

The intended level and scope of the key concepts is defined within the outcomes listed below. More detail of the outcomes is described in the grade seven science curriculum.

1. Interactions and interdependencies\*
2. Environmental monitoring\*
3. Environmental impacts\*
4. Producers, consumers, decomposers\*
5. Nutrient cycles and energy flow\*
6. Species distribution\*
7. Succession
8. Endangered species\*
9. Extinction\*
10. Environmental management\*

#### Outcomes for Science, Technology and Society (STS) and Knowledge

Students will accomplish the following:

1. Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions.\*
2. Trace and interpret the flow of energy and materials within an ecosystem.\*
3. Monitor a local environment, and assess the impacts of environmental factors on growth, health, and reproduction of organisms in that environment.\*
4. Learn how to describe the relationships among knowledge, decisions and actions in maintaining life-supporting environments.\*

These items\* are covered in this teacher's guide within the activities. Skill Outcomes and Attitudes Outcomes are also addressed through the classroom activities.

## Reptiles

Reptiles dominated the earth's wildlife long before humans and other mammals walked on earth. Reptiles were the first *vertebrates* to live entirely on land. They developed from amphibian ancestors more than 250 million years ago during the late Permian Period. The first fossil record of a reptile dates back to 315 million years ago, but the **Age of Reptiles**, the era during which reptiles predominated, lasted from 250 million to 65 million years ago. This era was also known as the Mesozoic Era and was the period of time in which dinosaurs were found throughout most of the world. The first snakes are believed to have evolved from lizard ancestors between 150 million and 100 million years ago. Turtles were present on earth before the dinosaurs. Turtles watched the dinosaurs emerge, succeed and disappear, as well as the rise of the birds and mammals.

### Age of Reptiles\*

Permian	Triassic	Jurassic	Cretaceous	Periods
280-245	245-208	208-135	135-60	Millions of years ago

\* Formerly known as the Mesozoic Era, which lasted about 180 million years, and is divided into three periods, the Triassic, the Jurassic, and the Cretaceous.

The success of reptiles is largely due to the evolution of the cleidoic egg (shelled with large yolk) where the embryo has an independent water supply. The development of internal fertilization enabled reptiles to be the first vertebrates to sever ties with water. They spread out across the landscape and became a dominant life form for 100 million years during the Mesozoic Era, also known as the Age of Reptiles.

The sheer variety of reptiles today is truly amazing. They have a considerable range of survival strategies and an astonishing array of lifestyles despite the constraints of being *ectothermic* ("*cold-blooded*"). Their adaptations to a variety of environments and the ways they move, migrate, court and mate, and forage for food rivals that of birds and mammals.

The class Reptilia has four orders: **Squamata** (lizards and snakes), **Testudinata** (turtles, terrapins, tortoises), **Crocodylia** (crocodiles and alligators), and **Rhynchocephalia** (lizard-like *tuatara*, found in New Zealand). There are approximately 7,500 living reptile species, which outnumber the mammals, with about 4,700 species. Reptiles, together with amphibians (about 5,000 species), outnumber the birds (9,000 species.).

### What are reptiles?

Reptiles are vertebrates, which means they have a backbone. Reptiles are different from other animals because of their scaly skin. All living reptiles share the following characteristics:

- They are ectotherms ("*cold-blooded*"); this means they do not maintain a constant body temperature and their internal temperature largely depends upon the surrounding environment.

- Turtles and most other reptiles lay eggs (*oviparity*), which develop and hatch outside the body resulting in young that resemble adults.
- Some reptile species in cooler climates retain eggs inside their body (*ovoviviparity*) until hatching or have a primitive placenta, which directly feeds the embryos (*viviparity*) and young are born live.
- Their body is covered with dry scales or *scutes* (horny plates.)

The mechanism of temperature regulation in warm-blooded animals or endotherms is considered an important evolutionary advance in that physical activity in these animals can be relatively independent of the ambient temperatures of their environment. In ectothermic animals, general activity and physiological processes depend largely on the ambient temperatures of their surrounding environment. Because reptiles are unable to regulate their own body temperatures, they must **thermoregulate**, which means when they are too warm they must seek a cooler environment and when they are too cool they must seek a warmer environment.

Reptiles are sometimes confused with amphibians. Reptiles are linked to amphibians for many reasons of biological and evolutionary similarities and the two classes are collectively known as **herpetiles**, or “herps” for short. The joint study of reptile and amphibians is known as **herpetology**, from the Greek *herpo* meaning to creep or crawl and *logos* meaning knowledge; together it means the study of crawling things! A **herpetile** is an individual “herp”. A person who keeps and breeds “herps” is called a **herpetoculturist** and the hobby is called **herpetoculture**.

Amphibians and reptiles share similarities, but are more different than alike.

	<b>Amphibians</b>	<b>Reptiles</b>
<b>Examples</b>	frogs, toads, salamanders, caecilians	snakes, lizards, turtles, crocodiles, Tuatara
<b>Similarities</b>	<b>Ectothermic</b>	<b>Ectothermic</b>
<b>Differences</b>	<ul style="list-style-type: none"> <li>• typically, lay jelly-like eggs in water or in moist environments</li> <li>• male deposit sperm externally - except the Tailed Frog (<i>Ascaphus truei</i>)</li> <li>• skin is moist and has no scales</li> <li>• metamorphosis from gill breathing larval stage to air breathing adult (exception; <i>neoteny</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• lay water-tight, shelled eggs on land or give birth to live young</li> <li>• male deposits sperm in female (one exception is the Tuatara*)</li> <li>• skin is dry and covered with scales</li> <li>• no metamorphosis, young look much like adult</li> </ul>

\* a rare lizard-like reptile restricted to a handful of islands off New Zealand; the egg is fertilized internally.

The reptile egg is substantially better adapted to survival on dry land than that of an amphibian egg. Although the shell of a reptile egg is somewhat permeable to water and gases, it generally restricts water loss. It also provides physical protection to the embryo within. This contrasts with amphibian eggs, which do not have shells and therefore are vulnerable to desiccation or drying.

## Classification

---

More than 2,000 years ago, Aristotle, a Greek philosopher, devised the first classification system with two kingdoms and simple categories to name plants and animals. In the eighteenth century, a Swedish botanist, Carolus Linnaeus, created a classification system based on similarities and differences among organisms that separate them into categories. The sequence of categories is as follows: kingdom, phylum, class, order, family, genus, and species.

### A Mnemonic Sentence to Remember the Categories

Kings	Play	Chess	On	Fine	Grained	Sand
Kingdom	Phylum	Class	Order	Family	Genus	Species

Here is another one: **King Philip Came Over For Good Sports.**

Linnaeus prepared a scientific species name in Latin for each organism. We still use this system today so that taxonomists around the world can communicate effectively. He used two words to describe each organism: a genus name and a species name. The genus describes the group and the species describes the specific animal. A subdivision of a species is called a subspecies and is the ranking next below a species. A subspecies is usually the lowest category recognized in classification and the differences separating subspecies are usually slight. Common names, however, vary because they are less formal and people in separate geographical areas may call the same species by different names, hence the need for consistency with scientific names.

Kingdom: Anjmalia
Phylum: Chordata
Subphylum: Vertebrata
Class: Reptilia

The class of Reptilia has four orders: **Squamata** (lizards and snakes), **Testudines** (turtles), **Crocodylia** (crocodiles and alligators), and **Rhynchocephalia** (lizard-like *Tuatara*, found in New Zealand.) The two orders present in Alberta are Squamata and Testudines. The following species are found in Alberta.

## Order: Squamata (Lizards and Snakes)

### Suborder: Lacertilia (lizards)

#### Family: Iguanidae

Subfamily: Phrynosomatidae

Genus: *Phrynosoma*

Species: *hernandesi*

*Phrynosoma hernandesi* Mountain Short-horned Lizard

## Suborder: Serpentes (snakes)

### Family: Colubridae

Genus: *Thamnophis*

Species: *radix*

*Thamnophis radix* Plains Garter Snake

Genus: *Thamnophis*

Species: *elegans*

Subspecies: *vagrans*

*Thamnophis elegans vagrans* Wandering Garter Snake

Genus: *Thamnophis*

Species: *sirtalis*

Subspecies: *parietalis*

*Thamnophis sirtalis parietalis* Red-sided Garter Snake

Genus: *Heterodon*

Species: *nasicus*

*Heterodon nasicus* Western Hog-nosed Snake

Genus: *Pituophis*

Species: *catenifer*

Subspecies: *sayi*

*Pituophis catenifer sayi* Bullsnake

### Family: Viperidae

Subfamily: Crotalinae

Genus: *Crotalus*

Species: *viridis viridis*

Subspecies: *viridis*

*Crotalus viridis viridis* Prairie Rattlesnake

## Order: Testudina (Turtles)

### Family: Emydidae

Genus: *Chrysemys*

Species: *picta*

*Chrysemys picta* Painted Turtle

## Our Attitudes

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Most reptiles and amphibians do not have the cute and cuddly appeal of many mammals or the grace of birds. In fact, most herpetiles seem alien. Imagine what the first humans must have thought of snakes. Even today, their attributes seem almost magical and supernatural. Snakes can move through all kinds of terrain, vegetation, and water without legs; they can find, capture and eat prey without appendages; they shed an old skin to reveal a new brightly coloured skin; they arise in the spring, resurrected from the icy winter; and in some cases cause sickness or death with a single bite. A science fiction writer could not ask for anything better. "Truth is better than fiction."

Snakes and other reptiles can have great horror movie appeal. Turtles, on the other hand, do not invoke fear and hatred in people. Turtles appear in TV commercials, magazine advertisements, cartoons, books and movies. These turtles may sound familiar: Franklin the Turtle, Teenage Mutant Ninja Turtles, Turtle Wax.

It is worth reflecting about our attitudes toward snakes. Our fear of snakes is deeply entrenched in our culture. Learning about reptiles will reduce ignorance and negative judgments about these fascinating creatures.

### **Rattlesnake Roundups**

Several states in the United States hold Rattlesnake Roundups. Roundups started as a misguided attempt to rid areas of rattlesnakes. Today, they have evolved into commercial events and in many cases promote animal cruelty and environmentally damaging behavior. These events go against the basic principles of wildlife management and the humane treatment of animals. One estimate of the number of rattlesnakes removed from natural populations every year at roundup events was between 60,000 to 101,000. The number of hunters is increasing, more of the rattlesnakes' ranges are covered, and methods used to capture rattlesnakes are more intrusive. All of these are factors leading to the decline of these animals.

Because rattlesnakes are venomous, they are widely feared and do not have the same appeal that most endangered mammal and bird species have. This means that education is particularly important for people to learn to appreciate snakes and other reptiles. A better understanding will lead to respect for these animals and end the senseless killing of snakes.

## **Wildlife Management**

---

In the past, *wildlife* management used to focus on the maintenance of individual game species, such as walleye and white-tailed deer. The past few decades have seen a shift as wildlife managers recognize the ecological values of nonconsumptive wildlife and the need to conserve all biodiversity and maintain basic ecological processes. Management now involves *habitat* and landscape management.

Yet, despite this improvement, some species are *At Risk* and must be protected. Protection can be sought through legislation such as the provincial *Wildlife Act* and the national **Species at Risk Act (SARA)**. Consultation also helps. In Alberta, **The Endangered Species Conservation Committee (ESCC)**, which consists of a number of stakeholders (biologists, scientists, naturalists and industry representatives) from various academic institutions, naturalist and industry groups, and government and nongovernment organizations, can determine a course of action for the recovery of species.

The most contentious and greatest challenge facing wildlife managers is protecting habitats. Even though some initiatives are underway that will increase protected areas (which will benefit a variety of species), industrial (resource extraction), agricultural and recreational developments reduce the value of many habitats to wildlife. The most fundamental element in wildlife conservation is the preservation of suitable habitat because without habitat, all wildlife conservation activities are virtually worthless.



## Alberta Regulations Regarding Reptiles

Regulations in Alberta do not protect most species of snakes outside the *hibernacula*. *Habitat* destruction and direct killing of snakes (e.g., intentional killing and road mortality) are the leading causes for their decline. Many people kill every snake they can, never realizing the value they have in our *ecosystem*.

### Non-game Animals

- Considered to be *wildlife*; protected as non-game (i.e., no season, no hunting anytime, generally cannot handle or keep in captivity – unlawful possession of wildlife).
- Potential for research licence; scientific purposes only.

**Non-game Reptile Species** – Western Hog-nosed Snake, Prairie Rattlesnake, Mountain Short-horned Lizard, Painted Turtle.

### Non-license Animals

- Animals (still wildlife, but not given protection as non-game animals).
- People who abuse animals (willfully causes or, being the owner, willfully permits to be caused unnecessary pain, suffering or injury) are subject to Federal Legislation relating to cruelty to animals. Penalties include the lifetime bans on animal keeping and heavy fines.
- Under Alberta's *Wildlife Act* – A person may possess any live non-license animal, except a raccoon, a skunk or a bat of a kind that is a wildlife animal.

**Non-licence Reptile Species** – Bullsnake, Plains Garter Snake, Wandering Garter Snake, Red-sided Garter Snake.

**Wildlife Act** (Website: [www.qp.gov.ab.ca/documents/acts/W10.cfm](http://www.qp.gov.ab.ca/documents/acts/W10.cfm))

- 27 (1) A person shall not hunt (i. Shoot at, harass; ii. Chase, pursue; iii. Capture or willfully injure or kill; iv. Attempt to injure or kill) *wildlife* outside an open season or if there is no open season for that wildlife.
- 38 (1) A person shall not willfully molest, disturb or destroy a house, nest or **den** of wildlife prescribed by the minister in areas and at times prescribed by the minister.

**Wildlife Regulations** (Website: [www.qp.gov.ab.ca/documents/regs/1997\\_143.cfm](http://www.qp.gov.ab.ca/documents/regs/1997_143.cfm))

96 Section 38(1) of the Act applies:

- (a) to the nests and dens, so far as applicable, of (iii) snakes (except prairie rattlesnakes) and bats, throughout Alberta and from September 1 in one year to April 30 in the next.
- 135 A person may possess any non-licence animal except a raccoon, a skunk or a bat of a kind that is a wildlife animal.

All reptile species can be found under Part 5 (Non-game animals) and Part 6 (Non-license animals) within the Regulations. Basically, reptiles in Part 5 cannot be hunted, killed, or kept in captivity. Reptiles in Part 6 are not protected except at dens in specified time periods.

Alberta's *Wildlife Act* is the provincial legislation that deals with wildlife. Protecting and maintaining suitable **habitat** is critical for maintaining wildlife populations and their long-term viability. Wildlife biodiversity or healthy wildlife populations are important indicators of the health of Alberta's environment. The provincial government is committed to conserving wild species and it pays particular attention to those that may be at risk of extinction.

## Status of Alberta's Reptiles

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Alberta (and most provinces and territories) and the federal government signed the Accord for the Protection of Species at Risk in Canada in 1996. This Accord commits the signatories to preventing species in Canada from becoming extinct because of human activity. It also requires that each province has an evaluation system similar to other provinces so they can be compared nationally. Alberta led the way such that the provincial process has now become the national standard.

The status evaluation of each species is an ongoing process and is updated every five years. Monitoring changes in wild species populations, particularly in areas where human pressure on land use is rapidly increasing, requires committed individuals and a concerted effort by governments.

### Important:

Snake dens are protected from destruction and disturbance from September 1 in one year to April 30 of the following year (under Alberta's *Wildlife Act*). Thus, they are not protected between May 1 and August 31. The exception is with the rattlesnake, in which its den sites are protected all year. Recently, steps have been taken to make amendments to the *Wildlife Act* with respect to the year-round protection of den sites for some of the other species of snakes found in Alberta.

The current legislation under Alberta's *Wildlife Act* ultimately fails to protect Alberta's snakes, other than the rattlesnake. This is because, although a den cannot be destroyed during the winter or when snakes occupy it, it can still be destroyed while it is vacant during the summer, thus potentially wiping out an entire population of snakes in the fall when they return to the destroyed den. With little or no time to find another den site or perhaps due to the fact that no alternate den site may exist in the area, these snakes will succumb to frost and ultimately die.

Information on Snake Hibernaculum protection is found in Section 36(1) of the *Wildlife Act*, or can be viewed on the following web site:  
[www.qp.gov.ab.ca/documents/acts/W10.cfm](http://www.qp.gov.ab.ca/documents/acts/W10.cfm)

## Definitions of General Status Categories

<b>Rank (2000)</b>	<b>Definitions (2000)</b>
<b>At Risk</b>	Any species known to be “At Risk” after formal detailed status assessment and designation as “Endangered” or “Threatened” in Alberta.
<b>May Be At Risk</b>	Any species that “May Be At Risk” of extinction or extirpation, and is therefore a candidate for detailed assessment.
<b>Sensitive</b>	Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming “At Risk.”
<b>Secure</b>	A species that is not “At Risk”, “May Be At Risk” or “Sensitive.”
<b>Undetermined</b>	Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.
<b>Not Assessed</b>	Any species that has not been examined for the general status document.
<b>Exotic/Alien</b>	Any species that has been introduced as a result of human activities.
<b>Extirpated/Extinct</b>	Any species no longer thought to be present in Alberta (“Extirpated”) or no longer believed to be present anywhere in the world (“Extinct”).
<b>Accidental/Vagrant</b>	Any species occurring infrequently and unpredictably in Alberta, i.e., outside its usual range. These species may be in Alberta due to unusual weather occurrences, an accident during migration or unusual breeding behaviour by a small number of individuals. If a species appears in Alberta with increasing predictability and more frequently, it may eventually be given a different rank. Changes in “Accidental/Vagrant” species may be a good indicator of general <i>ecosystem</i> or climatic changes.

From *The General Status of Alberta Wild Species 2000*.

Website: [www3.gov.ab.ca/srd/fw/status/index.html](http://www3.gov.ab.ca/srd/fw/status/index.html)

## Alberta's Eight Reptiles

There are eight reptile species known to occur in Alberta, three of which are listed as "May Be At Risk": the Prairie Rattlesnake, the Western Hog-nosed Snake and the Mountain Short-horned Lizard. Like amphibians, reptile species are going through a global decline. This decline is reflected in the status ranks of Alberta's reptiles.

Common Name	Scientific Name	Status Rank
<b>Turtles • Testudines</b>		
Painted Turtle	<i>Chrysemys picta</i>	Sensitive
<b>Lizards and Snakes • Squamata</b>		
Mountain Short-horned Lizard	<i>Phrynosoma hernandesi</i>	May Be At Risk
Western Hog-nosed Snake	<i>Heterodon nasicus</i>	May Be At Risk
Bullsnake	<i>Pituophis catenifer sayi</i>	Sensitive
Wandering Garter Snake	<i>Thamnophis elegans vagrans</i>	Sensitive
Plains Garter Snake	<i>Thamnophis radix</i>	Sensitive
Red-sided Garter Snake	<i>Thamnophis sirtalis parietalis</i>	Sensitive
Prairie Rattlesnake	<i>Crotalus viridis viridis</i>	May Be At Risk

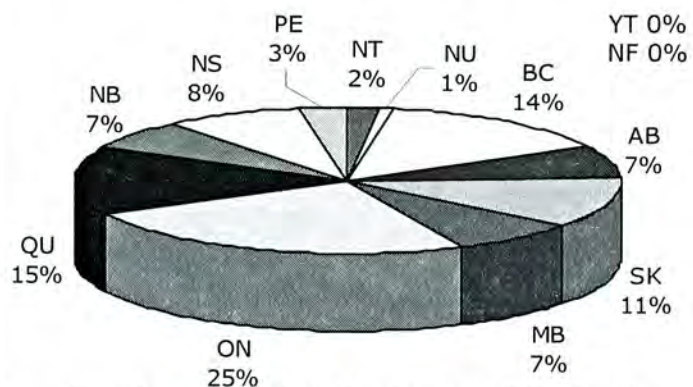
From **The General Status of Alberta Wild Species 2000**.

Canada has 42 species of terrestrial reptiles: 10 turtles, 25 snakes, and seven lizards.

Canadian waters provide habitat for two resident species of marine reptiles — both turtles.

Source: General status of species in Canada - [www.wildspecies.ca/](http://www.wildspecies.ca/)

Reptiles of Canada by Province



General status of species in Canada - [www.wildspecies.ca/](http://www.wildspecies.ca/)

## Status and Background of *At Risk* and *Sensitive* Reptile Species

Species	Population Notes	Background
<b>May Be At Risk</b>		
Mountain Short-horned Lizard	Rare and localized.	Population status and trend unknown. Occurs in strongly localized and isolated sandy grassland/badland/river break habitats.
Western Hog-nosed Snake	Extremely rare. Fewer than 100 site or specimen records from Alberta.	Information on populations and <i>hibernacula</i> is essential to properly determine status and management requirements. Current population trend unknown.
Prairie Rattlesnake	Relatively common in localized habitat.	Apparent population decline in similar habitat types in Saskatchewan. Maintenance in Alberta requires protection of key habitat elements such as <i>hibernacula</i> , and public education to reduce human-caused mortality.
<b>Sensitive</b>		
Bullsnake	Stable or possibly declining population.	Most vulnerable at winter dens. Requires conservation of prairie grassland summer range, protection of hibernacula, and better population information.
Red-sided Garter Snake	Common but localized. (Public sees a declining population.)	Protection of key habitats and public education may help to ensure a stable population.
Painted Turtle	Probably fewer than 100 individuals.	Known only from specific locations in Cypress Hills, lower Milk River and Oldman River. Very low population and extremely local and limited distribution leaves this species particularly vulnerable to site-specific habitat loss.
Plains Garter Snake	Common but localized. (Public notices long-term declines.)	Public education combined with protection of key habitats (hibernacula) will benefit this species.
Wandering Garter Snake	Common but localized. Least abundant garter snake.	Maintenance of stable populations is dependent on habitat protection and public education.

From **The General Status of Alberta Wild Species 2000.**

## Snakes

Together, lizards and snakes make up the largest Order of reptiles. There are roughly 4,300 lizard species and 2,700 snake species in the world. Worldwide there are only 250 turtle species. The Order Crocodylia (Gavials, Crocodiles, Alligators) consists of 23 species. The smallest Order, belonging to Rhynchocephalia, or the Tuataras, has only two species.

Snakes are not like other animals; they appear to be missing body parts that other animals have. They do not have legs, eyelids, external ear openings, or bladders. They have one lung instead of a pair; the exception is members of the boa family, which have two functional lungs. Snakes can coil, climb and slither because they have a flexible spine with 100 to 400 vertebrae, of which each is attached to a thin pair of ribs. Although some people see reptiles as “lower” than other animals because they are ectothermic, reptiles end up saving energy that can be allocated to other functions such as reproduction.

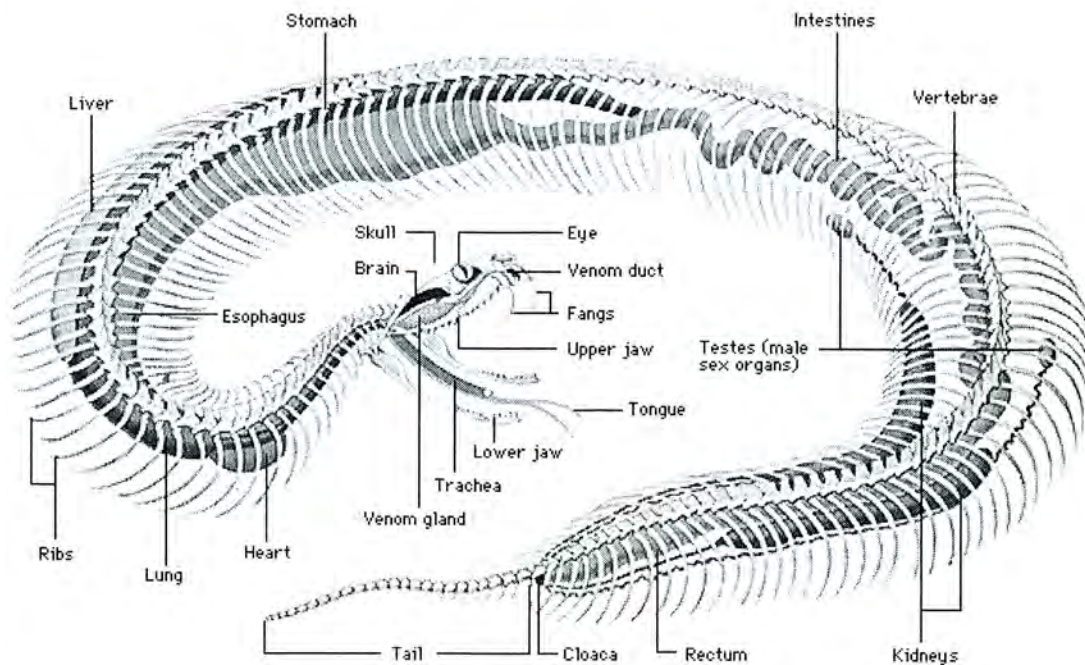


Diagram from *World Book* by James Teason

### Did you know?

The Sauria (Lacertilian) group of lizards, evolved into snakes over a period of millions of years, losing their limbs and their external ears and replacing their eyelids with a clear spectacle. These changes allowed snakes to burrow more easily and move efficiently through water or wet marshy areas in search of prey.

## Mythology

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Snakes have a hard time getting respect. Deep-rooted cultural biases may be partly responsible for the widespread fear and disdain of snakes. Their negative image is further developed from modern myths, folk tales and plain old misinformation.

Snakes are respected in some cultures and not in others, and the way people generally feel about snakes is heavily influenced by cultural beliefs and mythology. Here are some examples:

- The Aztecs of Central America worshipped a mythical plumed serpent.
- Aborigines in Australia associate the giant rainbow serpent with the creation of life.
- In India, cobras were regarded as reincarnations of important people.
- Among Roman Catholics, Saint Patrick is credited for getting rid of snakes in Ireland.
- In Ancient Greece, people believed snakes had healing powers. Doctors would allow snakes to crawl on bodies of sick people to cure them.
- According to ancient Hindu legend, the powerful god, Vishnu, rests on the coils of a giant cobra.
- In Ancient Europe, the druids believed that the Adder (type of snake) laid magic eggs. They were called adder stones and brought good luck and were used to ward off illness.
- In Greek mythology, Medusa was a beautiful maiden who has turned into a monster with a mass of writhing snakes in place of her hair. Any human who looked directly at her was immediately turned to stone.
- The Judeo-Christian culture has not been so kind to snakes. The serpent's role in "man's fall from grace" has contributed to the negative image of snakes. As punishment to Eve, the serpent's tongue was split so it could no longer talk and from that time on the snake has only been able to hiss. The serpent is a scaly manifestation of evil from the underworld.



## Myth-understandings

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It seems that no other animal is the subject of more myths and misunderstandings as the snake. A variety of symbolic meanings are attributed to snakes. In some cultures, snakes are a symbol of fertility and healing while in others they are associated with evil and sin. The origins of some myths are actually based on observations; however, most are from imagination and misunderstandings. For example, the Eastern Milksnake (*Lampropeltis triangulum*) is believed to suck milk from cows and goats. Milksnakes are common around barns because of prey availability (mice and rats) but they do not have the anatomical structures necessary to suck, nor are they able to digest milk.

There are many common myths about snakes. How many have you heard?

**Myth:** A snake can hypnotize birds and other prey.

**Fact:** Most snakes have poor eyesight and can only track the presence and movement of animals by their body heat and when they move. Snakes have no eyelids and they never blink, which may be the reason people think snakes can hypnotize.

**Myth:** You can figure out the age of a rattlesnake by counting the number of segments (also called buttons) at the end of the rattle.

**Fact:** It is not true that the number of buttons equal the age of a rattlesnake. Every time a rattlesnake sheds its skin, a new button is formed. A rattlesnake usually sheds several times a year and as the rattle ages, buttons at the end break off.

**Myth:** A constrictor snake crushes its prey.

**Truth:** Snakes that constrict their prey kill largely by suffocation. As they wrap their muscular body tightly around their prey, the rib cage of their victim is unable to expand and the lungs cannot function. Generally, they do not break bones or smash organs.

**Myth:** A snake only bites when in a coiled position.

**Truth:** Snakes can bite from any position. Coiling does increase the distance that a snake can strike. Snakes coil to protect their body (the vital body parts are in the centre of the coils), preserve heat, fit into small spaces, assist with camouflage, and maybe just because they can.

**Myth:** Snakes travel in pairs because if one gets killed the other seeks revenge.

**Truth:** Snakes hardly ever travel in groups or pairs. They do not have any social bonds. This myth may have arisen from observations of snakes during the mating season when a male may closely follow a female snake. Snakes do not have human emotions nor do they feel resentment.

**Myth:** Female snakes will swallow their young when confronted and will spit them out after danger has passed.

**Fact:** Although a few species of snakes will stay with their eggs until they hatch, parental care is largely not a behaviour snakes have developed. This myth may have resulted from observers seeing snakes eat young snakes of their own, smaller snakes of a different species, or other species' broods.

**Myth:** Hog-nosed snakes kill with their breath.

**Fact:** It was believed that a hog-nosed snake was able to mix poison with their breath and kill a person six metres away. In reality, the hog-nosed snake is virtually harmless to humans. In fact, it exhibits one of the most elaborate bluffing behaviours of all snakes: they may spread their hoods, hiss, and even strike without trying to bite. If they are continually harassed, they flip on their back and play dead. They rarely bite but if they do, it is less troublesome than a bee sting.



**Myth:** Snakes can sting with their tongues.

**Fact:** When a snake flicks its tongue, it is smelling the air.

**Myth:** Most snakes are venomous.

**Fact:** Venomous snakes only make up 10% of the species worldwide. The regularity at which people kill snakes would make a person think the world is overrun with venomous snakes because people kill snakes first and ask questions later. Fear, myths and misinformation lead to indiscriminate killing.

**Ophidiophobia** is an overwhelming fear of snakes. Many people with this phobia cannot even view a photograph of a snake without experiencing anxiety.

During the time of the Roman Empire, people believed that snakes brought good luck. They often built shrines to serpents and invited them into their homes. Aesculapius, the Roman god of medicine, was often portrayed holding a staff with a serpent coiled around it. Hermes, messenger of the gods, carried a similar staff, called a **caduceus**. It was originally paired with an olive branch decorated with garlands of ribbons. Later, it showed two snakes entwined in opposite directions. The latter version looked so much like Aesculapius' staff that it was adopted in modern times as a universal symbol of physicians.



**Keep this in mind:**

When humans confront a snake, the snake is more likely to try to escape than attack. That is not to say they would not defend themselves, but snakes have nothing to gain from conflicts with humans. No snake in North America is capable of eating a human. They are not vengeful nor do they chase people. That is making the snake think like a human, and that is not possible. Snakes are animals in search of a living, like all other animals in the wild.

## Snake Adaptations

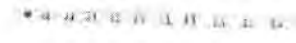



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Snakes have no legs but can move around quickly. They have no arms but most can climb trees. Some can squeeze small animals hard enough to stop their breathing. They smell with their tongue and they can swallow prey that is bigger around than they are. Snakes are amazing! The following section highlights some of the amazing features of snakes.

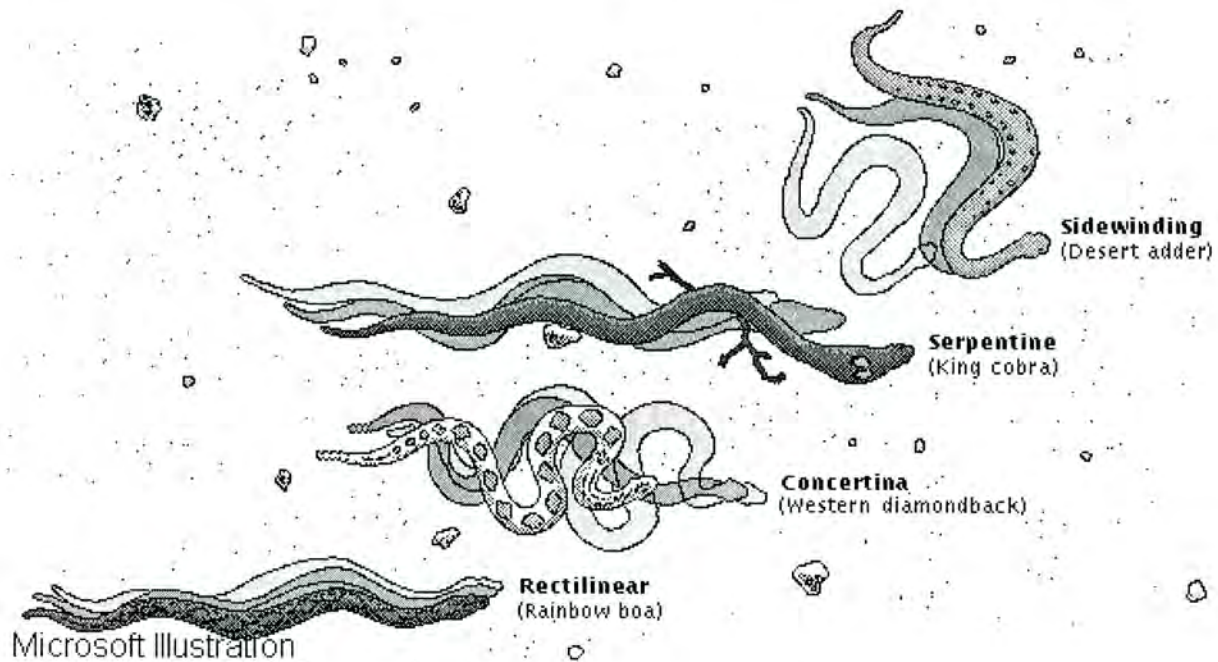
### A. Locomotion and Movement

A snake has between 100 and 400 bones (vertebrae) in its back, each with a pair of ribs. Humans have 33 vertebrae, with 12 pairs of ribs. All the bones in a snake's back enable it to glide and bend easily.

#### Snakes move in four ways:

1. **Rectilinear Movement** – Some snakes crawl directly forward, like a caterpillar, contracting the muscles along the length of the body; the *ventral* scales inch forward and retract, pulling the snake forward in a straight line; often used by large heavy-bodied snakes such as boas and pythons. 
2. **Lateral Undulation or Serpentine Movement** – Most snakes move in an S-shape, wiggling from side to side. They move forward by pushing the sides of their bodies backward against surrounding objects or the surface on which they are traveling. When using this mode of movement, a snake looks like a loose, wavy line. 
3. **Concertina** – If a snake is in a small space it bunches up its rear muscles and pushes half the body forward, then it bunches the front muscles and pulls the rest of the body forward. This action looks much like someone playing the accordion, squeezing the ends and pulling apart. A concertina is a smaller version of an accordion. 
4. **Sidewinding** – Snakes that live in areas with loose sand use this movement. The snake lifts the middle of its body and moves it about 15 cm to the side. The head and tail of the snake stay on the ground so it will not slide backwards on the sand. The snake's body moves sideways rather than forward. 

Below are additional diagrams demonstrating the four types of snake movement.



People think that snakes are fast. In reality, only a few snakes travel over 9 kph; the average speed is about 2 kph. A person can walk faster than that. Their *lateral* undulations and their adept ability at travelling through dense cover give the illusion that they are travelling faster than they really are.

## B. Senses

### Snake Eyes

Snakes have clear scales called **spectacles** that cover their eyes. Snakes cannot close their eyes because they do not have eyelids and they always seem to be staring. Snakes depend on other senses, particularly smell, to locate food and to find their way around their environment. Snakes can only see things close up. To help them see better, they often lift their heads and the front part of their bodies off the ground. Most snakes have round pupils. *Nocturnal* species, including vipers, have vertical pupils. A few snakes have horizontal pupils such as Asian tree snakes.

## Snake Charming

A snake charmer begins his performance by removing the lid of the snake basket and playing a few notes on his flute. As if in response to the summoning of the strange and melancholy tune, the cobra will slither out of the basket and gaze around at the growing circle of onlookers.

Within a few moments, the deadly serpent becomes attracted to the music and the movements of the snake charmer and concentrates its full attention on him. Raising a third of its nearly two-metre long body off the ground, it flattens its neck into a fascinating shape with a strange yellow blotch at the back, and begins to sway to and fro, apparently to the rhythm of the snake charmer's melody.

From time to time, the cobra appears to become agitated and lashes out at the snake charmer in a fast downward stroke, which is such an alarming sight that it evokes a gasp of fright from the spectators. They instinctively take a few paces back to avoid any such actions by the cobra toward themselves.

But this does not prevent many from throwing coins and paper money at the snake charmer, who goes on playing his flute, apparently oblivious to the money that is piling up around him. It is a magnificent sight to see the snake charmer calmly playing on while the cobra conducts its hypnotizing dance among all the coins, as if to guard its master's wealth.

After awhile the cobra apparently tires of this game and lowers its body to the ground, transforming its hood to its normal shape, and the snake charmer deftly returns it to its basket. After carefully gathering up the money, he walks off to seek more people to enthrall and entertain.

### The not so charming truth about snake charming:

If you thought the cobra was swaying to the tune of the flute, you were fooled – snakes do not hear airborne sounds. Snake charmers do not hypnotize cobras with their flute music either. The cobra simply follows the movement of the flute, which is moving back and forth. The cobra views the flute as an enemy, following its sweeping movements in preparation to strike at it. This is no easy feat for the cobra that has been confined to a basket and is disoriented after suddenly allowed out into bright daylight when the cover is removed. The charmer tries to convince the audience that his life is at risk, as the cobras are venomous. However, the cobra can only strike as far as one-third of its body length, a distance known and respected by the charmer. The basket offers further security against strikes by restricting the cobra's movements and limiting strikes to a predictable downward direction. Finally, the sad truth of the matter is, the fangs of the performing snakes are frequently removed or the mouth is stitched up to prevent their use. In reality, the charmer is perfectly safe.



### Sound

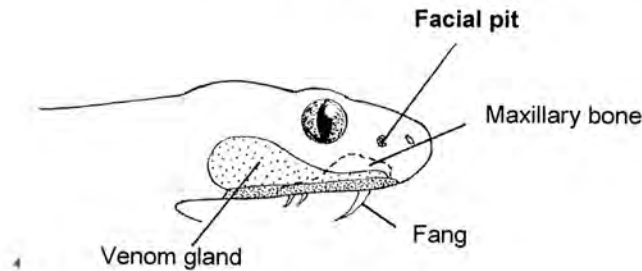
Snakes do not have ears and cannot hear airborne sounds like humans do. Snakes have an ear bone that connects the jawbone to the inner ear. They can sense vibrations when their lower jaw is in contact with the ground. Essentially, snakes can feel the approach of possible predators or potential prey through the vibrations they create on the ground.

### Smell

Snakes tongue-flick to pick up chemical signals, which are transferred to the *Jacobson's Organ* (paired pockets at the top of the mouth). Molecules on the tongue are deposited in the organ where they are analyzed and a message is sent to the brain. This ability is used for tracking down prey, scanning for a mate, and detecting predators and other substances.

### Detecting Heat

Pit vipers (Family Viperidae, includes the Prairie Rattlesnake) and most boas (Family Boidae) and pythons have facial *pits*. The heat-sensing facial pits enable these snakes to locate warm-blooded prey by the heat they radiate. Pit vipers have a pair of heat pits between their eyes and nostrils. Because the heat pits are on both sides of the jaw or in pairs, the snake can accurately pinpoint the direction of the prey, even in the dark.



Line drawing from the book, *The Amphibians and Reptiles of Alberta* (Russell and Bauer 2000).

## C. Prey

Depending on the species, snakes catch and subdue prey in a number of ways. Some snakes simply grab their prey with their mouth and then swallow. Some snakes that prey on larger animals may first subdue their prey, either by constriction or venom.

Generally, snakes use two different hunting strategies, or a combination of the two. The first strategy is by ambush where the snake “sits and waits” for prey to approach within striking distance. The second strategy involves the active foraging for, or seeking out, prey.

### Constriction

The Bullsnake is the only snake in Alberta that kills by constriction. Snakes that constrict coil their bodies around prey. The coils are wrapped so tightly that the prey cannot breathe and suffocates. Boas and pythons, which feed mainly of mammals, are examples of snakes that kill by constriction.

## Teeth

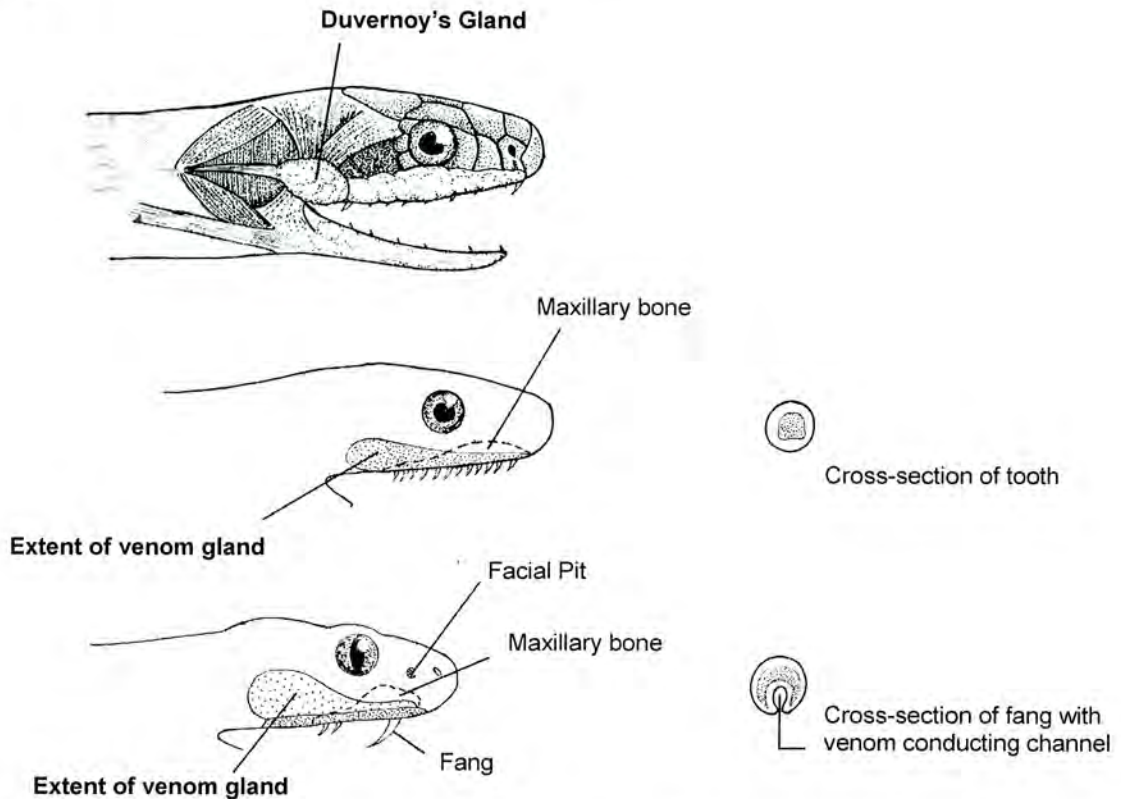
Snakes do have teeth. They are sharp and slant back to hook and hold a small animal. Snakes swallow prey whole. Imagine eating a watermelon whole in one swallow – a snake can swallow an animal five times larger than its own head. The snake's lower jaw unhooks from its skull so the mouth can open wide enough to swallow large prey.

Hog-nosed snakes are **opisthoglyphous** (having fangs at the back of the mouth); and use their fangs to deflate toads, which may puff themselves up with air to avoid being swallowed.

The prairie rattlesnake possesses large, highly developed, hollow fangs that are located at the front of the upper jaw. These movable fangs are swung forward from their folded resting position in the upper jaw, when biting.

## Venom

One would think that *venom* is a defensive strategy for snakes but it is primarily used for prey. In garter snakes and the hog-nosed snake, a mild venom is produced in the **Duvernoy's Gland**. Their venom is only harmful to the small animals on which these snakes prey. The rattlesnake has a complex venom delivery system, which is used to subdue and/or kill prey. A rattlesnake has control over the amount of venom it injects into prey.

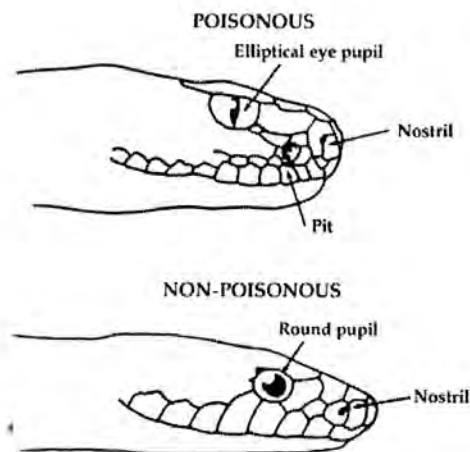


Schematic representation of the venom apparatus of Alberta snakes. The top two pictures show the rear-fanged mechanism of a garter snake. The bottom shows the front-fanged arrangement of the rattlesnake. Line drawings from the book, *The Amphibians and Reptiles of Alberta* (Russell and Bauer 2000).

Of the six species of snakes in Alberta, only the Prairie Rattlesnake possesses *venom* that is harmful to humans. The garter snakes and hog-nosed snake possess *venom* that is extremely mild and generally does not produce a reaction in humans. The Bullsnake does not have venom but its bite can still be painful.

There are no documented fatalities from snake bites in Alberta. Most hospitals in southern Alberta (Milk River, Medicine Hat, Lethbridge, Brooks, Calgary Foothills) have anti-venom. It is not always necessary to administer anti-venom, which is good because the anti-venom can cause allergic reactions in some people. If bitten by a poisonous snake seek medical attention immediately.

### Some differences between poisonous and nonpoisonous snakes in Alberta



### D. Defences

Reptiles have developed various defensive strategies depending on the species and circumstances. The vast majority of reptile species try to avoid confrontations with potential predators, including humans, whenever possible. Alberta's snake species and other reptiles follow the rules of **concealment** (seek refuge out of sight), **camouflage** (hide in full view), or **flight** (escape by fleeing, burrowing, or seeking shelter) as a means of defence.

When all else fails and if they are cornered, intimidation is the chosen behavior of some reptile species. Intimidation comes in the form of various bluffing behaviours or aggression. In Alberta snakes, depending on the species, intimidation may come in the form of striking (with mouth open or closed), hissing, body enlargement (spreading ribs on the neck or body), rattling of the tail (as in the case of a rattlesnake) or biting.

Snakes, like most animals, will defend themselves if threatened, injured or captured. Even then, the defensive maneuvers of some species are nothing more offensive than releasing foul-smelling secretions from glands at the base of their tail, in attempt to repulse a would-be predator (as in the case of garter snakes), or feigning death so that a predator will lose interest (as in the case of the hog-nosed snake.)

In self-defence, some snakes will indeed bite, but except in the case of Alberta's one venomous species, the rattlesnake, the resulting wounds are superficial. The important thing to remember is that unless you attempt to harm or capture a snake, it is almost impossible to get bitten.

### **Camouflage**

Snakes may also rely on camouflage to avoid predators. Their colour and patterns allow them to hide among the ground litter. The colourations of Alberta's snakes are subdued and do not stand out, specifically, the Bullsnake, Rattlesnake, Hog-nosed Snakes and the Wandering Garter Snake.

### **Optical Illusion**

A number of snake species have colouration that makes it difficult for a predator to estimate the speed and direction in which the snake is going. The longitudinal stripes running down the length of the body of a garter snake makes it appear as if the snake has not moved from its location, even though it has, as it slithers away. This fools a predator into thinking it has more time than it actually has to capture the snake.

Traverse bands and saddles (rings around body) have an even more startling effect. When a snake is moving quickly, these markings give an almost hypnotic effect, as they appear to flicker as the snake moves through vegetation or other cover. The speed of the snake is also difficult to estimate and because of the optical illusion created by the markings, it can even look like the snake is going in the opposite direction. By the time the brain of a would-be predator has processed the information, the snake may be able to escape. Snakes that move quickly have either longitudinal or bold transverse bands.

### **Bluff and Play Possum**

The hog-nosed snake is a real master at discouraging predators. It has a whole catalogue of tricks. When the hog-nosed snake is threatened, it bluffs and tries to fool a potential predator into thinking it is more dangerous than it really is. Its defensive display is quite elaborate. It will flatten its ribs on either side of its neck (to make a hood) so it appears larger while striking (often with a closed mouth) and hissing. When the snake produces a hood, it behaves somewhat like a cobra; it may even wave its head back and forth. If that does not work, the hog-nosed snake plays "possum" and will roll on its back, stick out its tongue and play dead. If you pick it up it will remain limp. Once it no longer feels threatened, it will right itself and crawl away.

### **Foul Secretions**

All snakes have glands in the anal region of their body that release a strong substance that has a disagreeable musky odour. Garter snakes release a foul-smelling secretion from



their *cloacal* glands as well as feces when handled. When they are captured, they twist and turn in an attempt to free themselves; all the while spreading their musk, which can be described as smelling like creosote (railroad ties.)

### Colouration

One defence strategy adapted by animals is **aposematic colouration**, which is when a colour pattern on an animal warns a potential aggressor of potentially unpleasant consequences if that animal is molested. A familiar one is the yellow and black colouration of wasps, whose pattern is interestingly adopted by a fly species as mimic colouration.

Like the fly species mentioned above, over time, some harmless snake species have taken on the colouration of venomous species. One example is the Scarlet Kingsnake, Scarlet Snake and the Eastern Coral Snake, which all inhabit the same region in southeastern United States. The Eastern Coral Snake (a poisonous species) has a body banded with black and red rings separated by smaller yellow bands. The two harmless species (Scarlet Snake and Scarlet Kingsnake) have bodies with black bands separating yellow and red rings. Locals in regions where these species' ranges overlap use the following rhyme to remember which one is venomous: "Red touch yellow, kill a fellow; red and black, friend of Jack." There is no colour imitation in any of Alberta's snakes.



Scarlet Snake



Eastern Coral Snake

### Warning

In addition to warning colours to advertise the presence of venom, some snakes warn potential aggressors with elaborate sounds. For example, if a rattlesnake feels threatened, it may produce an explosive buzz from the rattles on its tail. This sound is an unmistakable warning to would-be predators to retreat and the sound will long be remembered if followed by a bite.

Some non-venomous snakes mimic venomous snakes by adopting similar defence strategies. For example, the Bullsnake shakes the tip of its tail in the grass to resemble the sound of a rattlesnake's rattle.

If a Bullsnake is cornered, it will puff up and let out a hair-raising hiss to startle a potential predator. No other North American snake hisses like a Bullsnake. Not only is the hissing loud, but also very raspy sounding because of a flap cartilage in the front of the trachea that vibrates as air passes over it.

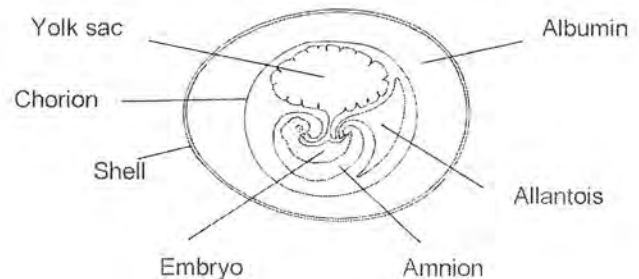
## Flee

Most snakes prefer to flee than have a confrontation. Only a very few species of snakes are considered to be aggressive and will defend themselves by attacking first. None, however, occur in Alberta.

## E. Growth

### Eggs

Some snakes and lizards have evolved the ability to retain their eggs internally until they have hatched, giving birth to fully developed young. This is called **ovoviviparity**. Most reptiles, however, lay leathery-shelled eggs, which are resistant to drying out. The embryo is protected in a moist environment where nourishment is supplied by the yolk sac (and metabolic waste is stored in the allantois). In Alberta, only two of the six species of snakes lay eggs.



It is rare for reptiles to care for their young. In most species, the young are independent from the moment of birth.

### Snake Skin

The skin of reptiles differs from that of amphibians in that the outer layer is thickened to form scales. These scales are composed of *keratin*, the same material that makes up human fingernails, mammal hair, and bird feathers... none of which are slimy! In some reptiles, areas of the skin are still thicker to form tubercles and crests. A reptile's skin is designed to reduce water loss.

Birds and mammals (including humans) shed and replace their skins constantly, cell by cell. Reptiles, on the other hand, typically do it all at once. When a reptile's skin cells are dead, a process called shedding replaces them. Shedding depends on many factors, for example, **growth** (a young reptile will typically shed more than an adult because of a higher growth rate) and as a response to an **injury** to speed up the rate of healing. A snake can shed its skin in one piece (which is called a shed), peeling it off like a sock—inside out!

The rattle on the tail of a rattlesnake is formed from the successive remains of the scale covering the extreme tip of the tail after the skin is shed. Rattles that consist of more than six or seven segments are rare because the material is brittle and the tip of the rattle is usually broken off, leaving only the most recently formed rings.

## F. Hibernation

One of the most important *habitat* components for snakes is the **hibernaculum** (or den). Snakes are *ectothermic* and are sensitive to variations in temperature. They must have protection from the cold winters and will overwinter in **dens** or *hibernacula* below the *frost line*.

Generations of snakes return to the same hibernaculum year after year; hundreds, and sometimes thousands, of snakes migrate to the same or a nearby hibernaculum to spend the winter. These dens are located underground below the frost line where openings occur: tree roots, shale cliffs, rock piles, animal burrows, rock outcrops, pits, fissures, crevices, and sinkholes, which all provide access to underground cavities.

The den provides a safe, humid place for snakes to spend the winter where the temperatures remain above freezing due to the insulating effects of the ground. Snow cover above the den, as well as the snakes themselves, which may be in the thousands, provide insulation, which can keep the hibernaculum above freezing.

Snakes hibernate in groups whenever possible to capitalize on increased humidity to help avoid dehydration. Large congregations of snakes at dens also improve breeding opportunities for some species that mate at or near the den.

While in hibernation, a reptile's body temperature drops, and its heartbeat and breathing slow down. It uses very little energy. During the summer, these animals get ready for winter by eating extra food and storing it as body fat. They use this fat for energy while hibernating. In many species of snake, hibernation is required to induce mating in the spring.

In Alberta, the Painted Turtle survives the winter by hibernating in the mud on the bottom of ponds and lakes, or in holes in the banks of rivers and creeks. It is important that the pond or lake used for hibernation does not freeze to the bottom and suitable dissolved oxygen is maintained in the water throughout the winter. Occasionally, young Painted Turtles, which hatch from eggs in late summer, over-winter as hatchlings in the underground nest created by the female turtle, emerging the following spring.

In Alberta, short-horned lizards hibernate in relatively shallow burrows of their own construction. These burrows are situated in the loose soil on south-facing slopes of the coulees. It has been speculated that this species may rely on snow cover for additional insulation to help it survive the winter.

### Critical Concerns for Hibernacula

An entire population of snakes can be wiped out with the destruction of one hibernaculum. Many dens are unknowingly dug up and destroyed by landowners and industry every year.

Garter snakes travel as much as 9 to 17 km to reach a hibernaculum from summering foraging habitats. You may wonder how snakes remember where a hibernaculum is located and how young snakes find a new hibernaculum. **Pheromonal** or chemical cues play a role in locating dens. The snakes pick up scent trails, left by themselves and other snakes, which provide directional cues to the hibernaculum in the area. Solar cues may be another navigational aid used by some snakes. An internal clock may allow certain snakes to correlate the time of day with the azimuthally position of the sun, thus providing them with an accurate compass.

The young of some snake species may not return to the den in their first year, but instead may overwinter in a pile of debris or other retreat that provides shelter from temperatures below freezing.

Optimal characteristics of a hibernaculum include the following:

1. Faces south, southeast to maximize spring solar radiation.
2. Below the frost line.
3. Near to, but not below, watertable.
4. Some topographical features or tree cover on the north side to protect the den site from the cold north winds in the spring and fall.
5. Good drainage.
6. Safe migration and movement corridors between the den and associated birthing sites and summer foraging habitats.
7. Quality summer habitat with abundant prey and shelter within dispersal distance of the den.

## Limiting Factors

Reptiles are one of the vertebrate groups least familiar to the public. As a result, they are one of the most misunderstood, feared, and persecuted groups of animals. For these reasons, the future of this fascinating and important group of animals looks increasingly uncertain.

Thankfully, a more positive outlook is slowly replacing this negative perception and more people are beginning to appreciate reptiles and marvel at their beauty and fascinating behaviour and natural history.

The most effective long-term reptile conservation tool is education. Greater tolerance, awareness, and respect for both reptiles and their habitats are crucial for their well-being and to ensure that they remain a permanent and integral component of Alberta's natural heritage. Research and direct conservation-oriented management initiatives such as the protection of native habitat and various projects to reduce road-related mortality may be instrumental for their survival.

The viability of snake and other reptile populations has been affected by a variety of events: draining of marshlands, cultivation of native rangeland, urbanization, chemical pollution, commercial trade, destruction of dens, road mortality, and intentional killing.

Snakes and dens are also affected by:

- The natural lifecycle of a sinkhole (i.e., den collapses).
- Periodic natural flooding of the den.
- Natural erosion, which may fill the entrance of a den with debris and soil and prevent movement of snakes into underground spaces.
- Poisoning of dens.

Some amphibians, birds and predatory mammals such as skunks, raccoons, and coyotes eat snakes and their young. Sometimes a *hibernaculum* is a target for predators because of the large concentrations of snakes.

### The Worlds Largest Hibernaculum – Narcisse Snake Den Area

The Narcisse Snake Den area is internationally renowned as a unique natural phenomenon representing the world's largest concentration of snakes. It is 5 km north of the hamlet of Narcisse, Manitoba. Tens of thousands of red-sided garter snakes congregate at the surface of their winter dens each year. Public viewing of spring and fall concentrations of snakes around the dens sites has reached about 25,000 annual visitors from around the world.

The Narcisse Snake Dens are seen as a tourist attraction, which helps to promote their importance, but can create significant challenges in ensuring the long-term protection of the resource. It is important that eco-tourism development and promotion are balanced with measures to protect the snake populations for the future.

#### **On the Web**

To find out more about the Narcisse Den Sites, key in **Narcisse** on your web browser. You will find many websites that school classes have developed about their visit to Narcisse. You can also visit Manitoba Conservation Wildlife and Ecosystem Branch at [www.gov.mb.ca/natres/wildlife/managing/snakes\\_narcisse.html](http://www.gov.mb.ca/natres/wildlife/managing/snakes_narcisse.html)

## Management

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### Death on the Roads

Snakes suffer at the hands of motorists. Roads passing through snake *habitat* can be littered with dead snakes because snakes linger on warm pavement during their *nocturnal* wanderings and during the day. Also because they do not move very fast and their long bodies make them easy targets some drivers even go out of their way to run over snakes. The problem with roads into remote and protected areas is that they invite people to use the area; more roads mean more vehicles, and higher snake mortality.

Roads have become a big problem for the Narcisse Dens in Manitoba. A well-travelled road fragments this important snake habitat—it divides the red-sided garter snakes migration route. On one side of the road are the snake dens (*hibernacula*) where they hibernate, and on the other side of the road are their summer foraging and birthing grounds. Every year the snakes have to cross the road twice during their seasonal movements and every year there is high snake mortality.

## Artificial Snake Dens

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Snakes take advantage of the warm subsurface geomorphology as a way to avoid the harsh cold temperate climate.

Snakes have unique hibernation behaviours including communal denning, occurrence of an active but non-feeding state for up to a month and a half after emerging from the dens, and dispersal over long distances (of up to 17.7 km for garter snakes and 25 km for the Prairie Rattlesnake) between dens and various habitats.

Given the predicted shortage of snake dens, the design and implementation of artificial snake dens can alleviate many of the hibernacula concerns. However, little research has been done on the design and implementation of these artificial structures. In addition, there have been few long-term studies of their effectiveness.

### Some of the advantages of artificial snake dens are:

- Provide a critical *habitat* resource to help sustain snake populations in areas where naturally occurring dens have been compromised.
- Easy to implement in conservation settings, with landowners, and for research.
- Will reduce events such as vandalism, flooding, and highway mortality through selective positioning.
- Opportunity to integrate education and research.
- Has long-term stability as a *hibernacula*.

The Metro Toronto Zoo designed an artificial snake den, which is actually on the zoo's grounds. It works both as a hibernaculum and as an educational device.

The Metro Toronto Zoo has identified six steps to building a den and they are as follows:

1. Select a site facing south for good solar exposure.
2. The den can be sized to fit into any available space, but it must be deeper than the *frost line*, at least two metres deep. The size of the den will determine its carrying capacity.
3. The hibernaculum must be situated close to the water table as the moist air ensures the snakes do not dehydrate over the cold, dry months.
4. The bottom is filled with rubble so that many chambers are created. The snakes can select the temperature they prefer, and can climb up if the den gets flooded.
5. Make sure there are tunnels that go down to the bottom of the pit in at least three corners. Snakes use the tunnels as passageways to get into the underground chambers.
6. There should be entrance openings for the snakes at each of the three corners. Cap the den with an insulating layer of sand and stone.

An important factor when creating artificial dens is its location. The den must be positioned within dispersal distance to critical habitats such as foraging, breeding, and birthing areas. The surrounding area must also support the natural history requirements that are critical to the ecology of the snakes (e.g., food and shelter availability.) Equally important, is the assurance of connectivity and safe travel routes (e.g., sufficient cover, no roads or other hazards) between critical habitat areas and the den.

### **IMPORTANT:**

**If you are considering constructing an artificial hibernaculum it is imperative that you contact your local Alberta Fish and Wildlife office to discuss the feasibility of the project and the current legal status designation of the species involved, under Alberta's *Wildlife Act*.**

## What We Can Do for Reptiles

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**Model Your Best Behaviour.** One of the best ways we can influence people is by modeling behaviours that are necessary to protect wildlife. It sets a good example for others to follow and they will see how easy and interesting it can be. This includes showing respect for animals (particularly reptiles), protecting *habitats* (including hibernacula and foraging sites), making others aware of why reptiles like road surfaces and to be vigilant when driving in reptile territories by not running over them.

**Educate others.** Reptiles are important creatures in the ecosystem. While reptiles have not received as much attention as birds and mammals, they play an important role in the balance of nature. Reptiles prey on a wide variety of animals and in some areas snakes keep rodent populations in check. In turn, reptiles are an important food source for many other animals. Reptiles are fascinating to see and learn about. Landowners and managers do not have all the information they need to help reptiles. You can make a difference by talking about reptiles. The more we know, the better our decisions will be.

**Habitat Protection.** Our awareness of habitat loss has grown, and many people overseeing land-use decisions have become more concerned about the needs of these animals. However, it is not enough to save small patches of habitat. Habitat fragmentation (habitat that becomes subdivided) does not provide for connectivity between different habitats used during different times of the year. Roads, farm fields, or development can fragment habitat.

**Minimize Impact.** Look at ways humans can lessen their impact on reptile habitat. Human activities can be changed to minimize negative effects on the natural environment. What can you do?

**Get Involved.** Join a conservation group, help a local community initiative to clean up a wetland, or volunteer at a *wildlife* event. Speak up for reptiles by writing letters to community land managers or a local government. Spur others to take action.

### Alberta's Six Snake Species

The next section of this program contains background information on each of Alberta's snake species. Use the information as the basis for classroom activities. Break your science class into small groups dedicated to individual reptile species. In the Activities section, there are plenty of ideas from which you can choose to teach students how to best learn about reptiles and their interactions with *ecosystems*.



# Prairie Rattlesnake

*Crotalus viridis viridis*

**Description:** 37 – 140 cm. The Prairie Rattlesnake's most distinguishable characteristics are its rattle located at the end of the tail, its broad triangular-shaped head (significantly larger than its neck) and its vertical eye pupils. Heat-sensing facial pits are located behind and below the nostril. Usually a light-coloured stripe runs behind the eye to the corner of the mouth. The background colour of the Prairie Rattlesnake is tan to brown with a series of faded brown blotches running the length of the back. Smaller spots occur along the sides of the body and the belly is yellowish. Males are larger than females.

**Alberta General Status:** May Be At Risk.

**Habitat:** Found in drier areas of grassland and sagebrush, usually in proximity to a river valley. Also found in farm fields, sandy soil near rock piles or boulders, rocky outcrops, and stony canyons.

**Natural History:** Rattlesnakes belong to a family of snakes known as Pit Vipers (*Viperidae*), named for the two facial *pits* on their face. Pit Vipers use heat-sensing organs to sense the infrared spectrum and locate warm-blooded prey such as small mammals and birds (see page 22 and 24 for diagrams featuring facial pits.)

If approached, a rattlesnake will coil itself, raise its head and shake its rattle. The rattle is used to warn potential predators that it is poisonous and to alert large animals to its presence, to avoid being stepped on.

Prey includes other reptiles, amphibians, juvenile ground squirrels, voles, and mice, which the rattlesnake ambushes. The size of the rattlesnake, size of prey, and level of hunger all may contribute to decisions regarding the allocation of *venom* during predatory bites. When they strike, injection and release of venom occurs in a split second. A Prairie Rattlesnake can strike at a speed of 2.43 m/sec for a distance up to half its body length. After envenoming its prey, the rattlesnake will then follow the scent trail left by the dying animal, which when located, is swallowed whole and head first.

A Prairie Rattlesnake's *hibernaculum* may be a long distance from its summer foraging area. Their dens are frequently shared with other species of snakes. They emerge from the den when the air temperature is about 10° C; usually late April to early May.

The Prairie Rattlesnake is a venomous snake that can cause harm to humans, although their bites are rarely fatal. Respect and caution should be used when in the vicinity of these snakes.

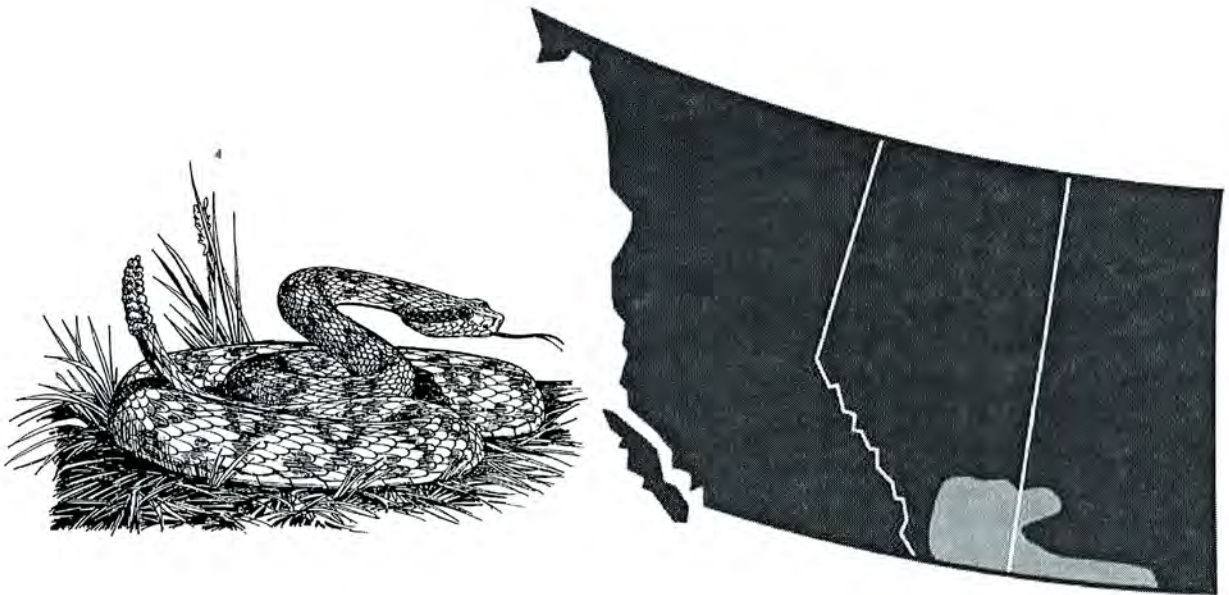
Prairie Rattlesnakes can live up to 15 years.

**Reproduction:** Sexual maturity is reached between 5 to 7 years. The female usually bears its first litter of live young at 6 to 8 years of age and may not feed the year she gives birth. The litter consists of 4 to 12 young, about 28 cm in length. They breed every second to fourth year.

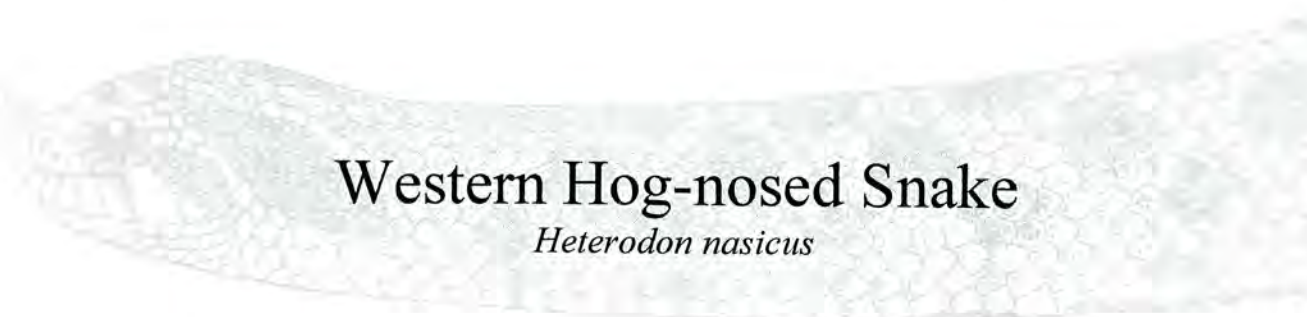
**Distribution:** In Alberta, the Prairie Rattlesnake is found primarily south of the Red Deer River and east of Lethbridge, in Alberta's Grassland Natural Region.

**Limiting Factors:**

- Habitat loss through human activities and disturbance, such as road and pipeline construction and agricultural activities.
- Population growth is slow due to late sexual maturity, small litters, and the fact that they do not breed every year.
- People sometimes kill rattlesnakes and destroy *hibernacula* because of fear and lack of understanding. These acts are illegal as the Prairie Rattlesnake, and its dens, are afforded protection, year round, under Alberta's *Wildlife Act*.



Prairie Rattlesnake range



# Western Hog-nosed Snake

*Heterodon nasicus*

**Description:** 40 – 90 cm. The most striking characteristic of this stocky snake is the sharply upturned and pointed snout or **rostral** scale. The background colour is brown to gray, with three to four rows of distinct or slightly faded dark brown blotches that go down the length of the back. There are two to three rows of spots on the sides of the body that are smaller than the back markings. The throat is white. The belly is black or black and white checkered.

**Alberta General Status:** May Be At Risk.

**Habitat:** The hog-nosed snake has specific soil, vegetation and water requirements. It occurs in low-growing vegetation and sandy or gravelly soil that is good for digging and burrowing.

**Natural History:** This snake is both *diurnal* and *crepuscular* (more active in the morning and evening than midday) depending on the air temperatures and weather.

Western Hog-nosed snakes are voracious feeders and will eat any small animal they find. Hog-nosed snakes are **opisthoglyphous** (having fangs at the back of the mouth); and use them to deflate toads, which may puff themselves up with air in an attempt to avoid being swallowed. Prey consists of toads, frogs, salamanders, other snakes, lizards, small rodents, and various invertebrates. Potential predators include, hawks, crows and coyotes.

When people or other animals threaten the hog-nosed snake, it tries to fool them into thinking it is more dangerous than it really is. Its defensive display is quite elaborate. It will flatten the ribs on either side of its neck so it appears larger while striking (often with a closed mouth) or hissing. When the neck area gets larger, it may wave its head back and forth. If that does not work, it will roll on its back, stick out its tongue and play dead until the danger passes. Even if a predator tries to turn it over, it will roll back over again. This defence strategy is common to all types of hog-nosed snakes, but may be less developed in our species than in others.

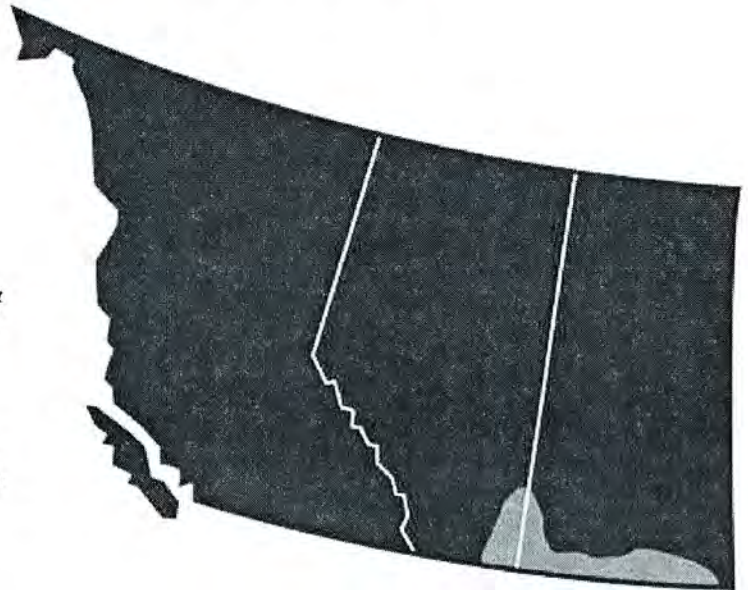
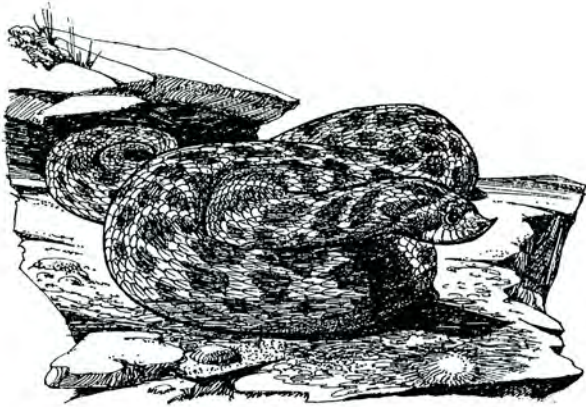
Along with the Bullsnake, the hog-nosed snake is the only other snake in Alberta that actually burrows.

**Reproduction:** Mating occurs from March to May. Four to 23 eggs are buried in sandy soil in mid-June to end of July. Incubation lasts about two months. *Neonates* (“snakelets”) are shorter than a pencil (about 14 cm) when they hatch.

**Distribution:** The Hog-nosed Snake has a limited distribution in Alberta; restricted to the short-grass prairie in the southeast corner of the province within the Grassland Natural Region. It can be found north of the Montana/Alberta border to the Red Deer River, and east of Orion, Medicine Hat, and Jenner, Alberta.

**Limiting Factors:**

- Specific habitat requirements and destruction of habitat may be a key reason for species' decline in Alberta.
- People kill hog-nosed snakes and destroy hibernacula because of fear and lack of understanding.
- Hog-nosed snakes are dependent on the burrows of Pocket Gophers for their hibernacula. Eradication of Pocket Gophers and other small mammals may reduce potential den sites.
- Its range is limited to areas with a sandy substrate in which they dig.



**Western Hog-nosed Snake range**

# Bullsnake

*Pituophis catenifer sayi*

**Description:** 100 – 250 cm. This large and powerful snake is the longest Canadian snake. It has a small head with distinctive black markings on the upper lip. Its background colour is yellow with blotches on the back and sides ranging from black to brick red. Sometimes mistaken for a rattlesnake, the Bullsnake is easily distinguishable from the rattlesnake because it has no facial *pits*, no rattle, and a small head.

**Alberta General Status:** Sensitive.

**Habitat:** Found in the drier areas of grassland, sagebrush, farmlands and native pastures. Often occurs in habitats with sandy soils and can be seen basking on rocks and boulders, which are also used for shelter.

**Natural History:** The Bullsnake is an accomplished tree climber and can often be found prowling for birds and their eggs up in a cottonwood tree. In the summer, they use their pointed head and tough rostral scale on the end of their nose to burrow through loose sand and penetrate mammal burrows in search of prey or to create a chamber in which to lay eggs.

The Bullsnake is a constrictor, killing its prey by squeezing, which results in suffocation. It is a powerful snake and will press a small animal against the walls of a burrow to kill it. Bullsnakes eat small animals such as mice, voles, shrews, ground squirrels, young rabbits and pocket gophers. They also prey on lizards, frogs, and invertebrates.

Bullsnakes hibernate alone or with garter snakes, hog-nosed snakes, rattlesnakes or other Bullsnakes in burrows on south-facing slopes.

The Bullsnake's first line of defence is to rely on its camouflage or escape to near by cover. If cornered, the Bullsnake will puff up and let out a hair-raising hiss. No other North American snake hisses like a Bullsnake. Not only is it loud, but also very raspy sounding because of a flap cartilage in the front of the trachea that vibrates as air passes over it. The Bullsnake may also coil up and vibrates its tail in vegetation to produce a buzzing sound (imitating the rattlesnake) and strike to frighten off predators.

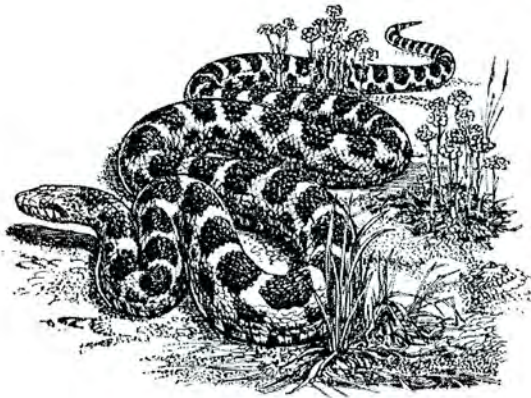
These snakes have a big appetite and are a valuable resource on a farm where they can keep a rodent population in check.

**Reproduction:** During the mating season, male Bullsnares are known to engage in combat with other males. When the female has been chosen, the male will climb on her back and grasp the female's head or neck in his mouth. Females are oviparous. One or two clutches of 2 to 24 eggs are laid each summer in abandoned animal burrows or burrows that they modify. Occasionally, more than one female Bullsnares will use the same egg-laying site in a given summer. Hatchlings emerge in late summer measuring 20 to 40 cm and may not feed until the next spring.

**Distribution:** Bullsnares are found in southeast Alberta, from the Montana/Alberta border to the vicinity near Drumheller. If you drew a line from Calgary to Cardston, that line would represent as far west as the Bullsnares has been documented in Alberta.

**Limiting Factors:**

- Bullsnares are vulnerable to loss of habitat because they have specialized *habitat* requirements.
- Bullsnares may be killed on roads as they move about their home range or when they use roads as sources of heat.
- People kill Bullsnares and destroy *hibernacula* because of fear and misunderstanding.
- Bullsnares are often mistaken for rattlesnares, and therefore may be more likely to be killed.



**Bullsnares range**

# Red-sided Garter Snake

*Thamnophis sirtalis parietalis*

**Description:** 46 – 130 cm. When the red markings on the sides of the Red-sided Garter Snake are present, they are the best characteristic for making a positive identification. Be forewarned, however, that these red markings are not always present. The background colour of this garter snake is a dark olive to black with yellow *dorsal* and *lateral* stripes. Although the stripes are most commonly yellow, they can also be greenish, orange or blueish in colour. The belly is bluish in colour and it is often darker nearer the tail.

**Alberta General Status:** Sensitive.

**Habitat:** A *habitat* generalist, the Red-sided Garter Snake can be found anywhere from city parks to farms to forested areas, from Wood Buffalo National Park down through to Waterton National Park. An accomplished swimmer, it is usually associated with water bodies (ponds, streams and lakes); however, it can also be found in dry forests more than 3 km from water.

**Natural History:** Red-sided Garter Snakes will prey on amphibians, small mammals, small birds, worms, molluscs, invertebrates, and fish. The Red-sided Garter Snake has mild *venom*, which will immobilize its prey. This venom does not affect humans.

When threatened or handled, garter snakes release a foul-smelling secretion from their *cloacal* glands, which is frequently accompanied with feces. When they are handled or captured by a predator, a garter snake will twist and turn in an attempt to free itself; all the while spreading their musk, which can be described as smelling like creosote (railroad ties.).

Up to 9,000 Red-sided Garter Snakes have been estimated using a single den in Alberta.

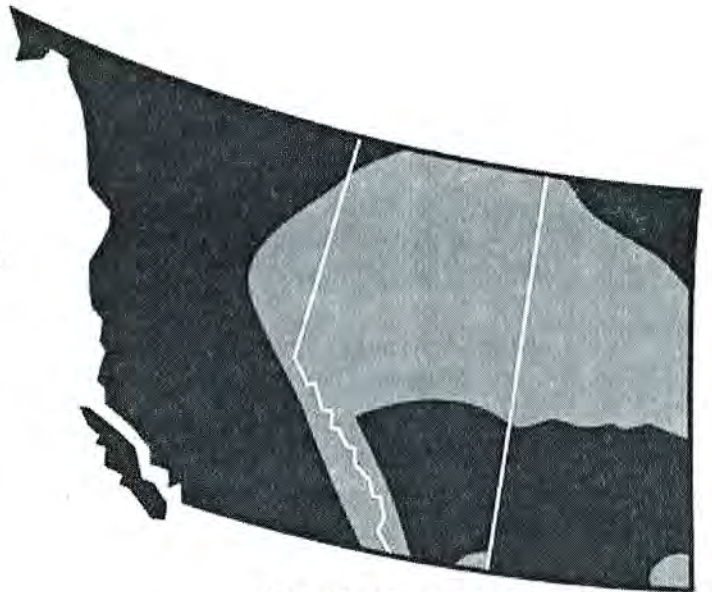
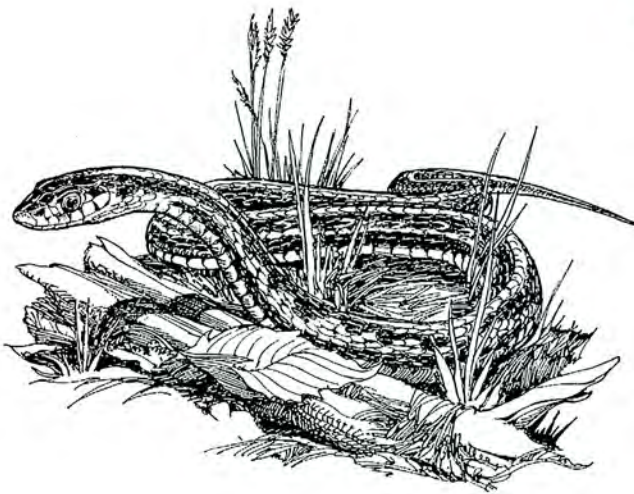
Red-sided Garter Snakes are well known for their ability to tolerate cold temperatures and are found further north than any other North American reptile.

**Reproduction:** The Red-sided Garter Snake, mates in the spring after emerging from the *hibernaculum* and occasionally in the fall. Twelve to 18 young are born live. At dens with massive concentrations of snakes, hormonal cues may play a large role in bringing males to females as well as enabling the males to determine if a female is receptive to mating.

**Distribution:** The most wide-ranging snake in Alberta, the Red-sided Garter Snake is most commonly found in the Boreal Forest, Foothills and Parkland Natural Regions. Occasionally, this snake has also been observed at a few locations in the Grassland Natural Region of southern Alberta.

**Limiting Factors:**

- Biologists and naturalists perceive a long-term decline in numbers of garter snakes primarily as a result of people killing them and destroying their hibernacula because of fear and misunderstanding. Dens have also been reported being unintentionally dug up during the winter or other times of the year.
- Degradation and loss of habitat caused by agricultural, industrial and urban developments, chemical pollution (biocides), road mortality, and periodic natural catastrophes (such as den collapse or flooding).
- Other current factors associated with declining populations of garter snakes include den site degradation and the disturbance or harassment of snakes at dens as a result of recreation or high visitor traffic, the introduction of non-native predators (e.g., game fish, domestic cats), over-collecting by individuals wishing to keep garter snakes as pets or for commercial trade, and diminishing water quality (reduction in prey base).



Red-sided Garter Snake range



# Plains Garter Snake

*Thamnophis radix*

**Description:** 50 – 100 cm. Similar in appearance to the Red-sided Garter Snake, the Plains Garter Snake is most easily identified by its predominant orange *dorsal* stripe, which runs from the back of the head to the tail. Plains Garter Snakes lack red markings. Its *Lateral* strips are yellow/green. A double row of dark blotches occurs between the dorsal and lateral stripes. The background colour of this garter snake is greenish gray, black or brown. The belly varies from whitish to bluish green and gray, and has two dark rows of spots.

**Alberta General Status:** Sensitive.

**Habitat:** The Plains Garter Snakes occurs in a wide variety of *habitat* types, ranging from wet meadows, boggy areas, parks, open prairies, margins of lakes, prairie ponds, streams, dugouts and river valleys.

**Natural History:** Plains Garter Snakes are *diurnal*. Like other garter snakes, they have mild *venom*, which help to immobilize prey, but this venom does not affect humans. At first sign of danger, this snake, like other garter snakes, will attempt to flee and seek cover in thick vegetation, under objects or in water. If molested, it may bite, but it is incapable of causing anything more than an insignificant superficial wound. More commonly it will release a foul-smelling musk secretion from its *cloacal* glands, as well as feces, to make itself a less appealing meal for would-be predators.

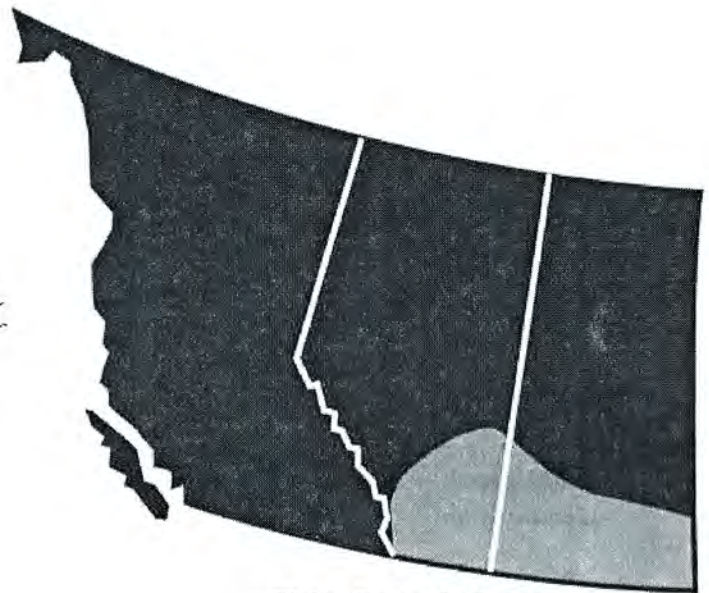
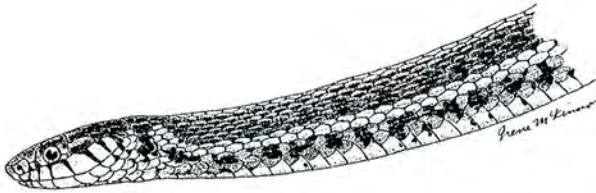
All garter snakes are active thermoregulators. This means they will alternately bask and seek cover throughout the day. Garter snakes are voracious feeders and will eat anything they can catch and swallow including fish, frogs, tadpoles, salamanders, insects, earthworms, small mammals, birds' eggs, and *carrion*.

**Reproduction:** Like all garter snakes in Alberta, mating occurs in the spring or fall, near the *hibernaculum*, where they are often found in large numbers. Around the beginning of July, 5 to 40 young are born live, ranging in length from 13 to 20 cm. There have been records of as many as 92 young being born at a single birth.

**Distribution:** Plains Garter Snakes are most common in the south and eastern regions of Alberta (Grassland and Parkland Natural Regions). The Cold Lake locality has been reported to be the most northern occurrence of the Plains Garter Snake.

### Limiting Factors:

- People kill garter snakes and destroy *hibernacula* because of fear and misunderstanding.
- Degradation and loss of habitat caused by agricultural, industrial and urban developments, chemical pollution (biocides), road mortality, and periodic natural catastrophes (such as den collapse or flooding).
- Other current factors associated with declining populations of garter snakes include den site degradation and the disturbance or harassment of snakes at dens as a result of recreation or high visitor traffic, the introduction of non-native predators (e.g., game fish, domestic cats), over-collecting by individuals wishing to keep garter snakes as pets or for commercial trade, and diminishing water quality (reduction in prey base).



Plains Garter Snake range

# Wandering Garter Snake

*Thamnophis elegans vagrans*

**Description:** 45 – 107 cm. The Wandering Garter Snake's background colour is usually brown or gray, with a light cream-coloured *dorsal* stripe and a black checkerboard pattern along its sides. Wandering Garter Snakes lack the bright orange dorsal stripe of the Plains Garter Snake and the red markings of the Red-sided Garter Snake. Wandering Garter Snakes also lack the dark olive to black background colouration of the other two species of garter snakes found in Alberta.

**Alberta General Status:** Sensitive.

**Habitat:** The Wandering Garter Snake is frequently encountered along ditches, streams, lakes, ponds, or marshes.

**Natural History:** The Wandering Garter Snake is a *diurnal* species usually seen basking in the sun near water. When it is disturbed it will take to the water or other cover such as thick vegetation or amongst rocks. It will eat insects, molluscs, worms, tadpoles, frogs, fish, mice, small birds, mammals, and even carrion. Like other garter snakes, it has mild *venom*, which will immobilize its prey but does not affect humans. The Wandering Garter Snake will often release a foul-smelling secretion from their *cloacal* glands, as well as feces when handled or when it is threatened.

**Reproduction:** Wandering Garter Snakes give birth to 4 to 25 live young, from July to September. <sup>4</sup>

**Distribution:** Widely distributed south of the Red Deer River. Its range overlaps with the Red-sided Garter Snake and the Plains Garter Snake in south and central Alberta. Broadly distributed in all *habitat* types throughout much of the Grassland Natural Region as well as into the Foothills and Parkland Natural Regions.

### Limiting Factors:

- People kill garter snakes and destroy *hibernacula* because of fear and misunderstanding.
- Degradation and loss of habitat caused by agricultural, industrial and urban developments, chemical pollution (biocides), road mortality, and periodic natural catastrophes (such as den collapse or flooding).
- Other current factors associated with declining populations of garter snakes include den site degradation and the disturbance or harassment of snakes at dens as a result of recreation or high visitor traffic, the introduction of non-native predators (e.g., game fish, domestic cats), over-collecting by individuals wishing to keep garter snakes as pets or for commercial trade, and diminishing water quality (reduction in prey base).



Wandering Garter Snake range

## Alberta's Single Lizard Species

Lizards are the most abundant and diverse group of reptiles, living in a variety of *habitats*. There are over 3,307 species in the world. Some lizards you may already know: geckos, iguanas, chameleons, monitors, and skinks. Lizards do not swallow their prey whole like snakes but chew them with their teeth.

Lizards are sometimes confused with salamanders. Their differences are easy to spot once you know that salamanders are amphibians and lack scales and require water to keep their skin moist. Lizards, on the other hand, have dry, scaly skin. Many lizard species are *diurnal*, spending much of their time basking in the sun. Some species, such as geckos, are *nocturnal* and are active primarily at night. You would never see a salamander basking on a warm rock; but you will find it in a shady moist area, like under a log.

# Mountain Short-horned Lizard

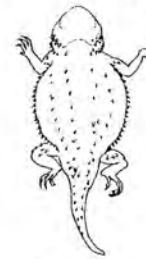
*Phrynosoma hernandesi*

**Description:** 4 – 7 cm. The Mountain Short-horned Lizard has a flat, oval-shaped body.

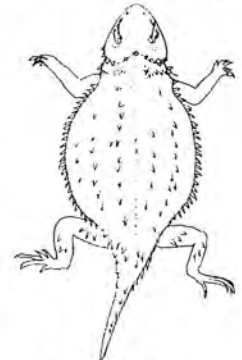
Horn-like scales occur on the back and a single row of fringed scales occurs along the sides of the body.

The short-horned lizard's overall body is mainly grey or beige and blotched with dark brown and speckled with white. Its colouration helps to camouflage it in its surroundings. The female is larger than the male; this is known as **sexual dimorphism**.

### Sexual dimorphism in short-horned lizards



Adult male



Adult female

**Alberta General Status:** May Be At Risk.

**Habitat:** The Mountain Short-horned Lizard inhabits the south-facing slopes of coulees where short-grass prairie and the coulee rim meets.

**Natural History:** The Mountain Short-horned Lizard is a sit-and-wait predator. Their diet consists mostly of beetles and ants; however, they also eat grasshoppers and other small invertebrates.

The Mountain Short-horned Lizard is cold tolerant reptile and is active from mid-May to early September. They exhibit complex **shuttling** behaviours when

regulating their body temperature throughout the day. They may flatten their body and adjust their position or orientation to increase the surface area exposed to the sun. To cool their body, they may seek shade, alter their orientation, narrow their body profile and may even burrow into the ground.

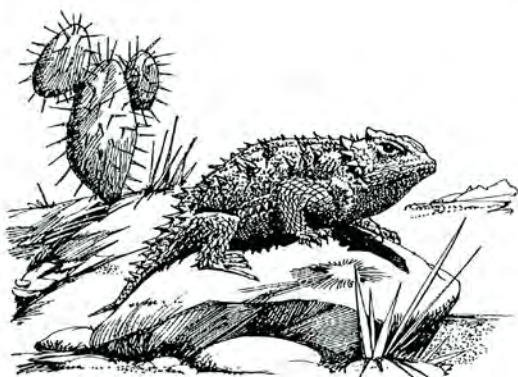
Short-horned lizards rely on their camouflage as their primary means of avoiding predators, which include birds such as crows and shrikes, snakes and coyotes. Certain short-horned lizards have a rather specialized defence. If attacked, many short-horned lizards will squirt blood from their eyes to startle a would-be predator. Short-horned lizards can shoot blood from their eyes over a distance of 1.2 m. They accomplish this by restricting blood flow out of their head, until the mounting pressure ruptures delicate capillaries in the eyes.

**Reproduction:** Male Mountain Short-horned Lizards are ready to reproduce in their second summer, females in their third. After mating, the female remains at the coulee rims while the males disperse into the short-grass prairie. The female gives live birth to 6 to 13 young, about 20 mm in length, in late June or early July. Females can live up to five years.

**Distribution:** In Alberta, the Mountain Short-horned Lizard is limited to extreme southeastern portion of the province. It is found only in arid, short-grass prairie habitat within the Grassland Natural Region, south of the South Saskatchewan River valley to the Montana/Alberta border.

**Limiting Factors:**

- In Alberta, Mountain Short-horned Lizards are susceptible to climate change as they are at the northernmost limit of their range.
- Habitat loss, degradation, fragmentation caused by cattle grazing, invasive plant species such as Crested Wheatgrass, urbanization, and development.
- Insecticide use can eliminate prey.
- Road mortality associated with oil and gas vehicles, dirt bikes, ATV's, etc.



Mountain Short-horned Lizard range

## Alberta's Single Turtle Species

Did you know that turtles are older than the dinosaurs? The earliest turtles lived 200 million years ago, 50 million years before the first dinosaurs appeared. The scientific name for turtles comes from the Latin word *testudo*, which means tortoise. Turtles have taken the scaly skin of reptiles to an extreme with the hard shell. All turtles have common traits: four feet, ribs fused to the shell, and leg bones that tuck into their body cavity. Turtles lack teeth, but they do have a horny beak and sharp claws for cutting and shredding food. Turtles have a poor sense of hearing but have acute vision with good colour perception and an excellent sense of smell.

People around the world have found uses for turtles and have included them in art, religion and myths.

- In Europe, the story, “The Tortoise and the Hare” credits turtles with determination and persistence.
- In Ancient China, they believed that a turtle named Kwei, created the universe and determined China’s fate.
- The Chinese Book of Rites labeled the turtle as one of the four benevolent spirit animals.
- Hindu myths imagine the universe being upheld by four elephants standing on a turtle’s back.
- Several North American tribes believed that the world was merely an island on the back of a turtle. The Muskogee believed that when the world was covered with water, the turtle, Locv, was the first being created and saved all the animals from drowning by teaching them to swim. Locv brought mud to the surface and formed dry land.

Turtles are unique reptiles. They have three characteristics that set them apart from other reptiles:

1. **Relatively long life-spans** – some turtles do not reach sexual maturity until they are 15 to 25 years old. The female Painted Turtle reaches reproductive maturity at 4 to 8 years of age. Individuals may reach an age of 40 years.
2. **Large clutch sizes** – some turtles can lay up to 100 eggs. A large reproductive strategy ensures that at least some of their offspring will survive the high rate of predation.
3. **Mass nesting migrations** – Sea turtles migrate several thousand kilometres from feeding grounds to nesting beaches. Some of the hatchling sea turtles are carried thousands of kilometres away by the currents, and will find their way back to the same beach 30 to 50 years later.

All turtles lay eggs, which they bury in the ground. Females choose areas with loose sand or soil that gets plenty of sunshine. Their nesting behaviours are very ritualized and can be explained in four steps:

1. **Choosing the Nest Site:** The female checks out potential sites by looking at it from the water, walking around, and will bulldoze through the soil with her head. It can take a few minutes or several hours to choose a site.

2. **Digging:** Once she chooses a site, she will dig a hole with only her hind feet. She will abandon the hole as a potential nest if she comes across a rock. She scoops out the dirt until the hole is flask shaped. If the ground is too hard, she may moisten the ground with urine to loosen the soil.
3. **Laying the eggs:** She positions her *cloaca* over the hole and begins to lay. She will rest between each egg. She will use her hind feet to slow the eggs as they drop into the nest. Painted Turtle eggs are around 32 mm long.
4. **Burying the eggs:** Finally, she will scoop the soil back into the hole with her hind feet. She will use her feet to pack the soil by kneading the dirt with her feet. She leaves when she is finished and never sees her hatchlings.

The temperature of the nest determines the sex of the hatching turtles. Turtles have TSD – temperature-dependent sex determination. In other words, the temperature experienced by the embryos as they develop determines their gender. Females result from temperatures of 29°C (84°F) and up and mostly males below 29°C (84°F).

The fate of turtle eggs is not usually a happy one; foxes, skunks, raccoons, and various other predators will dig up and eat the eggs. To compensate for this, turtles lay large numbers of eggs, and live a long time so they can produce many offspring.

Turtles face a number of threats and their populations are declining because of:

1. **Habitat Destruction** – Although wetlands are essential to amphibians and reptiles, humans frequently consider wetlands as marginal land and undesirable. As a result, wetlands are often drained, filled in, or altered. Wetland education and awareness campaigns are essential to conserve this important habitat. Loss and degradation of habitat affects virtually all species.
2. **Pollution** – Turtles bio-accumulate pollutants such as chlorinated hydrocarbons in their body fat. Chemicals such as these will gradually poison them or impair their reproduction. Pollution is the cause of decreased egg **viability** and increased rates of hatchling deformities.
3. **Road Mortality** – A turtle’s slow pace makes it highly vulnerable as they move across roads. Traffic is a serious threat to turtles, particularly to adult females, which may cross highways in search of nesting sites. The survival of turtles largely dependent on the low mortality of adult turtles since many eggs and hatchlings are subject to predators.
4. **Pet Trade** – Unscrupulous dealers can wipe out an entire population of turtles. If a collector finds a communal hibernating site, an entire population can be wiped out in a short order of time. The public must be aware that if an adult turtle is being sold in a pet store; it probably came from the wild.

**Note:**

The mortality of pregnant turtles not only removes all the potential future offspring, but it is impossible for surviving turtles to compensate for those losses. Once a turtle population starts to decline, it is difficult to reverse the trend.



## Family: Emydidae (Box and Water Turtles)

This is the largest and most diverse of all the turtle families with 33 genera and about 100 species. All members have small heads, short tails, and well-developed shells. A bony bridge usually unites the plastron (the lower shell of a turtle) and the domed carapace (the upper shell of a turtle.)

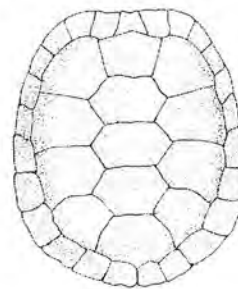
### Note:

Turtles and other reptiles can transmit *Salmonella* infections to humans. Always wash your hands when handling turtles and other reptiles.

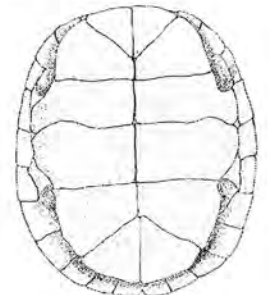
# Painted Turtle

*Chrysemys picta*

**Description:** 9 – 18 cm. The Painted Turtle is about the size of a dinner plate. It is one of the most colourful wildlife species in Alberta's wetlands. They are named after the bright red and yellow streaks on the head, neck, legs, and tail, which are set against a dark background. The **carapace** is an olive-black colour. The **plastron** can be yellow, cream or tan.



Carapace



Plastron

**Alberta General Status:** Sensitive.

**Habitat:** Painted Turtles live in nearly any permanent body of water with suitable basking sites, aquatic vegetation, and prefer muddy bottoms. They can be found in slow-moving rivers, creeks or lakes and stagnant water bodies such as marshes and ponds.

**Natural History:** Painted Turtles are *omnivorous* and feed on insects, worms, fish, snails, tadpoles, frogs, aquatic vegetation, algae, and *carrion*. They have a fixed tongue and cannot swallow their food on land. Therefore, their food is found and eaten in the water.

Painted Turtles hibernate in the debris and mud at the ponds and lakes; and in the banks of creeks and rivers. They do not rely exclusively on their lungs for oxygen needs during hibernation; they acquire oxygen through their skin and thin walled sac-like structures in the *cloaca*.

Painted Turtles are most commonly observed while basking. If approached this exceptionally alert reptile will dive into the water. At night, Painted Turtles bury themselves into the pond bottom. Their average life span is around five to 10 years.

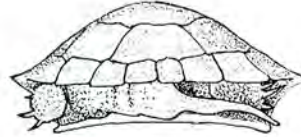
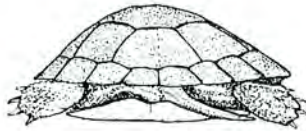
**Reproduction:** Female Painted Turtles are ready to reproduce at about 4 to 6 years of age; males at 2 to 5 years. They exhibit **sexual dimorphism**; the males are smaller than females and possess longer front claws, which are used to grab the carapace of the female during mating. In the spring, the female Painted Turtle scrapes out a flask-shaped hole in the ground and deposits 2 to 20 elliptical eggs. The young hatch in later summer or will hibernate in the nest and emerge the next spring.



Female



Male

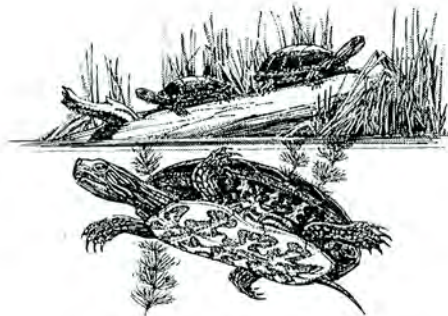


**Sexual dimorphism in the Western Painted Turtle**

**Distribution:** The Painted Turtle occurs in the badlands and prairies of southern Alberta, including the Milk River drainage, and the Manyberries and Cypress Hills regions. There have been sightings well outside their natural range, and are likely turtles collected and relocated from their native range or irresponsibly released pet store turtles.

**Limiting Factors:**

- Painted Turtle populations in Alberta are sensitive to *habitat* degradation and loss, pollution, road mortality and collection pressures as a result of the pet trade.



**Western Painted Turtle range**

## Monitoring Reptiles

Our best knowledge about the population health of reptiles comes almost entirely from repeated field observations by **herpetologists**, those who study amphibians and reptiles. This provides useful information on reptile status.

What do we gain by monitoring populations of reptiles? How will knowledge of population change in reptiles contribute to our ability to either understand or manage reptile populations or their *habitats*?

A monitoring program's primary functions are to warn of impending population problems, to direct conservation management and to generate hypotheses for research. Without a monitoring program, populations can collapse to the point that conservation and management options become limited, expensive and possibly ineffective, exactly the sort of situation which can lead to the listing of some species as endangered.

Reptiles, like other *wildlife*, are studied and evaluated to determine if populations are at risk. The categories used are:

- **Population Size/Abundance** – what is the current number of breeding individuals or breeding pairs in Alberta.
- **Population Trend** - Anticipated change in the breeding population over the next 10 years. This projection is based on current population trends if there are no other indicators. Population trend is the key indicator of the health of a species and is weighted more than any other category.
- **Geographic/Breeding Distribution Trend** – This is based on the abundance of a species within a major natural region (Rocky Mountain, Foothills, Parkland, Grassland, Boreal Forest and Canadian Shield). If distribution is patchy, it is termed *localized*; if it is widespread, it is termed *general*.
- **Habitat Integrity/Threats to Habitat** – The relative security of currently occupied *habitat* in Alberta over the next 10 years. This is a broad evaluation of all habitat risks, including loss and degradation because of human activities.

Monitoring populations is one way to check the health of habitat areas. Reptiles are vulnerable to changes in habitat quality, water quality and climate. Tracking changes in their geographic ranges may help us better understand changes happening in the environment.

### **Important Note to Schools:**

The Alberta Conservation Association has developed this teacher's guide to help Alberta students learn about and understand the needs of reptiles. It is not necessary to take a field trip in search of reptiles to accomplish a deep understanding of reptiles. The Reporting Form is enclosed should you happen to see any reptiles in your community or while on a field trip.

# Reptile Observation Form

Name of observer: \_\_\_\_\_

Address: \_\_\_\_\_  
Street Address / Box # / City / Postal Code

Phone Number: ( \_\_\_\_\_ ) \_\_\_\_\_ E-mail (optional): \_\_\_\_\_

OBSERVATION Date: \_\_\_\_\_ Time: \_\_\_\_\_  
dd - mmm - yyyy 24-hour format

Species Code	Status (✓ one)	Activity (✓ all that apply)	Count	Species Codes
	<input type="checkbox"/> Alive <input type="checkbox"/> Road kill <input type="checkbox"/> Predator kill <input type="checkbox"/> Dead (other)	<input type="checkbox"/> At / Near den <input type="checkbox"/> Basking <input type="checkbox"/> Breeding <input type="checkbox"/> Unspecified		<b>RSGS</b> - Red-sided Garter Snake <b>PGSN</b> - Plains Garter Snake <b>WGSN</b> - Wandering Garter Snake <b>GART</b> - Unknown Garter Snake Species <b>BULL</b> - Bullsnake <b>PRRA</b> - Prairie Rattlesnake <b>WEHS</b> - Western Hog-nosed Snake <b>MSHL</b> - Mountain Short-horned Lizard <b>PATU</b> - Painted Turtle
	<input type="checkbox"/> Alive <input type="checkbox"/> Road kill <input type="checkbox"/> Predator kill <input type="checkbox"/> Dead (other)	<input type="checkbox"/> At / Near den <input type="checkbox"/> Basking <input type="checkbox"/> Breeding <input type="checkbox"/> Unspecified		

## LOCATION - Alberta Township System (ATS)

Quarter: *NE NW SW SE* Section: \_\_\_\_\_ Township: \_\_\_\_\_

Range: \_\_\_\_\_ West of: *4 5 6* Meridian

Coordinate recorded with GPS unit (optional): \_\_\_\_\_  
(Easting / Northing / Zone 11 or 12 / NAD 27 or 83)

## DEN DESCRIPTION (if applicable)

- Crevice / Fissure  
  Roadside bank  
  Building foundation  
  Sinkhole  
  Gravel pit  
 Mammal hole(s)  
  Hillside  
  Bank along water  
  Other: \_\_\_\_\_



**Notes:**

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Notes for Recorders:

**Map Information**

National Topographic System (NTS) Maps are the standard topographic maps that cover the entire Canadian landscape. Scales include 1:50,000 and 1:250,000. Consult the yellow Pages to get topographic maps for your area. Medium scale mapping formats of 1:20,000 and 1:10,000 would be more useful for Alberta. Accurate UTM (Universal Transverse Mercator) coordinates (easting and northing) which are similar to latitude and longitude can be determined from a topographic map.

Global Positioning System (GPS) allows handheld units to use satellite signals to pinpoint locations on the earth's surface. When obtaining coordinates using GPS units, consult your manual and report full UTM, Zone (11 or 12), and Default (usually set to WGS84). Coordinates can be collected in NAD 83 (preferred) or NAD 27.

**Submit your observation to:**

Alberta Conservation Association/Alberta Fish and Wildlife Division  
7th Floor, O.S. Longman Building  
6909-116 Street  
Edmonton, AB T6H 4P2  
Fax: (780) 422-9685

*Note: Personal information collected on this Form will not be reveal to any third party and is exclusively for the purpose of verifying information on the Form, if need be.*



## Classroom Activities

### I. Attitudinal Study

#### **Background Information**

The fear of snakes and other reptiles is an old, deeply entrenched form of prejudice, born of ignorance and perpetuated through superstition and myth. It is time that we stop judging these fascinating animals on the basis of folklore and ignorance. One of the best ways to help students dispel misconceptions is to examine their own feelings about them.

#### **Activity Summary**

Students will examine their own beliefs about snakes and other reptiles. They will survey the beliefs and attitudes of people around them. All results will be compiled and recorded. Students will discuss ways to improve the image of “herps”.

#### **Materials Required**

- Attitude Survey
- Posters, coloured markers, rulers

#### **Procedure**

1. Have students talk about some of their attitudes towards reptiles. Attitudes are feelings. Feelings cause us to act and behave as we do. Feelings are behind the actions. Find something that they have a solid opinion about. Challenge them to think outside the box. What is behind the opinion? Information or feelings? Is it your opinion or someone else's? Are you afraid or unsure? Try to get them talking enough so you can show them how their feelings cause them to behave.
2. Talk about how some of their attitudes are formed. What are some influences? (Family, friends, media, rumors, culture.) Determine their misunderstandings about reptiles. Read some of the myths on pages 17-18. Do the students share any of their attitudes with the myths? What else can they add to the list?
3. Discuss their attitudes about reptiles. Determine if their attitudes are based on fact or fiction. Have them record their answers. (Do not tell them why, but have them refer back to their answers after you have finished this unit on reptiles. See if they have changed their attitudes. It may be their biggest revelation to discover that their attitudes about reptiles have changed somewhat or a lot. Maybe they will realize that reptiles really do need a public relations campaign!)
4. Direct them to develop some attitudinal questions about reptiles they can ask other students in the school or use the Attitude Survey already developed on page 57. Have them work in pairs, one to ask and the other to record. Have them determine how they will carry out their survey, record, and compile the data.

5. Compile all the data and have the class discuss how they can graph or visually record the survey data.
6. Discuss the survey results. What are the implications for reptiles? What can students do to help change the attitudes of others to assist in the protection of reptiles?
7. Do attitudes play a role in *wildlife* management? How can biologists implement the protection of habitat if there is no public support for it?

**Additional Activity Ideas:**

- Since there seems to be more misinformation about snakes than other reptiles, focus attitudes on snakes. Have students develop their own questions to determine the public perception of snakes.

# Attitude Survey

Circle the answer that best describes your feelings.

1 = somewhat agree    2 = agree    3 = disagree

- |   |   |   |   |
|---|---|---|---|
| 1. Snakes are vicious.  | 1 | 2 | 3 |
| 2. Snakes and lizards are slimy and gross.  | 1 | 2 | 3 |
| 3. I would rather help a panda bear than a snake.   | 1 | 2 | 3 |
| 4. It is high fashion to wear a snakeskin belt, snakeskin cowboy boots or an alligator purse. | 1 | 2 | 3 |
| 5. Most snakes are poisonous.   | 1 | 2 | 3 |
| 6. Turtles are cute.  | 1 | 2 | 3 |
| 7. It would be better if no lizards lived in Alberta.   | 1 | 2 | 3 |
| 8. Snakes are better dead than around me.   | 1 | 2 | 3 |
| 9. Whales are more important than lizards.  | 1 | 2 | 3 |
| 10. If I saw a snake in my backyard, I would kill it.   | 1 | 2 | 3 |

**When you ask people to participate in your survey, remember to tell them:**

- To be honest with how they feel.
- Remind them they will not be graded and their names will not be used.
- There are no right or wrong answers.



## II. Understanding Ectothermy

### Background Information

*Ectothermy* is a strategy that reptiles use to maintain their body temperature from external sources of heat. Cold weather is a limiting factor for reptiles because their physiology is linked directly to the environment. Reptiles are *poikilothermic* (their body temperature fluctuates and changes with their surroundings) and **ectothermic** (obtain their body heat from their surroundings.) These strategies have advantages and disadvantages.

#### Advantages

- Energy does not have to be devoted to producing body heat.
- Less energy means less food is needed to fuel their basal metabolic rate. A given area will be able to support more poikilothermic ectotherms.

#### Disadvantage

- Because they cannot produce their own heat, it severely limits the conditions under which they can stay active and where they occur geographically. (Some prey are poikilothermic and their activities are limited by climatic conditions.)

### Activity Summary

Students will graph two sets of data; one for a “*cold-blooded*” animal, the other for a warm-blooded animal. You will also discuss the strategies “cold-blooded” animals use to regulate their body temperature.

### Materials Required:

- Graph paper or
- Copy of data for graph A and Graph B, page 59, one per student

### Procedure:

1. Have students use the data on page 59 to make a graph. Discuss what the X and Y-axis will be labeled. Have students determine the labels for X and Y axis and calculate the intervals for each axis. Place both graph A data and graph B data will be on the same graph. Have students use different colours or lines to differentiate the data.
2. Discuss the strategies a “cold-blooded” animal must use to adjust its internal temperature. Review the following terms: *thigmothermy*, *heliothermy*.
3. “Cold-blooded” animals are called *ectotherms* (obtaining their body heat from external sources) and *poikilothermic* (having a fluctuant body temperature.) They cannot fully regulate their body temperature physiologically. They thermoregulate by behavioural means, moving into the sun, shade, or underground.

**thigmothermy** - they gain heat from the ground they rest upon

**heliothermy** - they gain heat directly from the sun’s rays

Reptiles can overheat. A temperature of 46°C may be fatal, while 40°C for some reptiles is comfortable. Some species will lower their body temperature by gaping their mouth, at the expense of water loss. Others raise their body off the ground and spread their

appendages to radiate heat. Behavioural thermoregulation ensures a reptiles body temperature remains within a tolerable range.

Colour change is another method to control temperature. Animals appear dark initially when exposed to the sun to increase heat absorption and become lighter to retard any further temperature rise.

### Data for Graphs

#### Graph A

Body Temperature	19°C	27°C	35°C	40°C	35°C	31°C	18.5°C
Time of Day	06:00	08:00	10:00	16:00	18:00	22:00	04:00

#### Graph B

Body Temperature	40°C	40°C	40°C	40°C	40°C	40°C	40°C
Time of Day	06:00	08:00	10:00	16:00	18:00	22:00	04:00

#### *Additional Activity Ideas:*

- On a piece of paper, have students draw a short-horned lizard resting on the ground. Include a bush, some rocks, some vegetation, and the sun. Or use the picture on page 61 and have students complete the worksheet. Use arrows and the following terms to show the ways in which a reptile interacts with its thermal environment: **conduction, thermal radiation, convection, direct solar radiation, thermal radiation from atmosphere, reflected light.** Answer on page 62, *Mountain Short-horned Lizard: The ways a lizard interacts with its thermal environment.* Provide assistance if students are not familiar with terms.
- Discuss infrared photography and its uses. How can it be used to study ectothermic and **endothermic** animals?
- Have students visit the web site for the Infrared Zoo: <http://sirtf.caltech.edu/Education/Zoo/zoo.html>. Assign students to write a paragraph about infrared photography and animal research.
- If you can find an infrared camera, bring it to class and demonstrate its use and the images it can produce. Compare a person who has had strenuous physical activity for 30 minutes and someone who has been sitting quietly.
- An experiment was found on the Internet that involves the measurement of fluctuations in body temperature of “cold-blooded” animals as measured by cholesteric liquid crystals. These crystals have a structure, which can be utilized to show change in temperature. Check out the experiment, *Body Temperature of “Cold-blooded” Animals and Liquid Crystals* at [http://olbers.kent.edu/alcomed/Sam\\_Net/August94/Brown.html](http://olbers.kent.edu/alcomed/Sam_Net/August94/Brown.html).

# Understanding Ectothermy

Name: \_\_\_\_\_

## Data for Graphs

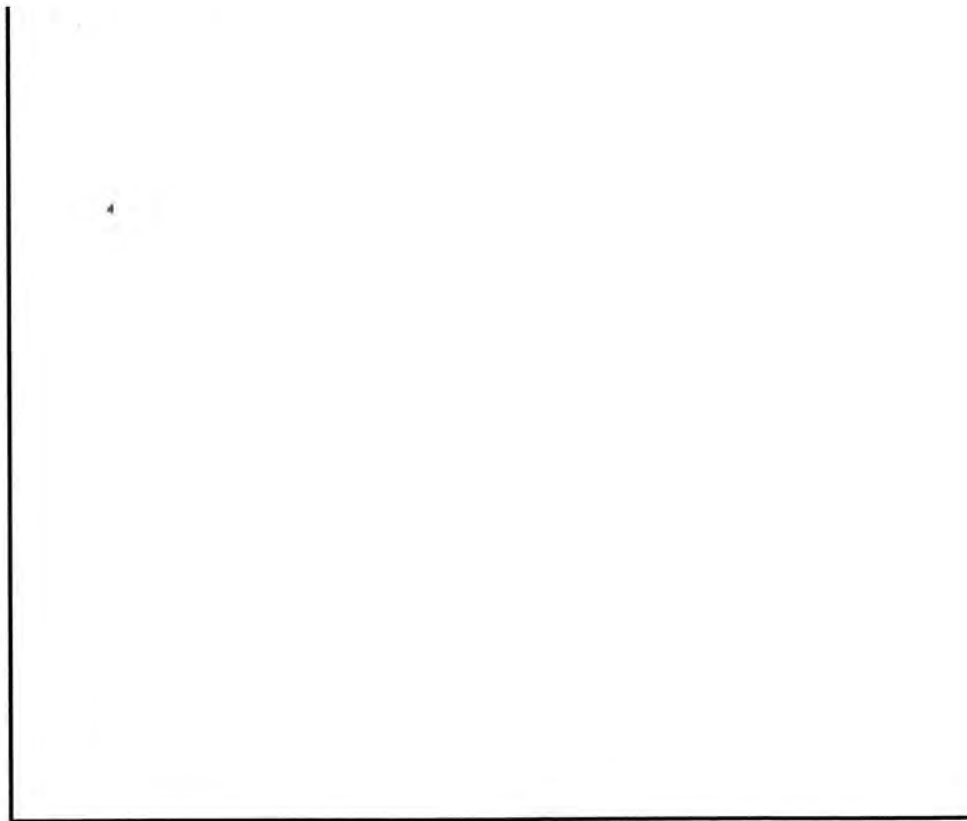
### Graph A Ecotherms

Body Temperature	19°C	27°C	35°C	40°C	35°C	31°C	18.5°C
Time of Day	06:00	08:00	10:00	16:00	18:00	22:00	04:00

### Graph B Endotherms

Body Temperature	40°C	40°C	40°C	40°C	40°C	40°C	40°C
Time of Day	06:00	08:00	10:00	16:00	18:00	22:00	04:00

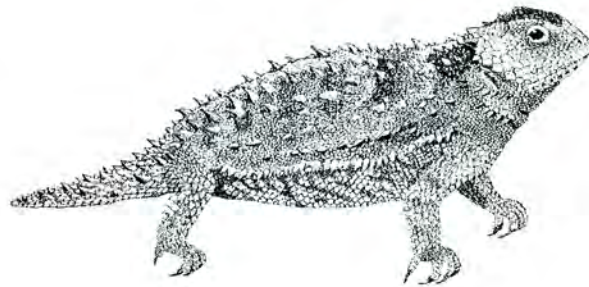
Make your graph below...



# Mountain Short-horned Lizard Name \_\_\_\_\_

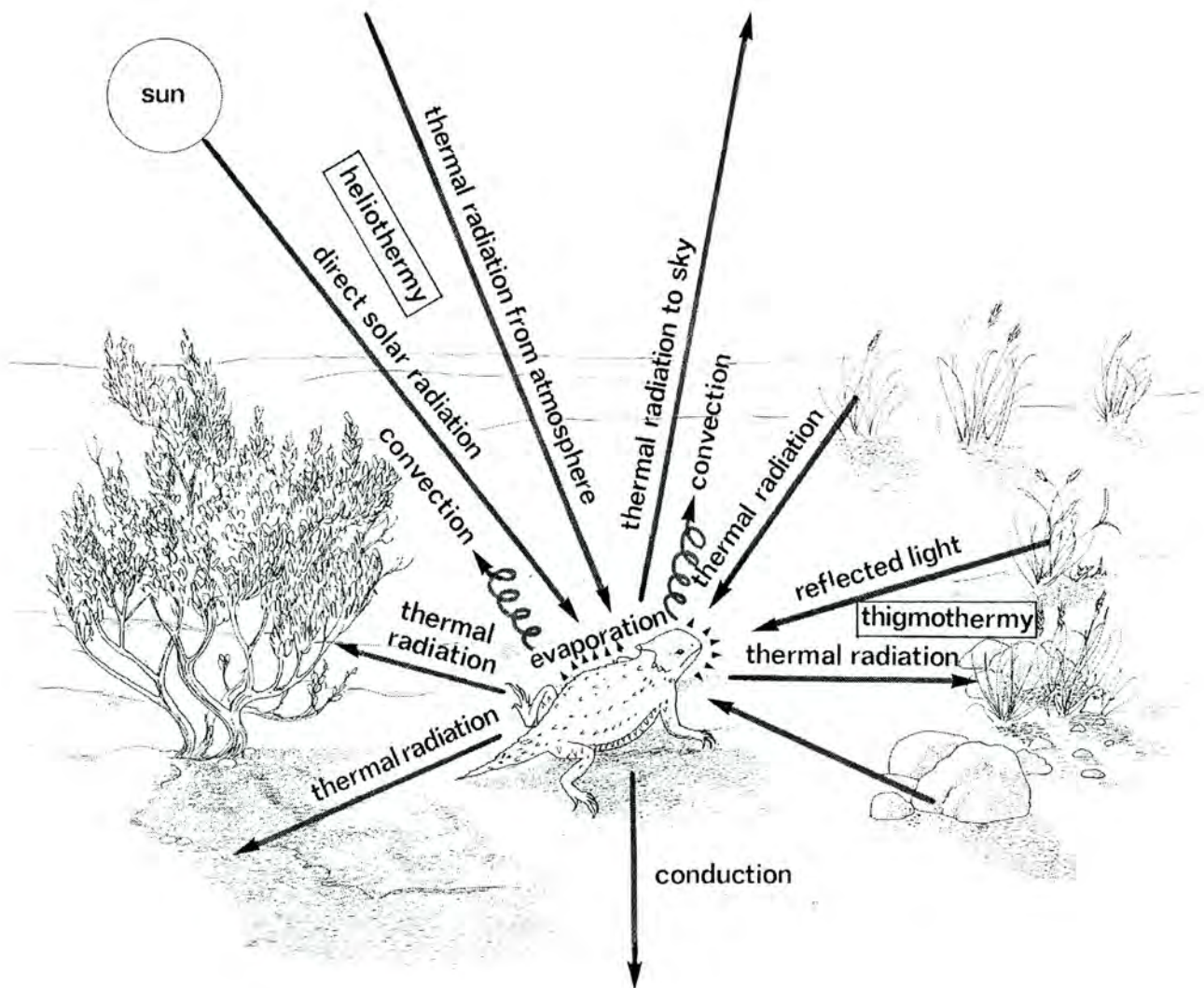
Finish the picture below. Draw arrows to show how this lizard interacts with its thermal environment.

Include the following terms: **conduction, thermal radiation, convection, direct solar radiation, thermal radiation from atmosphere, reflected light.**



# Mountain Short-horned Lizard - Answers

The ways a lizard interacts with its thermal environment.



From **The Amphibians and Reptiles of Alberta: A Field Guide and Primer of Boreal Herpetology** by Anthony P. Russell and Aaron M. Bauer.

### III. Seeing is Not Always Believing – The Optical Illusion of Snakes

#### **Background**

When animals are confronted with danger they behave in different ways. The short-horned lizard will freeze when exposed to danger and rely on its camouflage. Other animals attempt to flee or outrun the danger. Often when animals realize their camouflage has been detected, or freezing has not worked, they will flee at the very last moment. And as a last resort, some animals will fight to protect themselves.

Snakes have the overriding impulse to flee and it is only under severe duress that a snake will become overtly aggressive.

A number of snake species have colouration that makes it difficult for a predator to estimate the speed and direction in which the snake is going. The longitudinal stripes along the length of a garter snake's body produce the illusion that the snake has remain in the same place even though the snake has started to move away. This fools a predator into thinking it has more time than it actually has to capture the snake.

Transverse bands and saddles (rings around body) have an even more startling effect. When the snake is moving quickly, the markings create a flickering effect, which makes it difficult to estimate the speed of the snake. In addition, an optical illusion may be produced making it look like the snake is going in the opposite direction. By the time the brain of a would-be predator has processed the information, the snake may have made an escape. Snakes that move quickly have either longitudinal or bold transverse bands.

#### **Activity Summary**

In this activity, students will investigate the optical illusion snakes' colourations create when they flee.

#### **Materials Required:**

- copy page 65, *Seeing is Not Always Believing*
- coloured photographs of garter snakes, coral snake (from internet, library books)
- *Snakes of Alberta* poster (see Supporting Resources Section, page 100) optional

#### **Procedure:**

1. Discuss how bands of colour on snakes create a startling visual image that warns predators that may have an innate fear of that colour pattern. Bright bands on snake species also function to confuse predators encountering the snake. As the snake moves along through the grass, the bands seem to flicker and fuse together and make it difficult for a predator to determine the exact position of the snake. If you have ever tried to grab a garter snake, you may have noticed that you tend to reach for the snake near its tail. This is because the stripes make it appear longer than it really is.

2. Discuss the colourations of the Red-sided Garter Snake and the Plains Garter Snake; their long, *dorsal* stripes alternated with light and dark. Other snakes outside of Alberta have interesting coloured bands, like the coral snake, to confuse the predator. Colour bands also serve as warning that the snake is venomous.
3. Give each student a copy of the *Seeing is Not Always Believing* handout. Even when we are certain of the answers, our eyes still fool the brain to think otherwise. Snakes use the perceptual abilities (or disabilities) of predators to their advantage.

**Answers:**

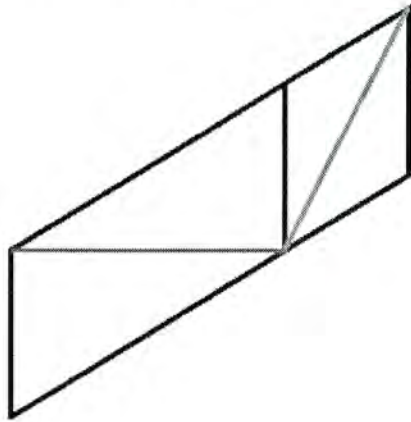
- A. The gray diagonal lines (from the centre vertical line) are the same length, although one appears to be much longer.
- B. The black and white image appears to spin.
- C. Which circle is bigger? They are both the same size (size is relative.)
- D. The long diagonal lines are parallel even though the smaller crosshatched lines make them appear unparallel.
- E. The two horizontal lines are of equal length. The tips of the arrow give the opposite illusion.
- F. The two long vertical lines are parallel and straight. The lines converging into the centre trick the eyes.

**Additional Activity Ideas**

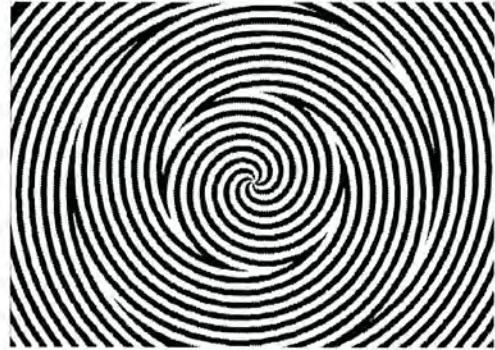
- Have students colour strips of paper (from adding machines, make thinner by cutting in half vertically) to resemble snakes. Have them move the paper strips along the floor or through grass to see the effects on the eyes and brain.

## Seeing is Not Always Believing: The Optic Illusion of Lines

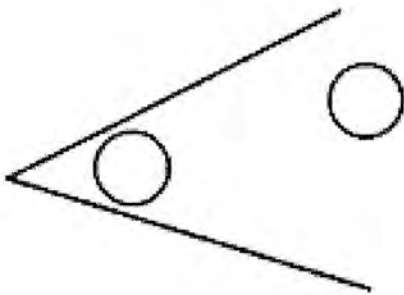
Fool-the-eye tricks or optical illusions have amused and puzzled people for many years. Can you figure out the optical illusion for each one below?



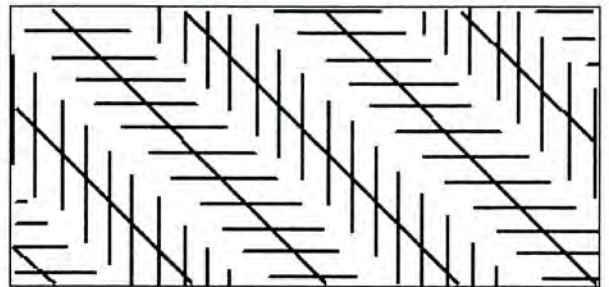
A



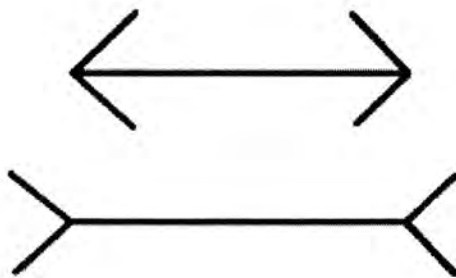
B



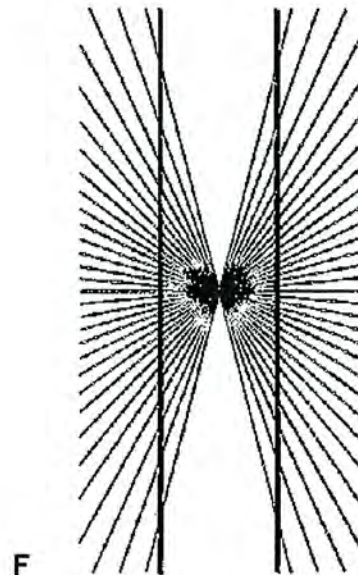
C



D



E



F



## IV. Home, Home on the Range Maps

### Background Information

Some snakes lay eggs while others give birth to live young. The geographic distribution of live-bearers gives us a clue. Live-bearers are mostly found in cooler climates than egg-laying snakes. Soils in the cooler climates are too cold for successful incubation, whereas eggs still inside the female can be kept warmer because she can bask in the sun and select warmer shelters. Live-bearing females spend more time basking thus accelerating the development of eggs so that birth can occur while temperatures are good for activity and the snakelets can find safety for the winter.

Why then, are not all snakes' live-bearers? The volume of the litter physically slows down females and they usually do not feed. Egg-layers do not suffer these costs and may be less vulnerable to predators, begin to feed again sooner, and maybe even lay another clutch of eggs.

The three species of garter snakes and Prairie Rattlesnake are live-bearers. The Western Hog-nosed Snake and Bullsnake both lay eggs and the young hatch in about 50 to 60 days. In some snake species, the female will coil around the eggs and protect them until they hatch. However, the vast majority of snakes lay their eggs and leave. Young snakes are completely independent and never receive any parental care. Note: Turtles lay eggs underground; the short-horned lizard gives birth to live young.

### Activity Summary

Students will map the ranges of the eight reptile species in Alberta.

### Materials Required:

- *Reptile Range Maps*, pages 68 and 69, one copy of each per student
- *Alberta's Six Natural Regions*, page 70, one per student
- *Ranges of Alberta's Reptiles*, page 71, one per student

### Procedure:

There are three mapping activities within this whole activity: A. Mapping each reptile's range, B. Mapping the six natural regions, and C. Placing the reptiles' ranges on the natural regions map.

#### A. Reptile Range Maps

1. The dots seen on these maps represent known species populations.
2. Have students connect the outside dots of each reptile species. Tell them that if one site is obviously a "wildcard" (which may be due to an introduction, i.e., pet release into the wild and a population begins), do not include that site in the range.
3. Make the line smooth by rounding the lines connecting the dots. Lightly colour in the range. Compare these to the range maps on the individual species page(s).

## **B. Alberta Six Natural Regions**

1. Have students outline in dark ink the watermark map of Alberta on page 70. Trace the boundaries for each natural area. Choose a different colour for each natural region. Answers on page 2, Alberta's Six Natural Regions. Or to view a current map depicting the Natural Regions and Sub regions of Alberta, visit the Alberta Natural Heritage Information Centre (ANHIC) website:  
[http://www.cd.gov.ab.ca/preserving/parks/anhic/natural\\_regions\\_map.asp](http://www.cd.gov.ab.ca/preserving/parks/anhic/natural_regions_map.asp)
2. For homework or as research, have students write three to four sentences that describe each natural region.

## **C. Ranges of Albert's Reptiles**

1. Have students plot the ranges of the six snakes and two reptiles (optional) on the watermark map of Alberta.
2. Discuss the implications of *habitat* overlap. What are some advantages and disadvantages? Refer to **Background Information** for *Understanding Ectothermy*, page 58.
3. They may discover through mapping the species' ranges that live-bearing snakes have a range further north than egg-laying snakes. Discuss why this would be so.
4. Compare species information to the natural regions.

### **Additional Activity Ideas:**

This activity is a good predecessor for the Poster Session activity, page 72.

### **A Note on Range Maps:**

Range maps were generated from information held on the Biodiversity Species Observation Database (BSOD) queried in June 2002. Maintained by Alberta Fish and Wildlife Division; BSOD stores observational data primarily on species at risk or of undetermined status in Alberta. Dots on the maps represent known populations of reptiles.

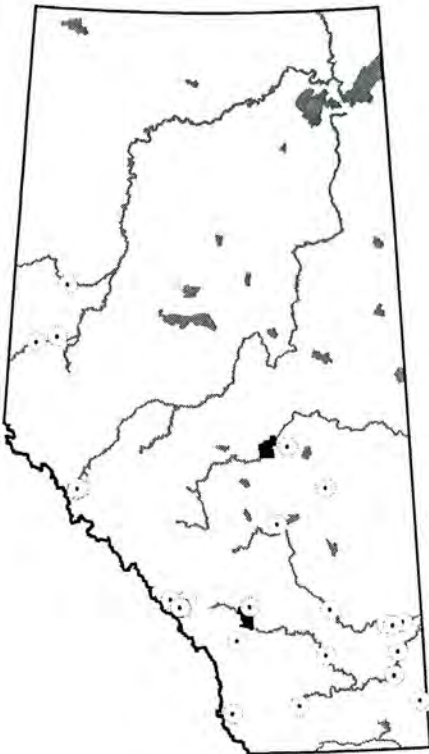
# Reptile Range Maps



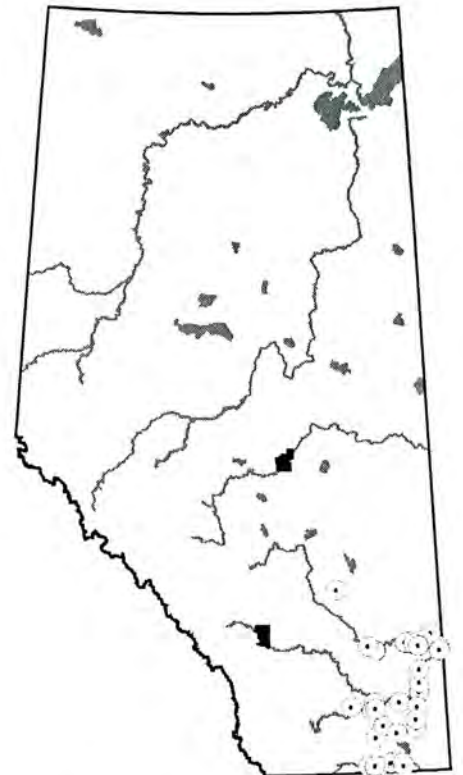
**Red-sided Garter Snake**



**Plains Garter Snake**



**Wandering Garter Snake**



**Bullsnake**

# Reptile Range Maps



**Western Hog-nosed Snake**



**Prairie Rattlesnake**



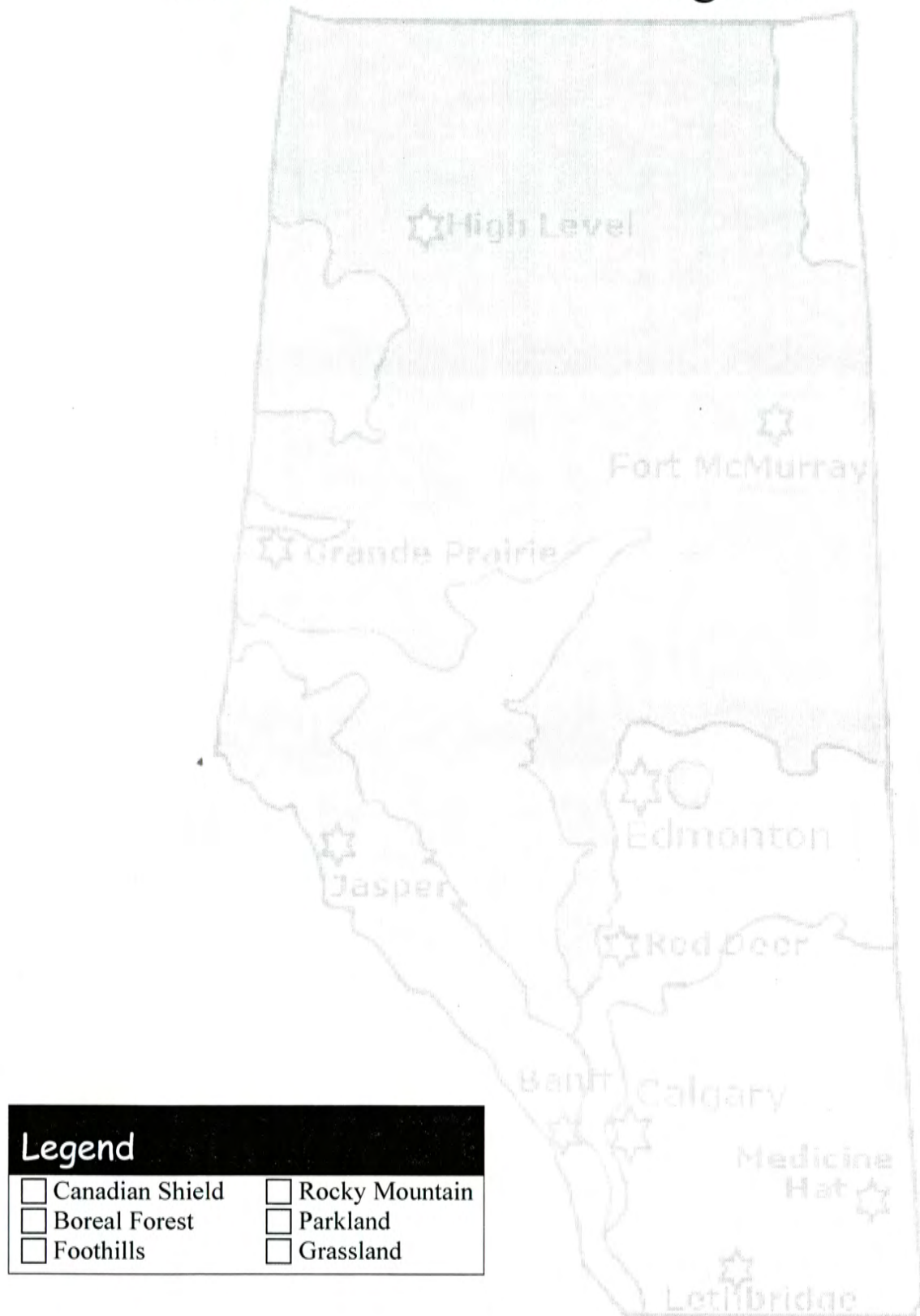
**Mountain Short-horned Lizard**



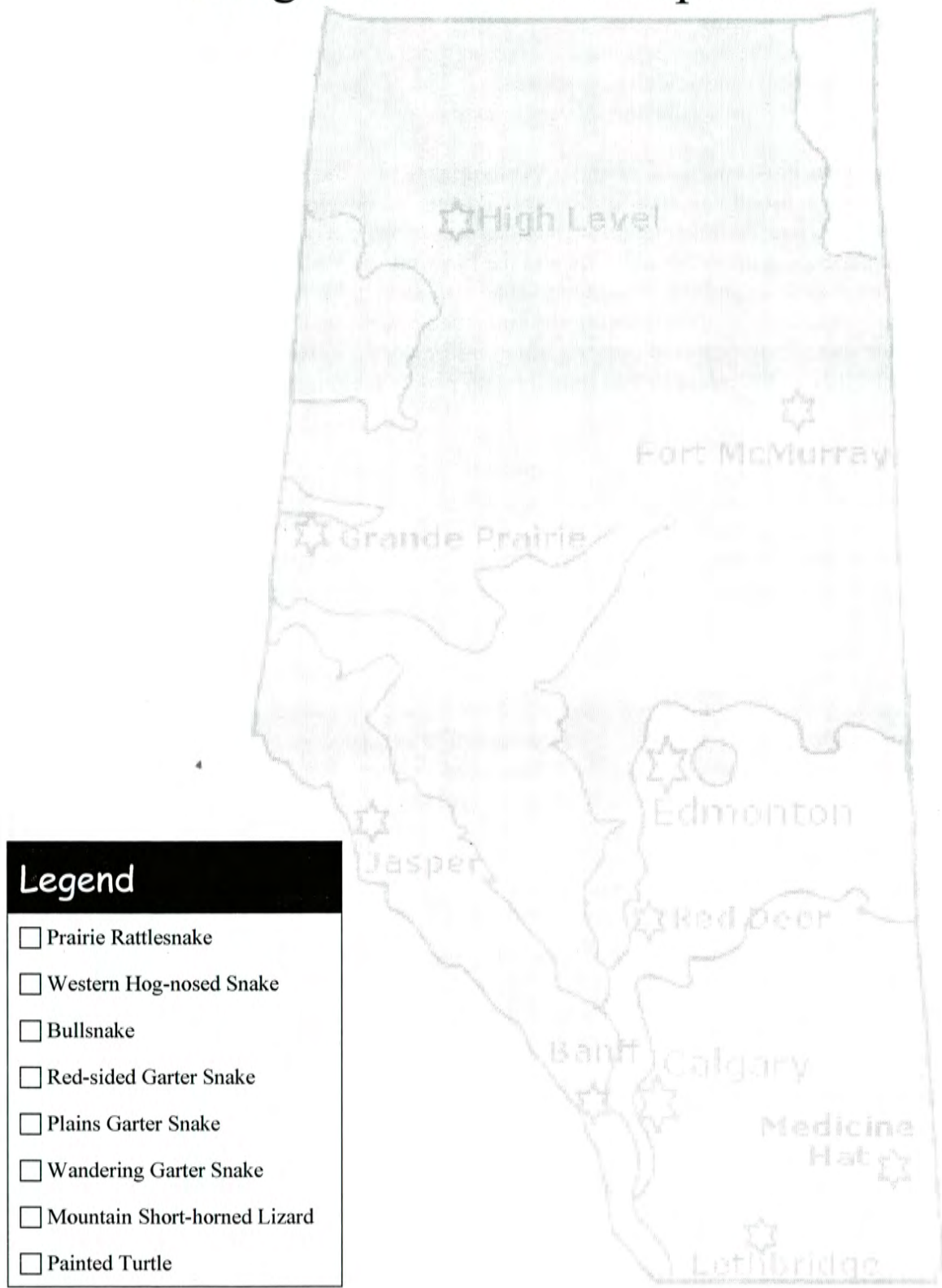
**Painted Turtle**



# Alberta's Six Natural Regions



# Ranges of Alberta's Reptiles



## V. Poster Session for Reptiles

### **Background Information**

The poster has become one of the most important types of scientific communication at professional meetings and scientific conferences. The power of the poster is that a biologist can discuss their data and interpretations directly with a person or a small group.

When biologists have conferences and opportunities to talk and share information and research, there is usually an area for **posters**. Posters are developed by biologists to communicate scientific information with colleagues or the public. They can be quite scientific depending upon the audience and the function. A poster session at a conference may last over an hour and the posters are usually on display for a day or two. Presenters stand or sit next to their posters during the entire session, while those attending will move around the room from poster to poster gaining information. Posters do not stand-alone. The availability of the researcher to interact with people is as important as the information.

Most posters are big: 1.2 m (120 cm) wide and 0.9 m (90 cm) tall. They have plenty of pictures to capture the audience's attention and large type size for easy readability. If the poster is about a *wildlife* monitoring program or research project, the project design, experiments, methods, and results are discussed. Posters have all the contact information of the people and organizations involved in the project. Less scientific posters are useful for public displays, for example, Parks Day or a community event.

### **Activity Summary**

The class will break up into small groups and each group will develop a poster for different reptile species. In class: Each group will make a presentation of their poster to the rest of the class. Out of class: Have your class present a Poster Session to the rest of the school or to a local grade three class learning about life cycles.

### **Materials Required:**

- Make an overhead of poster samples, pages 75 and 76.
- One poster, **Snakes of Alberta**. (See Supporting Resources, page 100, to obtain a copy.) Cut apart images if you would like each group to have a coloured photograph of the species they are working on; or better yet find alternate photographs from magazines or colour printed from the Internet.
- Poster/bristol board sheet, one per group or large portions of bulletin board paper.

### **Procedure:**

1. Introduce the concept of research/informative posters developed by biologists. Why would a biologist want to share research or information about a project?
2. Show an overhead transparency of the *Lethbridge Rattlesnake Conservation Program: An urban conservation initiative to maintain a key species in the mixed grass prairie ecosystem*. Discuss and evaluate the poster. What is your first

impression? Easy to assimilate the information? Readable? Determine the target audience. Does it answer more questions than it asks? Is it useful? Effective?

3. Break class into eight small working groups. Randomly assign a reptile species to each group. Provide a copy of the appropriate pages from this guide, for each group. For the Rattlesnake, provide a copy of the general information on snakes (pages 22-32) and the Rattlesnake pages (34-35); for the Bullsnake, copy pages 22-32 too and the Bullsnake pages (38-39) and so on. Same for Lizards and Turtles. The background information will be good start for the groups.
4. You may choose to have the groups use a regular sized bristol board or a large piece of bulletin board paper cut from a roll.
5. Provide the class with the information required for the poster. Refer below to **Poster Specifications**.

### **Poster Specifications**

- Reptile species (common name, Latin name)
- Description (include markings, special features)
- **Biotic** and **abiotic** components of **ecosystem**
- Draw a food web with species included
- Describe life history, habitat, and range in Alberta
- Identify purpose of poster and causes for concerns
- Reptile's status and implications
- **Limiting Factors**
- Management Issues, Human Impacts
- Conclusions/What we can do
- Use Visuals (maps, pictures, drawings)

### Areas to Evaluate

**Readability** – this is a measure of how easily the ideas flow from one item to the next. Write clear sentences and avoid spelling errors, grammar mistakes.

**Legibility** – A common mistake in poster presentations is the use of type that is too small. Posters are usually read from two metres away. A type size of 104 is appropriate. Students can do their own custom hand lettering.

**Organization** – Spatial organization is important so the reader is able to follow from one idea to the next.

**Succinct** – Studies show that it takes 11 seconds to grab and keep your audience's attention so make the words count. Have a clear message and be visually appealing.



People approach new information in a known spatial sequence. We track vertically from the centre to the top to bottom, and horizontally from left to right. This means that the most important message is in the centre top position followed by the top left, top right, bottom left and finish in the bottom right corner.

6. Evaluate individuals and their participation in the poster as well as the group presentation of the poster. If you wish to evaluate the students on this Reptile unit, have students take notes on the presentations. Tell them you will test them on a species, other than the one their group research and presented. Have students choose another reptile species. The more they know, the better the mark. The more they know about reptiles, the better for reptiles. Education encourages responsibility.

**Additional Activity Ideas:**

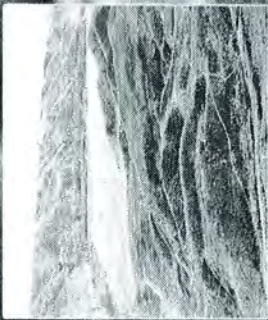
- Use the posters for any Reptile Awareness events you plan in the school or community.
- Place the posters in the library or along the halls for others students to observe.
- Visit the following website to see some posters done about leafy spurge. You can download in either JPG or PPT format and show to students as poster examples:  
[www.team.ars.usda.gov/cdgallery/posters.html](http://www.team.ars.usda.gov/cdgallery/posters.html)

# Lethbridge Rattlesnake Conservation Program

An urban conservation initiative to maintain a key species in the mixed grass prairie ecosystem

## Partners and Cooperators

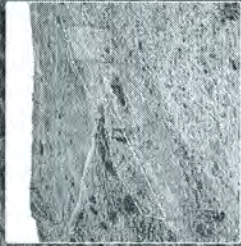
Alberta Conservation Association  
 Alberta Fish and Wildlife Division  
 City of Lethbridge  
 Lethbridge Naturalists Society  
 Runners Soul  
 Helen Schuler Coulee Centre  
 Paradise Canyon Land Corporation  
 Dr. Rod McFarlane (DVM)  
 Lethbridge Residents  
 Project Biologist: Reg Ernst



Prairie rattlesnake habitat in Lethbridge

## What Challenges Do We Face?

The rattlesnake population is small. The habitat is at the western extent of the species range. Some people have negative attitudes towards rattlesnakes. Habitat is being lost to urban development.



## What Have We Achieved?

High public support for the project  
 Improved problem rattlesnake response  
 In 2001-2002 successfully over-wintered 17 adult and 10 juvenile rattlesnake in the new hibernaculum

## What Are We Doing?

Public education- brochures, signs, interpretive talks, media liaison with residents  
 Construction of a new hibernaculum in a protected City nature reserve  
 Relocating problem rattlesnakes from residential and recreational areas to the nature reserve  
 PIT-tagging all snakes handled  
 Radio-tagging snakes to learn movements



## Goal

To maintain a population of prairie rattlesnakes in Lethbridge, Alberta

## Objectives

- To provide secure rattlesnake habitat for all life stages within, and adjacent to, the City of Lethbridge
- To evaluate the success of a newly-created hibernaculum
- To understand the movements, numbers, and population dynamics of rattlesnakes in the City of Lethbridge

## What Is Still To Do?

- Monitoring of 2002-2003 over-wintering success
- A more thorough radio-telemetry project to determine movement patterns and habitat use
- Monitoring of rattlesnakes returning to the new hibernaculum in Fall 2003
- Continued public education
- Continued improved responses to problem occurrences



Background photo courtesy Lynne Finlay



*(Insert Title Here)*

### Identification

- Length (total, snout-vent-length), weight, variations etc.
- Coloration, markings and other key diagnostic features.
- Similar species or species that it could be confused with.

### Status

- National Status - Committee on the Status of Endangered Wildlife in Canada (*COSEWIC*) - see web page.
- Alberta Status - Alberta's *Wildlife Act* - see web page.
- Note declines, inventories, surveys, and changes in distribution.

### Biology

- Distribution (North America, Canada, Alberta).
- General habitat description, microhabitat description.
- Critical habitat requirements for all age classes.
- Reproductive biology (mating season, egg or live-bearing, breeding habitat, etc.).
- Diet.
- Longevity (life span).



Place contact information and funding or partner logos here:

### Limiting Factors

- Habitat loss, alteration, degradation.
- Introduced invasive/exotic species (predators and competitors).
- Road kills
- Environmental pollution/chemicals - metals, pesticides, herbicides, industrial waste.
- Disease and parasitism.
- Human exploitation.
- Global climate change.
- Public persecution and misunderstanding.

### Management

- Monitoring, inventories, surveys, census.
- Habitat protection, enhancement and creation.
- Habitat inventory.
- Reintroductions, productivity enhancement.
- Education and awareness initiatives.
- Identified data deficiencies i.e., required research.
- Intensive field research projects.
- How to address limiting factors.

## Notes from Reptile Poster Session

Common Name	
Scientific Name	
Physical Description	
Status	
Habitat	
Range	
Natural History	
Limiting Factors	
Other	

## VI. Case Studies

### Background Information

Case studies are an excellent way for a group of students to discuss ideas. Students will be challenged to work through ideas, develop a plan for a solution, clarify their thoughts, express opinions, and accept the opinions of others.

### Activity Summary

Groups of students will discuss two different case studies about snakes. They will develop a plan to resolve the problem and present their solutions to the class.

### Materials Required:

- Case Study # 1 – Problems at the Park, page 80.
- Case # 2 – Lawn Problem, page 81.
- Accompanying information for both cases, bottom of this page and page 79.

### Procedure:

1. Divide the class into groups. Give each group one of the two case studies provided on pages 80 and 81. **Note:** The two case studies in this teacher's guide are based on some facts. Changes have been made to actual events to make the cases simpler and more interesting for the students and to protect the locations of the *hibernacula*.
2. Give the group time to read and begin discussion of the problems. Have them draw pictures to facilitate their understanding of the case. A drawing of the site in their case study will put all the students on the same wavelength.
3. As discussion progresses, provide information when necessary. When they are ready for information on monitoring, trapping and identifying snakes, provide copies of pages 82-85.
4. Use the notes listed for each case study to help students develop a sound plan and solution for each case.

### Notes for Case # 1 – Problems in the Park

- Soil erosion is causing the entrance to the *hibernaculum* and tunnels to collapse.
- Soil erosion is causing some concerns for visitor safety.
- Prevent escalation. Have students think about zoning off the hill, restricting access so restoration can occur.
- Develop a reclamation plan to repair damage and reduce the effects of the informal path.
- Monitor the snake population, condition of the fencing and signs. Use scale clipping and PIT tags (see pages 84-85) to monitor population.
- Increase public awareness of the impact of human use on the environment.
- Enlist public support with signage (stay on designated park paths, touch plants gently, keep pets on leash, quietly observe *wildlife*, and place litter in garbage cans.)

## Notes for Case # 2 – Lawn Problem

- If necessary, remind the students that snakes go to the same *hibernacula* year after year. As in Case # 1, this is a critical understanding. It was found that not all the snakes could be trapped at once. Three visits for trapping and translocation were done. The problem snakes were moved to a gravel pit into another *hibernaculum* about 9.5 km away.
- Visit the website for your own copy of the report entitled, *Red-sided Garter Snake (Thamnophis sirtalis parietalis) Relocation and Education Project Final report, Alberta Species at Risk Report No. 30.* at: [www3.gov.ab.ca/srd/fw/riskspecies/pdf/SAR\\_30./pdf](http://www3.gov.ab.ca/srd/fw/riskspecies/pdf/SAR_30./pdf)
- Non-license species like the Red-sided Grater Snake are not afforded protection under Alberta's *Wildlife Act*. Hibernacula are protected from disturbance and destruction from September 1 to April 30, under Alberta's *Wildlife Act*.
- Objectives for the project included: 1 - relocate Red-sided Garter Snakes to another occupied den, 2 - intensively monitor the den with both relocated and other snakes over a number of years to track population, age, and growth rates, and 3 - to inform the public about the importance of snakes in the environment.
- Drift fencing (made of poly-plastic) and funnel traps were used to live-capture the snakes at the lawn site. All snakes were scale-clipped, measured, weighed and all large snakes were PIT tagged each fall (1998 and 1999) when returning to overwinter. See table below. You will notice that during spring 2000, no snakes were captured at the lawn site indicating that all snakes using the den as a hibernaculum were relocated.

**Note:** See pages 83-85 for explanations of scale clipping and PIT tags.

<b>Date</b>	<b># Relocated and Scale-clipped</b>	<b># Relocated Snakes PIT Tagged</b>	<b># PIT Tagged from New Den</b>
Fall 1998	282	50	0
Spring 1999	341	80	40
Fall 1999	567	75	5
Spring 2000	0	0	55
<b>Total</b>	<b>1,190</b>	<b>205</b>	<b>100</b>

- The gravel pit den site was fenced and snakes were caught and counted upon dispersal, and direction of their dispersal was noted. One hundred snakes were PIT tagged to determine return rate of these resident snakes.
- Snakes from both sites were mixed to determine if mixing snakes would increase return rate to new den.
- Many techniques were used to inform the public and other researchers about snakes, their management, and their importance in the environment. These included talks, posters, reports, media releases and the production of an education poster. There were also field trips to the gravel pit site.

## Case Study # 1 - Problems at the Park

In a large, beautiful urban park a *hibernaculum* is badly situated. The park is completely surrounded by city communities. The problem is that the hibernaculum was not discovered until recently. The hibernaculum is situated beside a popular picnic area. The picnic area is full every Saturday and Sunday during the summer and fall. Families come down to picnic, walk the trails, and play games. The hibernaculum is also situated beside an outdoor education centre where school groups come daily during the school year to learn about nature in the outdoors. The hibernaculum is on the south side of a hill, which is next to the education centre.

The hill is just over two stories high. Park visitors and school kids can get to the top of the hill by a set of stone steps tastefully set into the hill which takes a gentle curve through the trees at the north end. The top of the hill provides a lovely vista of the parkland and creek. It is grassy on top and can easily handle large groups of people.

Over the years, children have slid down the south side of the hill creating a path worn down to the dirt. Children enjoyed the almost vertical slide on their bottoms down the hill. And visitors have worked hard to go up the hill on the same crude path because they were not aware of the stone staircase on the north side of the hill. Years of uncontrolled trampling have widened the crude dirt path on the south side and have caused erosion, serious soil compaction, and damage to vegetation. The hibernaculum is located right beside this dirt path.

Develop a plan<sup>4</sup> for the park to protect the hibernaculum. Keep in mind that it is a public park, and cannot be watched and policed all the time. Develop a plan for some options and consider including pictures of any plans you have thought of. Include a monitoring program and how you will measure the success of this project.

## Case Study # 2 - Lawn Problem

The Jones family live on acreage outside of town. They bought the acreage from another family that had transferred to Ontario. They moved into the house during the wintertime. They loved the peace and quite of the countryside and the children had lots of room to play outside. Before their first spring came, the family bought a ride-on mower to cut the grass in the front and back of the house. The Jones family loved the location even more as spring turned into summer. Mrs. Jones enjoyed her new gardens, and Mr. Jones would spend at least three hours on his lawn mower grooming the lawns. The kids built forts, and played ball. It was a match made in heaven for the Jones family.

During the fall of their first year, the kids came in with a box full of snakes. It was more than the usual one or two that a parent would expect a child to find. But the kids were excited and they identified them all as one species, the Red-sided Garter Snake.

It was during their second spring that Mr. Jones noticed the same garter snakes throughout the lawn. He noticed large numbers of them moving toward an opening in the lawn. He called Fish and Wildlife and they discovered that he had a *hibernaculum* under his front lawn. Hundreds of snakes were migrating down into the hole for the winter. He was assured that was the end of the snakes for a while. He did not realize that the same number of snakes would appear again in the spring when they dispersed from the hibernaculum.

The family discussed the idea of having a hibernaculum on their property. In the end, Mrs. Jones wanted them all to be gone because she feared them. Mr. Jones found that each time he mowed the lawn during the fall and spring he would accidentally kill about 50 snakes. He was not prepared to stop cutting the lawn and at the same time he did not want to deal with the dead snakes. He approached Fish and Wildlife again for help.

Fish and Wildlife suggested that the snakes be relocated to another den site. They would find another location and physically move them from the acreage. Fish and Wildlife thought that if the snakes were not moved, the snake hibernacula, along with the snakes, might be destroyed.

Develop a relocation plan. Include in the plan where the snakes will go, how you will collect the snakes, move the snakes, record the snakes, and how you will monitor the project's success. Keep in mind the life history of snakes and the impact this relocation will have on the community; an educational component must be included in your plan.



## Background Information for Surveying Reptiles

Our best knowledge about the population health of reptiles comes almost entirely from repeated field observations of biologists. Knowledge of populations contributes to the ability of *wildlife* managers to understand and/or manage the reptiles and their *habitats*. To clarify a population's status and potential threats, more detailed information on the biology of each species, average life span, survivorship, fecundity, movements, habitat selection, and genetic relatedness of populations are necessary. As with all of Alberta's reptiles, more baseline data and on going monitoring programs are essential.

There are two reasons for sampling a wildlife population; to do an inventory or to monitor a population.

An **inventory** is done to produce a list of all the species present in a given location, with or without their abundance. A wide variety of sampling techniques is used to find all species, for example, annual bird counts.

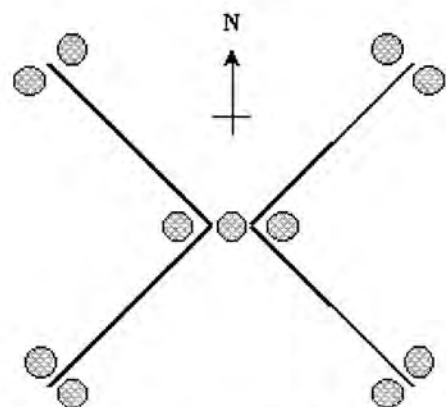
**Monitoring** begins with choosing a species to survey. A monitoring survey reports accurate data on the relative abundance of a sampled population. A monitoring program's primary purpose is to warn of impending population problems, to direct conservation management and activities, and to generate hypotheses for research. Without a monitoring program, a population can collapse to a point where no amount of conservation activities would help.

## Techniques Used to Capture Reptiles

### Trapping and Drift Fencing

Trapping, in conjunction with a drift fence is a technique used by scientists to sample populations of lizards, snakes, turtles, salamanders, and other small animals. A fence is strategically place to intercept animals. When an animal comes across the fence, its way is blocked, so it moves right or left along the fence and eventually falls into a small bucket called a **pit fall trap**, buried into the ground alongside the fence. The size (depth) of the pit fall trap is determined by the size of the species' being studied. Animals are not harmed when they fall into pit fall traps.

The fences are made with hard plastic, sheets of plastic or other material. The height of the fence also depends on the species' being studied and may range in height between 45 and 60 cm. The bottom of the fence is buried into the ground about 10 cm to prevent animals from crawling underneath. Wooden stakes are attached to one or both sides of the fence every three to six metres to keep it upright. The length of a fence



Design for arrays of **drift fences**. **Pit fall traps** are shaded in grey

can vary to suit the needs of a project and can range from a few meters to a few kilometers.

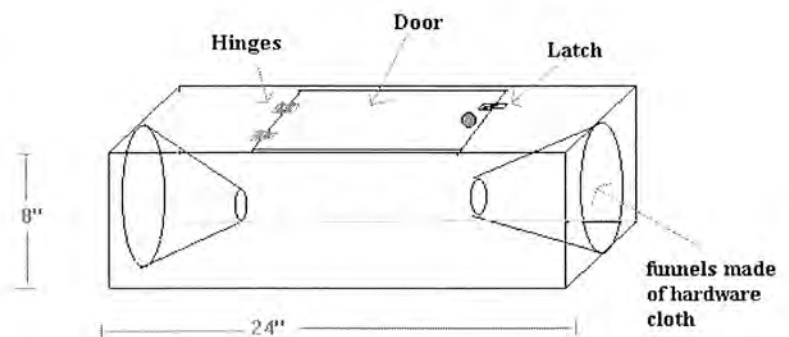
Each trap along the drift fence is numbered and checked two to three times a day to ensure the health and comfort of the captured animals. Information is recorded on data sheets such as date, location of capture (fence and trap number), species, length, weight, and unusual markings. Lizards, turtles, and non-venomous snakes may be marked for identification. See *Marking Reptiles* below.

The drift fence can be used to conduct a capture, mark and release and recapture study. The animals are captured, marked to allow for individual identification, and released. Recapturing a marked animal can provide information such as the animal's range, movement patterns, and growth between captures.

The fence is a barrier to the animals' movements and is constructed to increase the effectiveness of certain traps such as the pitfall or funnel trap set along the fence.

### Funnel Trap

Funnel traps are made with hardware cloth (grid wire in sheets) and are placed along the fence. Funnel traps can be used in conjunction with **pit fall traps**, or alone. Funnel traps can be especially effective in capturing snakes. Rolling the wire into a cone open at one end creates a funnel. A cone is placed at both ends of a box, pointing to the interior. Boxes can be made from wood or hardware cloth. With the funnel trap next to the fence, the animal moves through the large end of the funnel into the box. Care must be taken to ensure that no sharp wire edges are created from the construction of the wire funnels that may injure the animals being studied.



Funnel trap design made with 1/4" plywood.

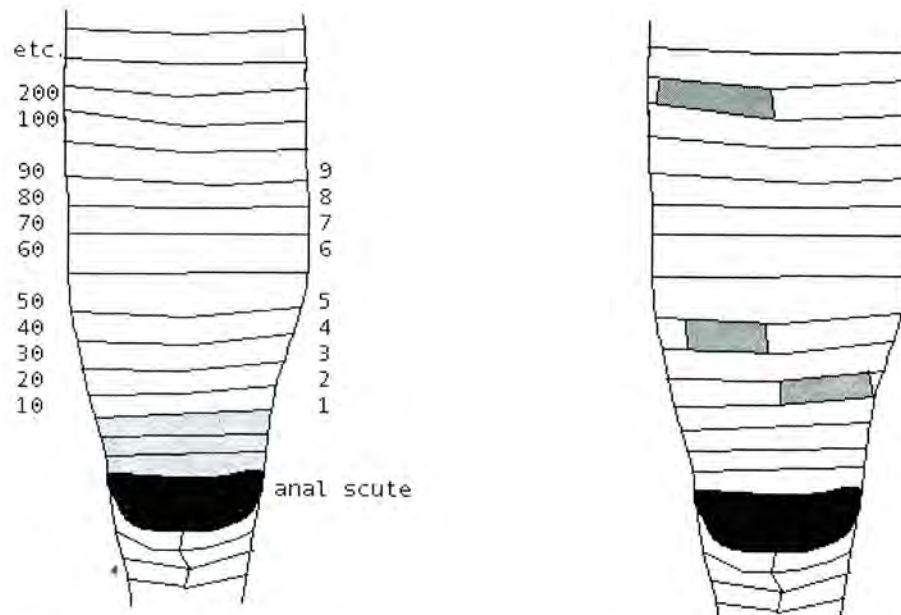
### Techniques Used to Mark Reptiles

Techniques used for identifying individual reptile species include: use of *natural markings* (i.e., recording colour patterns and unique markings); various forms of *external marking* methods (painting, tattooing, branding, toe clipping); affixing various *bands or tags*; and *internal marking* techniques such as radioactive markers and PIT tags (see pages 84 and 85). The most common methods used in Alberta are discussed below.

## Scale Clipping:

**Turtles** – Turtles have either 22 or 24 plates called marginal *scutes* around the top of the shell, the carapace. Scutes are be notched with a file or fingernail clippers without injuring the turtle.

**Snakes and Lizards** – Scales are clipped and occasionally cauterized with a small soldering iron. Clipped scales either do not grow back or grow back a different colour. Researchers identify the snakes by counting scales on a snake's belly from its anal opening and clipping the scale edges at a different numbered location on each snake. This does not injure the snake.



**Ventral** scale-clip numbering method: left diagram illustrates the numbering system; right diagram shows a sample clip, #242.

From: Takats, L. 2002. Red-sided Garter Snake (*Thamnophis sirtalis parietalis*) Relocation and Education Project - Final report. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 30, Edmonton, AB. 19 pp.

## PIT Tags

PIT tags are one of the biggest breakthroughs in *wildlife* identification. PIT stands for Passive Integrated Transponder. The tag is about the size of a grain of wild rice and consists of a small transponder encased in glass, which is inserted under the skin. Each tag has its own 10-place alphanumeric code, which is activated by an electromagnetic wand. It does cause minimal discomfort to the animal when injected.

PIT tags make it easier for researchers to study individual growth, survival, and movement patterns of reptiles. The tags are more accurate than counting clipped scales

when more errors can be made. The PIT tags are durable and ideally suited for long-term monitoring programs. They have been used for monitoring a variety of species.

PIT tagging is an expensive method of identification and requires a moderate level of skill to administer the tag.

## Radio Telemetry

Small *radio transmitters* can be attached to animals, internally or externally, to follow their movements. The radio signal can be picked up with a hand-held antenna from a considerable distance (up to 1 km) but can be limited by the rough topography, the length of the antenna, and the limited signal strength due to battery size. It is possible to use temperature-sensing transmitters to investigate thermal patterns of *gravid* reptiles.

### Internal Radios

A tiny radio transmitter, smaller than a thimble, can be surgically inserted into the body cavity of a snake while the snake is anesthetized. When the snake recovers, it is returned back to the capture site and tracked.

### External Radios

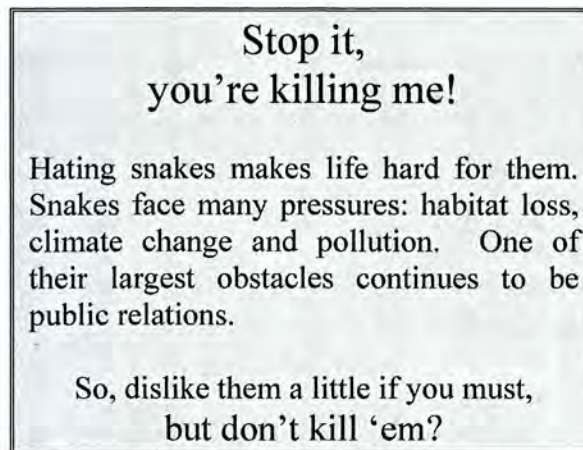
Not all reptiles are surgically implanted with transmitters. Small bands and collars are used to attach a radio to an animal such as the short-horned lizard.

### An Example of a Lizard Study

One research study monitoring a Mountain Short-horned Lizard population used radio telemetry to follow individuals. Small transmitters weighing a gram were placed on the short-horned lizard's back, over the pelvic area (each radio has its own wavelength). The transmitter was an oval shape with a 4 cm antenna sticking out of one end. It was coated with epoxy to make it smooth, with no corners, so it would not get caught on vegetation, rocks or other objects and debris. There were two eyelets at each end, which were sutured to the lizard's back. Coating the transmitter with glue and rolling it in crumbled soil helped camouflaged it. During the study, challenges and complications existed with the use of the transmitters: batteries lasted about a month and had to be replaced, and sometimes the lizards ran into obstacles and the radios were dislodged. Biologists conducting the study say the lizards are very hard to find because of their cryptic colour and small size, so *telemetry* is a helpful and effective tool to study their movements.

**Important:** Persons, agencies, or institutions wishing to conduct research involving activities such as, but not limited to, trapping, marking, or impeding movements of reptiles or other wildlife in Alberta **must** obtain a **Research Permit** or a **Collection License** from Fish and Wildlife Division of Alberta Sustainable Resource Development. For more information, contact your local Fish and Wildlife office.

## VII. Reptile P.R. (Public Relations)



From the **Snakes of Alberta** poster

### **Background Information**

The purpose of public relations campaigns is to raise public awareness about an important issue. Many campaigns provide education in schools and other community locations, and to the public through television appearances, advertisements, and the distribution of program literature such as brochures or flyers. Time and resources must be devoted to planning and implementing a successful public relations strategy. The strategy used in public relations should relate to the overall purposes of the organization.

A public relations campaign manages communication between an organization and the public and builds a mutually beneficial association between the two, i.e., reptiles play an integral role in the *ecosystem* and this is how reptiles help you/people.

A public relations campaign includes:

- **Public Awareness** – to make people aware
- **Public Information** – to offer information and awareness
- **Public Education** – to make school students aware

There are three types of campaigns:

1. **Reinforcing** – reinforce the attitudes and behaviours of those who already agree with the position, i.e., reptiles are an integral part of the ecosystem.
2. **Changing** – change the position of those who disagree, i.e., despise snakes and other reptiles.
3. **Behaviour Modification** – change behaviour, i.e., persuade people to become active or recruit them to help deliver message that reptiles are worthy of conservation.

**A Successful Campaign has:**

- The right **message** to a target group.
- An appropriate **appeal** to the interests of the target audience.
- Appropriate **media** for the target audience.
- Considered various media to deliver messages.

- A methodical planning and production campaign.
- Monitors and evaluates the campaign.

### Activity Summary

Small groups of students will choose the message, media, and target audience to deliver a short campaign message about reptiles. This activity will help students deliver appropriate messages to a target group about reptile *habitat* loss and misunderstandings.

### Procedure

1. Discuss public relations (PR). What are the benefits of a PR campaign? Are there any going on right now in the community or in the news (i.e., water conservation)? Bring in samples from the local media and discuss what makes them successful. What media and methods work best? What works for them?
2. Discuss the importance of a PR campaign for reptiles. Why bother? People have to change their attitudes and understandings about reptiles, so any campaign students develop will be a **Changing** campaign (see 2 above - *change the position of those who disagree*) with the sole purpose of changing peoples' attitudes.
3. As a class, decide on the **message** they will deliver to a group of people about reptiles.
4. Have small groups of students choose a **specific group** they will target a message to. Make sure there are a variety of groups selected throughout the class, i.e., families, teens, hunters, adults, outdoors enthusiasts, landowners, and so on.
5. Groups will select the appropriate **means** to get the message effectively to the target group. How will they do it?
6. Have groups present their Reptile PR Campaign to the rest of the class. Evaluate the group's effectiveness of the message delivery to the target audience and their creativity.

### Ideas for Media

**Design an Exhibit** – Assign a group of students with the task to develop an interactive exhibit for a local zoo about Alberta reptiles. Not only must it help educate people who have misconceptions about reptiles, but also it must present information in a way that involves the reader. Make the exhibit with things to interact with, flaps to lift, puzzles to figure out, buttons to push, and any number of other interactive elements.

**Develop a Public Awareness Campaign** – Develop a strategy to inform the local community about the threats to local reptiles.

**Find a Habitat Restoration Project** – Have students identify and volunteer some time in the local community where riverbanks can be replanted with native species, sites of erosion are identified and protected, fencing restored to allow vegetation to recover.

- Produce a Video** – Make a 30-second commercial about an Alberta reptile.
- Real Estate Agency** – Have a group of students form a real estate agency selling land to clients...reptiles. Pictures must be accompanied with a rich text that describes the landscapes and the habitats suitable for their clients.
- Write an Advertisement** – Choose one of Alberta’s reptiles and develop a one page magazine advertisement.
- Write an Article** – Write an article about how private citizens can play a critical role in protecting the community’s *wildlife* and plants.
- Learn From Others: Invite Speakers into the Classroom** – Have a group of students find some speakers to do short presentations about local wildlife, projects being done locally, community initiatives to improve natural environments, and projects to lessen the community’s impact on the environment.
- Be Image Consultants** – Have a group of students be an image consultant company for the reptiles. Compare their job to making an ordinary teenager who can sing into a pop star—transform reptiles that have fascinating characteristics into animals with a positive public image. Their task and challenge is to make reptiles rise above the misunderstandings.
- Write a Radio Spot** – A group of students have 15 seconds to increase the image or general awareness of reptiles.
- Host a Talk Show** – Have a group of students hold a talk show where the host interviews various reptile species from Alberta. One of the questions can be, “What adaptations do you have that make you a successful reptile?” Model some of the questions after a real talk show format.
- Organize a Reptile Day** – Have a group of students organize an event in the school where the theme is reptiles and there are key messages.
- Try this one for Legislation** – Propose a change to the *Wildlife Act*.

**Important:**  
 Protection of den sites during the time when the snakes are both present and not present is critical. Snake dens are protected from destruction and disturbance from September 1 in one year to April 30 of the following year (under Alberta’s *Wildlife Act*.) Thus, they are not protected between May 1 and August 31. The exception is with the rattlesnake, in which its den sites are protected all year.

Information on Snake Hibernaculum protection is found in Section 36(1) of the *Wildlife Act*. Alberta’s *Wildlife Act* can be viewed on the following website:  
[www.qp.gov.ab.ca/documents/acts/W10.cfm](http://www.qp.gov.ab.ca/documents/acts/W10.cfm)



## VIII. Design an Experiment

### Activity Summary

Students will develop a hypothesis (optional) and design an experiment to test the hypothesis that snakes use pheromones to find hibernacula.

### Background Information

Snakes have learned to migrate over long distances in the fall to communal underground dens where they hibernate. In the spring they emerge in large numbers, and after mating, some species disperse up to 17 km to foraging sites. In the fall, snakes find their way back to the hibernacula and the cycle begins again.

Scientists know that snakes returned to the den but for awhile they were not sure how the snakes were able to find their way back to the dens after spending the summer many kilometres away. Is there a leader? Does the moon or sun give clues? Is it the effect of the earth's magnetism? Or is it just a great memory?

Some scientists came up with a hypothesis. **Migrating red-sided garter snakes rely on pheromones (chemicals given off by the snake's body) to locate winter hibernation sites.**

### The Real Experiment

Here is what Dr. Robert Mason and his colleagues at Oregon State University came up with. They made a Y-shaped maze using numbered pegs. They had a snake move through the maze and recorded the pegs it touched. More snakes were sent through the maze and they recorded if the snakes touched the same pegs in the same order as the first snake.

They recorded all the variables: sex, length, time, temperature and weather factors. They collected 100 snakes from an area just before the snakes actually reached the den site. The snakes were collected in pillow cases and tested in the Y maze within 24 hours of capture. The experiments were performed in a field at Narcisse, Manitoba in the same environmental conditions migrating snakes are naturally exposed to. The snakes were returned back to the site of capture.

### Procedure

1. Discuss the life cycle of the Red-sided Garter Snake. Highlight the two major habitat components: the hibernacula and foraging grounds.
2. Have students work in pairs or small groups. Ask them to develop a hypothesis for how they think Red-sided Grater Snakes find the hibernacula. If students are having problems developing a hypothesis, give them the following hypothesis: **Migrating Red-sided Garter Snakes rely on pheromones (chemicals given off by the snake's body) to locate winter hibernation site.** Have them design an experiment to test it.



3. The experiment design should include: hypothesis, apparatus, location, procedure. It should have enough information so that if they gave it to another group, the second group should be able to carry out the experiment from the information provided, no questions asked.
4. Have groups share their experiment designs.
5. Share the experimental design that Dr. Robert Mason at Oregon State University (see above, The Real Experiment) carried out. Results were accurate enough to claim that snakes use pheromones and scent trails to find hibernacula.

## IX. Reptilian Word Search

Make a copy of page 91 *Reptilian Word Search*, one for each student.

Answer: heliothermic

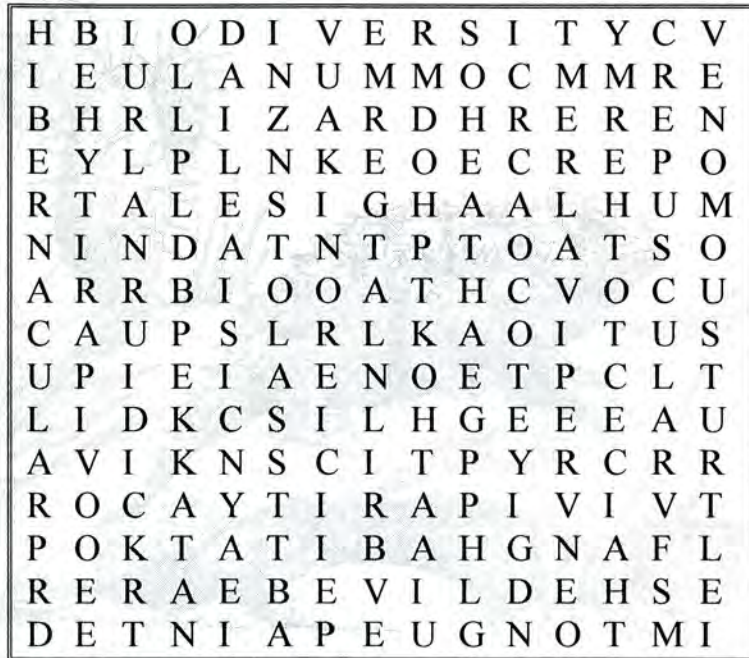
### *Activity Ideas for Word List*

- Have students choose 10 words and write a definition for each one as they pertain to reptiles.
- Describe *hibernacula*.
- Write a paragraph explaining *poikilothermy*.
- What are the advantages for an animal to be *ectothermic*?
- Finds words that refer **only to turtles** (carapace, painted, turtle); **only to lizards** (lizard); **only to snakes** (Bullsnake, communal, fang, *hibernacula*, hog-nosed, *pit*, Rattlesnake, shed, sinkhole, venomous, viper); **common to turtles, lizards and snakes** (bask, biodiversity, *cloaca*, *ectothermy*, *habitat*, *herpetology*, poikilothermy, rock).
- Make a *Venn Diagram* using all the words with three interlocking circles (one for turtles, one for lizards, and one for snakes.) This is similar to the above exercise but is more visual and graphic.

# Reptilian Word Search

Name \_\_\_\_\_

Use the *Reptile Vocabulary Word List* and find the words in the letter grid below. Look for the words going up, down, across, backwards, and diagonally. Be careful, some letters will be found in more than one word. Ignore any hyphens in the word list.



## Reptile Vocabulary Word List

- |                     |                      |                    |
|---------------------|----------------------|--------------------|
| <i>Bask</i>         | <i>Fang</i>          | <i>Rattlesnake</i> |
| <i>Biodiversity</i> | <i>Habitat</i>       | <i>Rock</i>        |
| <i>Bullsnake</i>    | <i>Herpetology</i>   | <i>Shed</i>        |
| <i>Carapace</i>     | <i>Hibernacula</i>   | <i>Sinkhole</i>    |
| <i>Cloaca</i>       | <i>Hog-nosed</i>     | <i>Tongue</i>      |
| <i>Communal</i>     | <i>Live-bearer</i>   | <i>Turtle</i>      |
| <i>Crepuscular</i>  | <i>Lizard</i>        | <i>Venomous</i>    |
| <i>Cryptic</i>      | <i>Oviparity</i>     | <i>Viper</i>       |
| <i>Den</i>          | <i>Painted</i>       | <i>Viviparity</i>  |
| <i>Diurnal</i>      | <i>Pit</i>           |                    |
| <i>Ectothermy</i>   | <i>Poikilothermy</i> |                    |

Write the leftover letters below to find solve this clue: *An animal that gets its body heat by basking in the sun is called...*

\_\_\_\_\_ C

## Reptiles in the Classroom: Some Things to Think About

There are many and varied points of view about reptiles as pets, and more views about reptiles in the classroom. A reptile in the classroom can be a great learning experience for students. We know that many animals suffer persecution in the wild because of people's fears and misinformation. If students had a chance to interact with a Corn Snake for example, then perhaps they would be more respectful to snakes and other reptiles. There are pros and cons of keeping reptiles in the classroom. Read both sides and decide what suits your situation the best.

### **Pros**

- Reptiles can be interesting and fun for students.
- Students can learn first-hand how and why to respect a reptile.
- Students can learn responsibility with care-taking activities.
- Many common captive-bred reptiles have a wealth of readily available information with respect to their care and needs.
- Respect of reptiles can go a long way towards conserving wild populations. A classroom reptile can be a great ambassador for those in the wild.

### **Cons**

- Space. Depending on the species, reptiles need at least a 20-gallon aquarium tank as a vivarium (cage). Some reptiles require significantly larger cages. If you do not have the room, do not get a reptile.
- Expense. Do not underestimate the cost of keeping a reptile. They need regular and quality food, proper housing and associated equipment (heaters, heat lamps, lighting, shelters, etc.). Individuals keeping reptiles must also be prepared to visit the vet if health concerns arise.
- The ethical consideration of keeping wild animals in a cage. Many feel that keeping reptiles is an anti-conservation activity.
- An alternate home and a willing individual, familiar with the proper care of the reptile, is required when there is no further interest in the reptile or to care for it during the summer or other school breaks.
- Research may need to be undertaken to acquire the necessary knowledge to properly raise and care for a reptile in captivity. Many reptiles have complex needs and require specialized care. All too often snakes and their kin are viewed as requiring minimum care rather than specialized care. Inadequate care can be fatal or cause suffering. Care of reptiles requires detailed knowledge of their ecology and behaviour as well as physiology.
- Reptiles are *ectothermic* and need heat to maintain their preferred temperature to keep their metabolic and immunological processes functioning at optimal levels for health, growth and reproduction. Care has to be taken to ensure heat and power sources are available and NOT turned off.
- Some reptiles are *nocturnal* or spend a great deal of time hiding from view. Preventing reptiles from practicing these natural behaviors or providing inappropriate surroundings can stress the animal.

- Food for the reptile that cannot be kept at school will have to be kept at the teacher's home for every feeding day. Alternatively, frequent trips to a local pet store or other supplier of food, for the reptile, may be required.
- Some reptiles have a long life span (15 to 20 years) and commitment is required to care for the animal for this duration.
- Weekend and vacation care taking may be inconvenient for some.

Keeping a snake or other reptile requires the same commitment and responsibility as keeping other pets. You are responsible for their well-being and must be willing to give the time and effort for proper care.

You should have no doubts that caring for a classroom reptile requires knowledge, resources, and support from school administrators. If you choose to keep a reptile in the classroom, do it well.

**Some reptiles that make suitable classroom pets:**

Corn Snakes, Kingsnakes, Milk Snakes, Ball Pythons, Leopard Geckos, Bearded Dragons, and Blue-tongued Skinks.

**Some reptiles that do not make suitable classroom pets:**

Green Iguanas, Red-eared Sliders, Painted Turtles, Box Turtles, Monitors, Crocodiles, large constrictors (boa's and pythons), venomous snakes, and garter snakes.

**Whenever possible, select captive bred animals.**

**Warning – Salmonella:**

Snakes, turtles, and most reptiles carry the bacteria *Salmonella* inside their bodies. Salmonella poisoning can cause vomiting, fever, diarrhea and stomach cramping. Salmonella is often associated with food poisoning. Wash your hands with warm, soapy water after handling any reptiles, touching their cages and before eating food. Reptiles are not a good choice for day-care centres. Children under 12 years should be supervised when handling reptiles.

## Sample Test Questions

### Sentence Completion

1. If there are no hibernacula, there are no snakes.
2. A reptile sunning itself is also referred to as basking.
3. The Painted Turtle spends the winter buried in mud at the bottom of a pond.
4. A reptile meets all its needs in its habitat.
5. A *gravid* female is pregnant.
6. The gender of a turtle is determined by the temperature of the embryo in the nest, as it is developing.
7. The top of a turtle's shell is called the carapace.
8. Alberta has one venomous snake(s).
9. Pit vipers have facial pits that enable the snake to locate warm-blooded prey by the heat they radiate.
10. Two specifications of a hibernaculum are: below the frost line and above the water table.

### Short Answer

1. How would you tell the difference between a Hog-nosed Snake, a Bullsnake, and a Rattlesnake? (Hog-nosed: upturned snout; Bullsnake: round pupil, small head; Rattlesnake: rattle, triangular head and vertical pupil)
2. What is the size of a short-horned lizard? (40 to 70 mm)
3. Why should we be concerned if some reptiles in Alberta are at their northernmost range? (Climate changes can cause the northernmost range to shrink, thus overall shrinking of the entire range of the reptile. If north warms, then range would expand and shrink in south as it becomes too dry, i.e., for garter snake and Painted Turtle.)
4. Which of Alberta's reptiles lay eggs? (Painted Turtle, Hog-nosed Snake, Bullsnake)
5. Which of Alberta's reptiles have live births? (Mountain Short-horned Lizard, Wandering Garter Snake, Plains Grater Snake, Red-sided Garter Snake, Prairie Rattlesnake.)
6. Draw a food chain with a snake in it. Label the components and the consumers from beginning to end. (Solar energy → plants (producers) → rodents (primary consumers) → garter snake (secondary consumer) → red-tailed hawk (tertiary consumer) → bacteria, insects (decomposers))
7. List three things that can cause a population of reptiles to decrease in size or disappear. (Loss of *hibernacula*, changes to *habitat*, climate change, pesticides, pollution, hunting, pet collectors, road mortality, etc.)

### Essay Writing

1. From your own choosing, describe one species of Alberta's reptiles and include the following in your write-up: 250 words, common name, Latin name, habitat, range, draw a food web, describe its life cycle, and *limiting factors*.
2. Describe your attitudes and feelings towards reptiles. Have they changed? What had the biggest impact on changing your attitude towards snakes?

## Glossary

### A

- Abiotic** non-living objects, substances, processes or components of the environment, for example, climate, water, soil.
- At Risk** any species known to be “At Risk” of extinction or extirpation after formal detailed status assessment and designation as “Endangered” or “Threatened” in Alberta.

### B

- Biodiversity** biodiversity includes all organisms, species, and populations; the genetic variation among these; and all their complex assemblages of communities and ecosystems. It encompasses the interrelatedness of species, genes and ecosystems, and their interactions with the environment.
- Biotic** having to do with living things; something caused by or produced by living things; having to do with biological aspects of an environment (as opposed to geographic etc. aspects).

### C

- Carrion** dead and putrefying flesh.
- Cloaca** the single chamber through which the contents of the digestive, reproductive, and excretory systems pass; opens to the outside of the body at the vent.
- Cold-blooded** cold-blooded animals’ temperatures change with that of their surroundings. Includes amphibians, reptiles, fish and all invertebrates. See ectotherms.
- Conduction** the transfer of heat between two objects; caused by a temperature difference.
- Convection** the movement of heat caused by the motion of air. Hot air rises. Cooler air flows under or drops beneath hot air where it gets heated and rises.

COSEWIC	Committee on the Status of Endangered Species in Canada. This committee is responsible for producing the Official Canadian List of Species at Risk. COSEWIC reviews scientific status reports about species of concern from each province. <a href="http://www.cosewic.gc.ca">www.cosewic.gc.ca</a>
Crepuscular	active at twilight; active at dawn or dusk.
<b>D</b>	
Diurnal	active during the day.
Dorsal	pertaining to the back (dorsum).
<b>E</b>	
Ecosystem	an association of living things and their interactions with each other and the environment.
Ectotherms	ectothermic animals; animals that cannot internally maintain a constant body temperature and obtain body heat from external sources; includes reptiles, amphibians, fish and invertebrates; see “cold-blooded”.
Ectothermy	a strategy that reptiles use to maintain their body temperature from external sources of heat.
Endotherms	being able to maintain a constant body temperature independent of the outside temperature; mammals and birds are endothermic; “warm-blooded”.
Environmental Indicators	key measurements that can be used to monitor, describe, and interpret changes in the environment.
<b>F</b>	
Frost Line	the frost line penetration in soil and/or the depth at which the earth will freeze and swell. This depth varies depending on the latitude and elevation of an area and other geological, soil and environmental factors.
<b>G</b>	
Gravid	pregnant; bearing eggs or developing young internally.

## H

Habitat	an area that provides the food, water, shelter and space an animal or plants need to live.
Heliothermy	a strategy to gain heat directly from the sun's rays; heliothermic animals typically bask.
Herpetology	study of amphibians and reptiles; from the Greek word <i>herpeton</i> , which means "crawling things." Reptiles and amphibians evolved from a common ancestor millions of years ago but the two groups are not closely related (they were once thought to be close cousins and were put together under the zoological umbrella.)
Herpetofauna	reptiles and amphibians, collectively.
Hibernacula	dens used by snakes; singular, <i>hibernaculum</i> – places where snakes gather to hibernate during the winter.
Hibernaculum	a single den used by snakes; plural, <i>hibernacula</i> – a place where snakes gather to hibernate during the winter.
Hibernate	to enter an inactive or dormant state for the winter.

## J

Jacobson's organ	a sensory organ, in the roof of a reptile's mouth, that analysis chemical signals that are picked up by the tongue of snakes and some lizards.
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## K

Keratin	fibrous proteins occurring in hair, feathers, hoofs, claws, horns, scales, etc. of animals.
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## L

Lateral	pertaining to the side.
Limiting Factors	factors or features in the environment that reduce the size, and number of the populations of a species or negatively affects a species overall health, reproductive potential and behavior, or any other aspect of its natural history.



## N

- Neonate a baby from birth to four weeks.
- Neoteny in some salamander species, larvae fail to transform into an adult form and become sexually mature while maintaining larval features (e.g., gills and tail fins); most common in salamanders from the family Ambystomatidae.
- Nocturnal active at night.

## O

- Omnivorous feed on many kinds of plant and animal foods.
- Ophidiophobia fear of snakes.
- Oviparity production of eggs that hatch and develop outside the body.
- Ovoviviparity production of eggs that are fertilized and hatch inside the mother but the embryos lack a placental connection to the uterus and so do not feed off the mother. The young are born as miniature adults.

## P

- Pit a pit-shaped heat sensory structure located between the eye and nostril of rattlesnakes. Similar heat sensing pits occur along the jaw of various species of snakes from the family Boidae (boas and pythons). Pits are capable of detecting minute differences in ambient temperatures.
- PIT tag PIT stands for Passive Integrated Transponder. Depending on the model, the tag is about 10 mm long x 2 mm wide; it is encased in glass and inserted under the skin of an animal to uniquely mark individuals for identification purposes.
- Poikilothermic having a fluctuating body temperature that varies with surroundings. Mechanisms to help regulate temperature are: *ectothermy*, *heliothermy*, and *thigmothermy*.

## R

- Radio transmitter a small device that emits a radio signal, which can be picked up by a receiver and used to locate animals.



## Supporting Resources

### Books

***The Amphibians and Reptiles of Alberta: A Field Guide and Primer of Boreal Herpetology.*** Anthony P. Russell and Aaron M. Bauer. Second Edition. University of Calgary Press: 2000. 279 pages.

This is a must-have if you are teaching about Alberta's reptiles. It is both a field guide and a natural history guide. It covers how to observe amphibians and reptiles, keys to identification, distribution information about each species, how they cope with the cold and aridity, their defences, and human interaction. Contains a Table of Contents, Bibliography, Glossary, Index, and colour plates.

***Canadian Skin and Scales.*** Pat E. Bumstead. Simply Wild Publications Inc.: 2003. 163 pages.

This is an excellent reference book about Canadian amphibian and reptile species. Every Canadian species is illustrated with a line drawing, natural history information and interesting facts. Scattered throughout the book are trivia questions and tidbits on reptiles and amphibians of the world. Geared to students aged nine to 13 years. Contains Table of Contents, Glossary, Websites and Index.

Quantity discounts are available on bulk purchases for educational purposes. Available from: Simply Wild Publications Inc., 100 Lake Lucerne Close SE, Calgary, AB T2J 3H8 Phone 1-877-278-5999 or Fax (403) 279-3304. You can also visit the website at [www.simplywildpub.com](http://www.simplywildpub.com).

### Posters

***Snakes of Alberta.*** A large horizontal poster with coloured photographs of Alberta's six snake species and the Mountain Short-horned Lizard and the Painted Turtle. This is a must-have if you are learning about Alberta's reptiles in the classroom. Measures 96 cm wide by 63 cm high.

***Grasslands.*** This poster illustrates vegetation and wildlife found on Alberta's prairie. The poster also depicts and explains how human impact has altered and fragmented these disappearing grasslands. Beautifully illustrated. The reverse side is covered with information. A resource appropriate for grades 7 to 9. Measures 96 cm wide by 68 cm high.

***Wetlands: Webbed Feet Not Required.*** This is a poster kit exploring functions of wetlands, types of wetlands, wetland ecosystems and wetland issues. Activities are targeted to grades 4 to 6; however, the information is excellent for grade seven. Poster measures about 96 cm by 65 cm.

All posters available from:

Information Centre - Publications

Alberta Environment/Alberta Sustainable Resource Development

Main floor, Great West Life Building

9920 – 108 Street

Edmonton, Alberta, Canada T5K 2M4

Tel: (780) 422-2079 (toll-free by dialing 310-000 first, then (780) 422-2079)

Fax: (780) 427-4407

E-mail: [env.infocent@gov.ab.ca](mailto:env.infocent@gov.ab.ca)

## Web Sites Worth Visiting

Regrettably, websites come and go. Please keep your list up-to-date by visiting the addresses frequently. And unfortunately, websites may become linked to inappropriate sites, therefore, inspect in advance the websites you want students to visit.

### **Alberta Endangered Species Conservation Committee**

[www3.gov.ab.ca/srd/fw/escc/index.html](http://www3.gov.ab.ca/srd/fw/escc/index.html)

### **Alberta Environment**

[www3.gov.ab.ca/env/](http://www3.gov.ab.ca/env/)

### **Alberta Conservation Association**

[www.ab-conservation.com](http://www.ab-conservation.com)

### **Alberta Natural Heritage Information Centre**

[www.cd.gov.ab.ca/preserving/parks/anhic/](http://www.cd.gov.ab.ca/preserving/parks/anhic/)

### **Alberta Special Places**

[www.cd.gov.ab.ca/preserving/parks/sp\\_places/index.asp](http://www.cd.gov.ab.ca/preserving/parks/sp_places/index.asp)

### **Alberta's Species at Risk**

[www3.gov.ab.ca/srd/fw/riskspecies/](http://www3.gov.ab.ca/srd/fw/riskspecies/)

### **Canadian Amphibian and Reptile Conservation Network**

[www.carcnet.ca](http://www.carcnet.ca)

### **Committee on the Status of Endangered Species in Canada (COSEWIC)**

[www.cosewic.gc.ca](http://www.cosewic.gc.ca)

### **Ecological Monitoring and Assessment Network**

(The Great Amphibian and Reptile Quiz)

<http://www.naturewatch.ca/cgi-bin/quiz/step1.asp>

### **Infrared Zoo**

<http://sirtf.caltech.edu/Education/Zoo/zoo.html>

### **International Fund for Animal Welfare: Amphibians and Reptiles as Exotic Pets**

[www.ifaw.org/page.asp?unitid=514](http://www.ifaw.org/page.asp?unitid=514)

### **Nature Watch Programs**

(FrogWatch, IceWatch, PlantWatch, WormWatch)

[www.naturewatch.ca](http://www.naturewatch.ca)

### **Reptile Information**

<http://www.carcnet.ca/english/reptileinfo.html>

**Status of Alberta Wildlife**  
[www3.gov.ab.ca/srd/fw/status](http://www3.gov.ab.ca/srd/fw/status)

**Status of the Plains (Western) Hog-nosed Snake**  
[www3.gov.ab.ca/srd/fw/status/reports/pdf/hognose.pdf](http://www3.gov.ab.ca/srd/fw/status/reports/pdf/hognose.pdf)

**Status of the Prairie Rattlesnake**  
[www3.gov.ab.ca/srd/fw/status/reports/pdf/prsnake.pdf](http://www3.gov.ab.ca/srd/fw/status/reports/pdf/prsnake.pdf)

**Status of the Mountain Short-horned Lizard**  
[www3.gov.ab.ca/srd/fw/status/reports/pdf/eshl.pdf](http://www3.gov.ab.ca/srd/fw/status/reports/pdf/eshl.pdf)

**Survey on the Importance of Nature to Canadians (Environment Canada)**  
[www.ec.gc.ca/nature/index\\_e.htm](http://www.ec.gc.ca/nature/index_e.htm)

**Wild Species 2000**  
[www.wildspecies.ca](http://www.wildspecies.ca)

**Alberta's *Wildlife Act***  
[http://www.qp.gov.ab.ca/documents/Acts/W10.cfm?frm\\_isbn=0779722442](http://www.qp.gov.ab.ca/documents/Acts/W10.cfm?frm_isbn=0779722442)

**Alberta Wildlife Regulations**  
[www.qp.gov.ab.ca/documents/regs/1997\\_143.cfm](http://www.qp.gov.ab.ca/documents/regs/1997_143.cfm)

**World Wildlife Fund Canada**  
[www.wwfcanada.org](http://www.wwfcanada.org)

