COSEWIC
Assessment and Update Status Report

on the

Pygmy Short-horned Lizard
Phrynosoma douglasii

in Canada

EXTIRPATED
2007

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

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Previous reports:

COSEWIC 2000. COSEWIC assessment and status report on the Pygmy Short-horned Lizard *Phrynosoma douglasii* (Pigmy Short-horned *Phrynosoma douglasii* and Greater Short-horned *Phrynosoma hernandesi*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. iv + 22 pp.

Powell, G.L., and A.P. Russell. 1992. COSEWIC status report on the short-horned lizard *Phrynosoma douglasii* (Pygmy P.d. douglassii and Eastern P.d. brevirostre) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-22 pp.

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Pygmy Short-horned Lizard — Photo by ©Suzanne L. Collins.

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COSEWIC
Assessment Summary

Assessment Summary – April 2007

Common name
Pygmy Short-horned Lizard

Scientific name
Phrynosoma douglasii

Status
Extirpated

Reason for designation
There have been no confirmed sightings in Canada in the past 50 years, although there have been anecdotal reports during that time.

Occurrence
British Columbia

Status history
Last reported in 1898. Designated Extirpated in April 1992. Status re-examined and confirmed in May 2000 and in April 2007. Last assessment based on an update status report.

COSEWIC
Executive Summary

Pygmy Short-horned Lizard
Phrynosoma douglasii

Species information

The Pygmy Short-horned Lizard was recently recognized as a separate species. It is the smallest of the horned lizards, rarely exceeding 6 cm from its snout to vent. Compared to some other ornately armored horned lizards, the Pygmy Short-horned Lizard has relatively small horns on its head and body. It is often referred to (incorrectly) as a horned toad. All 13 species of horned lizards are confined to the arid and semi-arid portions of North and Central America.

Distribution

The Pygmy Short-horned Lizard inhabits the Great Basin and surrounding areas from northern California and Nevada through eastern Oregon and Washington, most of southern and eastern Idaho and into the extreme south-central part of British Columbia, in the Okanagan and Similkameen Valleys.

Habitat

A broad variety of habitats are used from deep-soiled desert basins to shallow-soiled slopes and ridges. Consistent features are well-drained sites with exposed ground and access to friable soils for burrowing, thermoregulating and foraging. The Okanagan and Similkameen Valleys still appear to have suitable habitat for this species, and some of this habitat is currently protected. Parts of the Pygmy Short-horned Lizard's range are over 2000 m above sea level.

Biology

Pygmy Short-horned Lizards give birth to up to 15 live young, unlike some other horned lizards that lay eggs. Sexual maturity in females usually occurs in their third year. Longevity is unknown but is at least five years in the wild. Like all temperate-zone reptiles, Pygmy Short-horned Lizards must hibernate through the winter, which they do in shallow burrows.

The primary prey of all horned lizards is ants, especially the harvester ant. Other invertebrates, such as beetles, grasshoppers, and snails, are also eaten, most commonly

by adults. Foraging starts after the lizards have warmed in the morning sun and continues until the heat of the afternoon when they seek refuge in shade or a burrow.

Pygmy Short-horned Lizards have many potential predators, including birds, snakes, coyotes and weasels. The first line of defence is remaining motionless, to take advantage of their cryptic colouration, texture, and posture. If detected, the lizards can flee from slow moving predators or inflate their bodies and make intimidating gestures. Their horn-like projections are minor deterrents, but can be effective against predators that must swallow them whole. Some horned lizards are capable of shooting a stream of foul-tasting blood into the mouths of certain predators, but this behaviour has not been observed in Pygmy Short-horned Lizards.

Population sizes and trends

The Pygmy Short-horned Lizard is considered to be extirpated (locally extinct) in Canada, as confirmed observations have not been made in the last 100 years. Four survey attempts have failed to locate this lizard, although the public has reported at least 18 anecdotal observations since the first specimens were collected. The most recent of these was in 2004.

Limiting factors and threats

Habitat loss has been extensive in the Okanagan Valley and to a lesser extent in the Similkameen Valley. Although this habitat loss is likely a contributing factor to the species' extirpation, it appears that Pygmy Short-horned Lizards were already rare by the early 1900s. This rarity may have been a result of relatively recent colonization, trampling by many large herds of cattle driven through this narrow valley en route to the Cariboo goldrush, or severe population declines when extreme cold or prolonged winters with little snowfall caused mortality during hibernation. If the species were reintroduced, current potential threats would include extensive habitat loss, road mortality, and predation by native and exotic animals.

Special significance of the species

The Pygmy Short-horned Lizard was one of Canada's most intriguing creatures that ventured north from the deserts in the south. It encountered the limits of its ecological tolerance in the southern interior of British Columbia. It was one of only 7 species of lizards in Canada.

Existing protection

The Pygmy Short-horned Lizard is listed in Schedule 1 under the *Species at Risk Act* and listed under the BC *Wildlife Act*. Both acts protect individuals and their residences from deleterious activities. In the United States, Idaho appears to be the only state where it is illegal to collect, harm, or otherwise remove this species from its natural habitat (Idaho Fish and Game 2006).

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment Canada / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune
Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

Update
COSEWIC Status Report

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SPECIES INFORMATION

Name and classification

Horned lizards (Family: Phrynosomatidae), colloquially known as horny or horned toads, belong to a single genus (*Phrynosoma*). All species inhabit portions of the arid and semi-arid ecoregions of North and Central America. Currently there are 13 recognized species within the genus, eight of which occur in North America (Crother 2000). Two species extend their ranges into Canada. The Greater Short-horned Lizard (*P. hernandesi*) extends from the Great Plains into southern Alberta and Saskatchewan and the Pygmy Short-horned Lizard (*P. douglasii*) historically extended from the Great Basin into the southernmost part of central British Columbia. Previously, as many as six subspecies of short-horned lizards were recognized (Nussbaum *et al*. 1983). Recent genetic assessments have resulted in the Pygmy Short-horned Lizard being recognized as a distinct species (Zamudio *et al*. 1997). More recent work suggests that *P. hernandesi* is more closely related to the Rock Horned Lizard (*P. ditmars*) than to *P. douglasii* (Hodges and Zamudio 2004). No subspecies of P. douglasii are currently recognized.

The spellings of both the common name and the species name have been in contention. Pygmy has also been spelled Pigmy, recently Short has been dropped (e.g., Sherbrooke 2003), and douglasii has been spelled with two “s” and one “i”. This report adopts the updated spelling presented in the Scientific and Standard English names of Amphibians and Reptiles of North American (Crother *et al*. 2003).

Morphological description

All horned lizards are relatively small with rounded and flattened trunks and short legs. This squat form makes it difficult for them to move quickly or with agility in a cluttered environment, but does allow them to have large stomachs, accommodate a large number of embryos, and create a large dorsal surface area for heliothermy (basking in the sun). Equally as distinctive are elaborate parietal and squamosal horn-like protuberances on their heads and bodies. Each species has its own unique array of horns. The tail is short and incapable of regrowth if lost.

Males have an enlarged tail base that houses the hemipenes and a pair of elongated post-cloacal scales (Nussbaum *et al*. 1983). Males also have enlarged femoral pores in single rows along the lower back edge of the thigh that may function as scent glands (Sherbrooke 1981). Female Pygmy Short-horned Lizards are slightly larger than males, averaging 7 mm longer from snout to vent (SVL) (Nussbaum *et al*. 1983).

The Pygmy Short-horned Lizard is the smallest of the horned lizards, usually about 4.5 cm long from snout to vent (SVL) (Lahti 2005) with a maximum size of 6.5 cm SVL (Nussbaum *et al*. 1983). The horns on the rear crest of the head are shorter than in other horned lizards (same width at their base as they are long) and a distinct notch separates these horns from either side of the head. A single row of horns forms a fringe along the margins of the body (Figure 1).

Colour and pattern are variable within the species. Overall, the colour matches the substrate so that when they are motionless, the lizards are very difficult to detect. The dorsum is typically grey with about 12 dark blotches, usually arranged in transverse rows of 2 to 4 blotches (Nussbaum *et al*. 1983) with no blotches being centred above the vertebrae (Brown *et al*. 1995). Each blotch is paler on its posterior edge. When horned lizards are cool they tend to be darker, which allows greater absorption of solar heat, and they become paler as they warm (Sherbrooke 2003). The tail has dark transverse bands and the ventral surface is pale.

Newborns resemble adult lizards but they are a mere 2.2 cm (Nussbaum *et al*. 1983, Lahti 2005) to 3.2 cm SVL (Brown *et al*. 1995). Newborns appear to lack horns, which develop as they mature (Brown *et al*. 1995).

Photos by Scott Fitkin of the Washington Department of Fish and Wildlife

Figure 1. Photographs of an adult and a juvenile Pygmy Short-horned Lizard from the nearest known population in Washington State.

Two other lizard species are sympatric with the Pygmy Short-horned Lizard in Canada; the Northern Alligator Lizard (*Elgaria coerulea*) and the Western Skink (*Eumeces (Plestiodon) skiltonianus*). Neither of these species resembles horned lizards.

Genetic description

There has been an assumption that the Canadian population of Pygmy Short-horned Lizards was disjunct from populations to the south in Washington State. This is unlikely, though, as there is a continuum of suitable habitat to remaining populations in Washington State, suggesting that populations were continuous, at least until historic times. The limited vagility of the species, especially in a heterogeneous landscape, may account for great differences in life histories of neighbouring populations (Nussbaum *et al*. 1983, Marcot 1997). This effect seems evident in the Oregon Cascade Mountain population, which appears to be significantly different than other populations in the Pacific Northwest (Brown *et al*. 1995). The most intensive genetic analysis has been

conducted by Hodges and Zamudio (2004) who examined 38 populations of Pygmy Short-horned Lizards and confirmed that *P. douglasii* was a distinct clade, although this finding is not supported by morphological data. No genetic analysis has been conducted to determine whether the Canadian population was distinct in any way from nearby populations in Washington State or elsewhere.

DISTRIBUTION

Global range

The core range of the Pygmy Short-horned Lizard is the Great Basin Desert. The species extends from northern California and Nevada, through eastern Oregon and Washington, most of Idaho, and into the extreme south-central portion of British Columbia (Schmidt 1953, Sherbrooke 2003, Stebbins 2003). An historic record (1937) exists from extreme southwestern Montana, where the species' current status is unknown (St. John 2002). Figure 2 depicts their known global range.

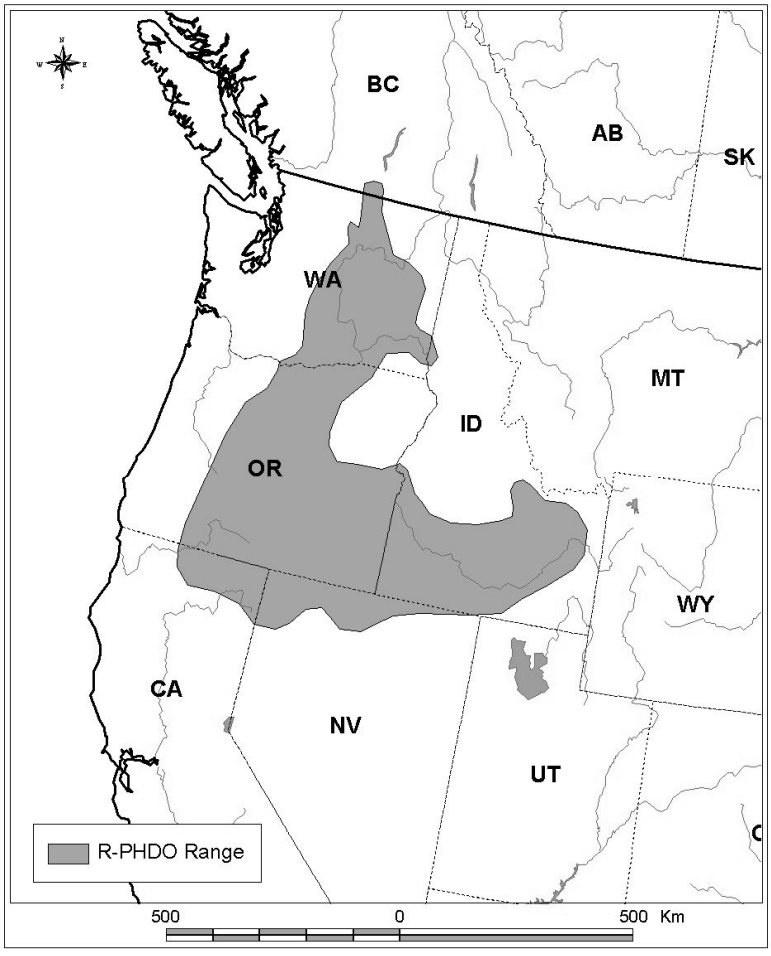

Figure 2. The global range of the Pygmy Short-horned Lizard.

Canadian range

In Canada, the only confirmed records of the Pygmy Short-horned Lizard are from Osoyoos in the Okanagan Valley of British Columbia, immediately north of the International Boundary. However, nearly 20 observations have been reported since these first ones were collected in Osoyoos and are discussed in more detail in the Population Abundance section. The extent of these records is the Similkameen Valley from Chopaka at the International Boundary north to Keremeos, and from the International Boundary at Osoyoos north to Kaleden (south of Penticton). These records occur throughout the South Okanogan Basin (SOB) ecosection and the southeastern part of the Okanagan Range (OKR) ecosection. It appears that these records are restricted to the very hot and dry Bunchgrass (BGxh1) and Ponderosa Pine (PPxh1) biogeoclimatic zones. Portions of the very hot and dry Interior Douglas Fir (IDFxh1) biogeoclimatic zone may be suitable as well.

The potential range of the species in Canada has been modelled using Terrestrial Ecosystem Mapping (Iverson and Haney 2005) as a map base (Figure 3). This method identifies a substantial area where Pygmy Short-horned Lizards could occur and much of it has not been surveyed. All but one of the past observations falls within this modelled area. The Washington Gap Analysis Project (Washington Cooperative Fish and Wildlife Research Unit 1997) portrays suitable habitat within Okanogan County, consistent with usable habitat predicted by the Canadian model.

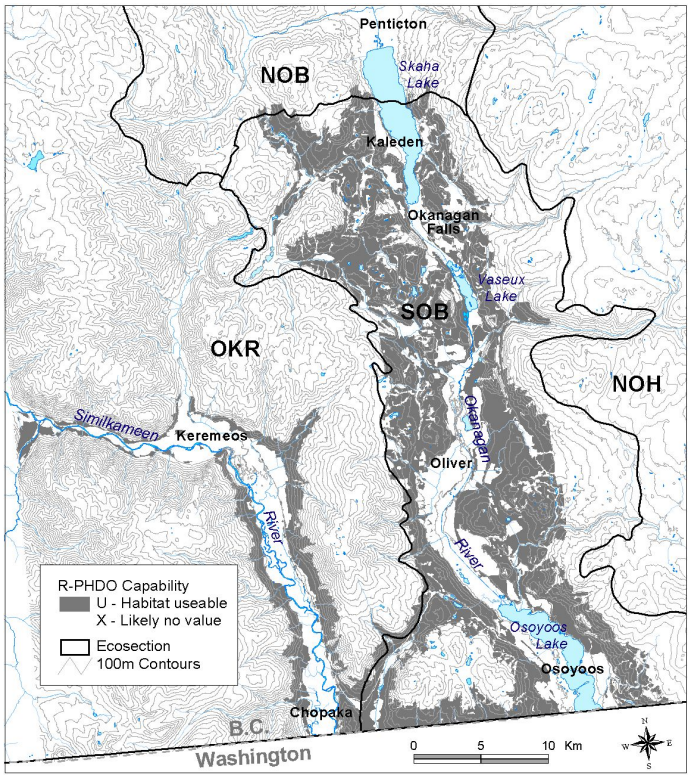

Figure 3. The predicted range of the Pygmy Short-horned Lizard in Canada using a habitat use model.

In Okanogan County in Washington State, the Pygmy Short-horned Lizard is documented in Brewster, the town of Okanogan, throughout the Methow Valley (S. Fitkin pers. comm.) and anecdotal observations have been made as far north as Siwash Creek near Tonasket, 30 km south of the International Boundary (J. Heinlen pers. comm.).

Areas of habitat use are often represented as Element Occurrences or Areas of Occupation. This is difficult to portray for the Pygmy Short-horned Lizard as the only confirmed locations are not precise and the remaining observations are unsubstantiated. The habitat use model identifies 42,256 ha of potentially usable habitat in Canada, which constitutes less than 1% of the species' global range.

HABITAT

Habitat requirements

The habitat requirements of the Pygmy Short-horned Lizard are poorly understood; however, it appears that a broad range of habitats is used. Generally, the species occurs in a variety of shrub-steppe and open forested ecosystems, but always on well-drained sites (Brown *et al*. 1995). Vegetation must be adequately sparse to permit heliothermy (basking) and to allow unencumbered movement through the understory (Sherbrooke 2003, Lahti 2005). However, vegetation is selectively used for shade when it is very hot (e.g., James 2004, Lahti 2005). Friable soils suitable for burrowing are needed somewhere within an individual's home range, although the area can be dominated by very shallow or coarse-textured soils. In fact, lithosols (soils with significant rubble) were preferred in Kittitas County, especially by males in the spring (Lahti 2005). This habitat is similar in structure to habitat supporting high concentrations of Pygmy Short-horned Lizards in the Methow Valley of Okanogan County, between elevations of 750 and 1050 m asl (S. Fitkin pers. comm.). Contrastingly, in the Columbia Basin the lizards also are commonly seen in big sagebrush (*Artemesia tridentata*) stands with flat, deep aeolian soils (R. Friesz pers. comm.). However it appears that mostly adult females use these areas, having broader habitat tolerances than neonates or adult males (Lahti 2005). Some populations in Washington State occupy areas with sparse to moderate densities of antelope bitterbrush (*Purshia tridentata*), some big sagebrush, bitterroot (*Lewisia rediviva*), and snow buckwheat (*Erigonium niveum*) (S. Fitkin pers. comm.). Pygmy Short-horned Lizards are extremely cold tolerant and in the Oregon Cascade Mountains can be found up to at least 1,677 m asl (Brown *et al*. 1995) and occasionally over 2000 m asl in open stands of subalpine fir (S. Fitkin pers. comm.).

The only hibernaculum described for this species was in Kittitas County where a female repeatedly burrowed during cool nights and then was last observed in mid-October at a depth of 4 cm under uprooted sod (Lahti 2005). In southern Alberta, at latitude similar as the Okanagan Valley, Greater Short-horned Lizard hibernated on warm aspect slopes where soils are sufficiently friable to permit burrowing to a depth of 10 cm (James 2004).

Habitat trends

Approximately half of the native grasslands in the South Okanagan have been converted into intensively developed lands since 1940 (Bezener *et al*. 2006). This trend has accelerated in recent years with tremendous pressures from agricultural and residential development. The distribution of potentially suitable habitats in the Okanagan currently is highly fragmented. The remaining suitable habitat in the Similkameen is more contiguous but the soils are typically less friable.

A recent population projection for humans in the Regional District of Okanagan-Similkameen anticipates a total population increase of 30% between 2004 and 2031, adding 24,506 residents to the existing population of 80,822 (Hobson and Associates 2006). This development will lead to increasing density of existing urban and rural areas as well as the expansion of new neighbourhoods into outlying areas. The latter will have the greatest detriment on potential Pygmy Short-horned Lizard habitat.

Habitat in the remainder of the lizard's range has also been significantly reduced from historic levels as a result of agricultural and residential development. The interior Columbia and Klamath basins retain 70% of their shrub-steppe and a mere 30% of their grassland ecosystems (Quigley *et al*. 1996).

Habitat protection/ownership

Land tenure was overlaid to determine land status of potential lizard habitat identified in the habitat use model. The majority of potential habitats occur on Indian reserves (31%) governed by three distinct Bands. Private lands (29%) account for the second greatest tenure of usable habitats. Most of this habitat is situated on a relatively small number of large ranches. The provincial government's protected areas represent 18% of the usable habitats. Usable habitat on other conservation lands, such as private organizations (3%) and federal lands (5%) bring the amount of protected lands to 26%. The provincial government also has 14% of the usable habitat in an unprotected status and some of these lands (2400+ ha) are available for disposition (BC Government 2004). A national park reserve is being considered for the south Okanagan and lower Similkameen valleys that could include some existing protected areas with the possibility of some adjacent lands (T. Hurd pers. comm.). Table 1 summarizes ownership of potentially suitable habitats for the Short-horned Lizard in Canada.

Table 1. Tenure and Areas of Suitable Habitats for Pygmy Short-horned Lizards in Canada.

Tenure	Area (ha)	%
Fed. Crown - CWS	470	1%
Fed. Crown - NRC	1745	4%
Indian Reserves	12,919	31%
Prov. Crown - Protected	7234	18%
Prov. Crown	5910	14%
Private	11,859	29%
Private Conservation	1120	3%
Total	41,256	100%

BIOLOGY

A substantial amount of anecdotal biological information has been collected and numerous studies in the southern United States have been conducted on many of the species of horned lizards, including populations that were formally considered to be the same species as the Pygmy Short-horned Lizard, but are now recognized as *P. hernandesi*. Excellent observations are summarized in Amphibians and Reptiles of the Pacific Northwest (Nussbaum *et al*. 1983) and Reptiles of Washington and Oregon (Brown *et al*. 1995). In addition to these texts, a doctoral study was conducted on lizard life histories with specific information on the ecology and behaviour of Pygmy Short-horned Lizards (Zamudio 1996). Another study was conducted in Idaho, focusing on the growth rates and densities of Pygmy Short-horned Lizards (Guyer and Linder 1985) and another on the ecology of a population in Kittitas County, Washington (Lahti 2005). A brief study of the relationship between land management activities and Pygmy Short-horned Lizard abundances was also conducted in Idaho (Reynolds 1979). Beyond this, it is necessary to speculate about their biology, based on what is known of other horned lizards, in particular, the extensive studies that have been done on the Greater Short-horned Lizard in Alberta at the same latitude (e.g., Powell and Russell 1985, 1991a,b, 1993, 1994, 1996, 1998, James 1997, 2002, 2004, Powell *et al*. 1998). Consequently, great attention has been paid in this report to identifying whether the following information is specific to Pygmy Short-horned Lizards, other species of horned lizard, or just horned lizards in general.

Life cycle and reproduction

Short-horned Lizards are the most cold tolerant of the horned lizards but must nonetheless seek winter refugia during the cold winters typical of northerly latitudes or high elevations (Heath 1964, 1965). During hibernation, metabolism is greatly reduced as a function of body temperature. Hibernacula have been observed for the Greater Short-horned Lizard in Alberta where lizards burrow only to about 10 cm, and it is thought that snow cover provides additional insulation against freezing (e.g., James 1997). This strategy poses a dilemma in areas such as the Okanagan and Similkameen valleys that often have little or no snow cover during cold periods in the winter. These lizards must find deeper refugia, employ cryonics, or suffer widespread mortalities. Pygmy Short-horned Lizards emerge from winter hibernacula in late March to early June, depending on local climate (Brown *et al*. 1995). In the Okanagan, the Western Skink emerges from hibernacula in late March to early April (Sarell unpubl. data).

Mating occurs shortly after winter emergence (Brown *et al*. 1995), which is typical for most horned lizards (Pianka and Parker 1975, Montanucci and Baur 1982, Sherbrooke 2003). During the mating period, adult male horned lizards defend territories by performing head bobbing and pushup displays when another male is encountered, while adult females roam among males' territories until mating occurs (Sherbrooke 2003).

The embryos are retained in the mother throughout gestation and young are born live. Viviparity (retention of eggs until live birthing) is typical of all short-horned lizard species and two other species of high elevation horned lizards in Mexico. Live bearing is an adaptive strategy employed by many reptiles in cooler climates or where seasons of activity are shorter (e.g., Zamudio and Parra-Olea. 2000). Clutch sizes for other species of short-horned lizards have exceeded 30 (e.g., Goldberg 1971), but in the Pacific Northwest clutch sizes appear to range from 3 to 15 (Nussbaum *et al*. 1983, Brown *et al*. 1995, Stebbins 2003), with a tendency for larger and presumably older, female horned lizards give birth to larger numbers of young (Sherbrooke 2003). Pygmy Short-horned Lizards are born in August to mid-September in eastern Washington and Oregon (Brown *et al*. 1995); however, the first neonate observation in Kittitas County was on the 16th of July (Lahti 2005). *Phrynosoma hernandesi* in Alberta is reported to have a single brood each year with parturition occurring in late July (Powell and Russell 1991a), similar to that found in Kittitas County. Two high elevation species in Mexico extend embryonic development over winter and young are born in the following summer (Zamudio and Parra-Olea 2000). Maternal care for newborns has not been reported.

One mark-recapture study in Idaho surmised that male Pygmy Short-horned Lizards cease to grow after one year whereas females continue to grow throughout their second year, attaining larger adult sizes than males (Guyer and Linder 1985). Growth rates for *P. hernandesi* in Alberta have been observed to be the same for both sexes until they reach approximately 270 active days old, at which point males cease to grow and female growth continues (Powell and Russell 1991a). Sexual maturity in males is thought to occur in their second year, as has been documented for *P. hernandesi* in Alberta (Powell and Russell 1991a). Consequently, their first breeding experience could not occur until the following spring. Females of the same species in Alberta become mature in their second year and would also have to wait until the following spring to breed (Powell and Russell 1991a).

Longevity of short-horned lizards is not well documented. Growth studies of the Greater Short-horned Lizard (*P. hernandesi*) indicate that minimum ages of adults are two for males and three for females and estimated maximum longevity exceeds five years (Powell and Russell 1991a). Guyer and Linder (1985) refer to Pygmy Short-horned Lizards in Idaho as being “long-lived iteroparous” (capable of multiple, separate breeding events). This statement is based on the low mortality rate associated with adults (35%) as compared to neonates (90%). However, it should be noted that mortality rates could be lower if emigration had gone undetected. In the wild, the Desert Horned Lizard (*P. platyrhinos*) is known to live at least eight years and horned lizards are capable of living 10 years in captivity (Sherbrooke 2003). A generation time of five years for the Pygmy Short-horned Lizard is assumed.

Foraging

All horned lizards consume terrestrial invertebrates, with at least 50% of their diet consisting of ants (Sherbrooke 2003). The most sought after are harvester ants (*Pogonomyrmex* spp.). Horned lizards are unaffected by the stings of these ants

(Schmidt *et al*. 1989) and are able to consume some 70+ ants per day, and perhaps as many as 200 (Whitford and Bryant 1979, Sherbrooke 1995). Worker ants are usually taken at the entrance to the nest or along foraging trails. Harvester ants can be locally plentiful and are eaten by very few other predators and subsequently are easily exploited, even by young horned lizards with small gapes. Ants, however, have a very low nutrient to exoskeleton ratio so many must be eaten to fulfill a lizard's nutritional demands, and hence the advantage of a very large stomach.

Juvenile Short-horned Lizards almost exclusively eat ants, which constitute up to 90% of their diet (Lahti 2005). Adult horned lizards, especially females, have large gapes and are capable of consuming larger insects (e.g. Orthoptera, Coleoptera) and other invertebrates (Powell and Russell 1983), including snails (Stebbins 2003). In Kittitas County adult diets were almost 70% ants, and beetles were the next most commonly eaten prey (Lahti 2005), which is consistent with prey studies in northern California (Zamudio 1996). This diversity may permit some partitioning of prey resources between different ages and sexes within the same general area.

It is believed that horned lizards do not require free-standing water. It is assumed that their water requirements are met by licking dew, taking advantage of precipitation by "rain harvesting" (translocation of water along scutes to the mouth) and from the prey they consume (Sherbrooke 2003).

Defences and predation

Horned lizards avoid predation initially by flattening their bodies onto the ground and remaining motionless. When immobility is coupled with their cryptic appearance, lizards often go unnoticed by potential predators. Smaller, fast-moving predators that detect horned lizards are met with a bluff consisting of inflating the body and sometimes lunging at the predator (Sherbrooke 2003). Fleeing is attempted when slow-moving predators approach. Attempts to bite the lizard are usually painful because of the horns and attempting to swallow the lizard can cause death to predators such as snakes and hawks when the lizard becomes lodged in the throat (Sherbrooke 2003). This is less effective for *P. douglasii* as its horns are relatively small, possibly a result of having few reptilian predators which swallow their prey whole (e.g., leopard lizards, whiptails) throughout their range (Dumas 1964). Some horned lizards are capable of squirting blood derived from a sinus below their eyes, especially during encounters with canids (e.g., coyotes), which find the liquid distasteful. In humans, the blood causes eye irritation (Sherbrooke 1983, 2001, 2003) and hence these two species do not see eye to eye. Squirting blood has not been observed in Pygmy Short-horned Lizards (Sherbrooke 2001).

The most effective predators of Short-horned Lizards are birds, especially Loggerhead Shrikes (Pianka and Parker 1975). This shrike is considered a rare visitor in western Canada so it is unlikely to be a significant predator of the Canadian population of Pygmy Short-horned Lizards. The Northern Shrike is a common overwintering resident within the range of these lizards, but most of the birds do not

arrive until October and leave by April (Cannings *et al*. 1987), during which time the lizards are hibernating. Other avian predators include hawks, such as the American Kestrel (Sherbrooke 2003), which can be relatively abundant in the Okanagan and Similkameen Valleys. Ravens, Burrowing Owls and Swainson's Hawks have also been reported to prey upon horned lizards (Duncan *et al*. 1994, Whitford and Bryant 1979). Wild felids have not been identified as predators but the domestic cat has been cited as a significant predator (e.g., Monaster 1997).

Dispersal/migration

Virtually nothing is known of dispersal or migration behaviour of the Pygmy Short-horned Lizard. Hibernacula could be located within their active home range or could be located some distance away. The Greater Short-horned Lizard was detected moving 100 m during the breeding season and 266 m over a one week period prior to hibernation (James 2004). One Greater Short-horned Lizard in Utah was translocated and returned 400 m to its place of capture (Pianka and Parker 1975), indicating a capability of homing behaviour.

Adaptability

Horned lizards are not very adaptable to changes in their environments. They have evolved physiology and behaviours that bond them to arid environments. Even within these arid ecosystems their occurrence is not ubiquitous (James 2004). Even subtle changes such as colonization by invasive plants or agronomic species can make habitat unsuitable (e.g., Reynolds 1979). In addition, horned lizards are dietary specialists, feeding primarily on one species of ant.

POPULATION SIZES AND TRENDS

Search effort

Pygmy Short-horned Lizards are very difficult to detect, as they can be either underground, or motionless and camouflaged. Therefore, negative search results do not confirm the absence of the species in an area. Four separate survey attempts have been made to find the Pygmy Short-horned Lizard in Canada. Stan Orchard conducted the first of these in 1989 (Orchard 1990). Surveys were conducted on the east side of Osoyoos Lake, Veronica Lake on Anarchist Mountain and Chopaka in the Similkameen. No lizards were observed but it is unclear how much effort was expended.

A 10-day survey was conducted by G. Powell who searched the east side of Osoyoos Lake as far south as the International Border (Powell and Russell 1991b). If one assumes that approximately 100 hours were expended and that density might be similar to that reported for *P. hernandesi* at a study site in Saskatchewan (Powell and Russell 1998), then as many as four Pygmy short-horned Lizards could have been expected to be found. However, no lizards were found in their search. Search efforts in

Washington State yielded less than one (0.71) individual per search hour (Lahti 2005) and up to three per search hour (S. Fitkin pers. comm.).

In 2003, the author conducted four surveys averaging four hours each for a total of 16 hours over a 20-ha parcel that was about to be developed into a vineyard (Sarell unpubl. data). No lizards were found despite very suitable habitat conditions.

In 2004, a series of drift fences (totaling 200 m) and pitfall traps were installed for a week on the Osoyoos Indian Reserve (Reballato 2004). The site was dominated by big sagebrush, had silty soils and an abundance of harvester ants. Traps were checked daily but no lizards were captured.

Abundance

P. douglasii is considered to be fairly stable throughout most of its range (G5) with an assumed metapopulation of more than 10,000 individuals, but is considered vulnerable (S3) in Washington State (NatureServe Explorer 2005). There have only been two confirmed observations in British Columbia and although unconfirmed observations have been made as recently as 2004, the population is assumed to have dwindled or become extirpated. The majority of the population decline may have occurred prior to the 1900s. The greatest reported density of Pygmy Short-horned Lizards is 14 per ha in Idaho (Guyer and Linder 1985) but most sites are probably similar to that reported in Kittitas County, where 1.7 *P. douglasii* per hectare were found.

The abundance of Pygmy Short-horned Lizards in Canada, either historically or currently, is entirely unknown. Four surveys within the past 20 years have not revealed any individuals, but there appears to be a much larger area of potentially suitable habitat than has been surveyed and anecdotal reports continue to occur.

The first record of the Pygmy short-horned Lizard in Canada was made by Charles de Bois Greene at Osoyoos in 1898 (Fannin 1898). He captured two individuals and these specimens are housed in the Royal BC Museum. It was previously speculated that the lizards were found on the east side of the valley, likely on the Osoyoos Indian Reserve (Orchard 1990, Powell and Russell 1991b). However, de Bois Greene lived on the west side of the valley and could have easily found them on the slopes above his house, which were undeveloped at the time (W. Preston pers. comm.). There is some confusion regarding the collection date as Cowan (1936) cites the year as 1910 and that has appeared in other accounts (e.g., Gregory and Campbell 1984). Other early accounts cite the Pygmy Short-horned Lizard as occurring near Keremeos in the Similkameen Valley (Anderson 1901) or as far north as Vaseux Lake in the Okanagan Valley (Parham 1937). Neither of these accounts provides any substantiation to its claims. One individual was captured and released near Osoyoos by J.D. Gregson and G.P. Holland in 1937 (Orchard 1990). Apparently they provided a very compelling account. Bill Preston found another individual dead on the road near the Chopaka Border in the lower Similkameen Valley in 1960. Unfortunately the specimen was not collected. Vic Palermo found four during the 1970s, one each at Chopaka and

Anarchist Mountain (East of Osoyoos), and two near Vaseux Lake. Palermo also recalled that the "old fellow on Highway 3 that sold turtles" reported seeing one near Kaleden (south of Penticton), probably in the 1970s. A poll conducted with Osoyoos Indian Band members (Chapman 1995) produced five accounts of six individuals, mostly observed in the 1970s and 1980s. More recently, reports have come from the Richter Pass, Cawston, and the Nk'Mip Desert and Heritage Centre east of Osoyoos. All but one observation were from sites in arid ecosystems. In total, 19 individuals have been reported (Sarell unpubl. data). This probably represents considerably fewer sightings than have been made of the Ogopogo in the same time period, but at least there are two lizards in a jar to provide an indisputable argument that they are not myth in British Columbia. However, until a confirmed observation is made, this lizard must still be considered extirpated from Canada.

Fluctuations and trends

Horned lizard populations are declining throughout most of their ranges due to anthropogenic impacts (e.g., Pianka and Vitt 2003). Fluctuations in horned lizard occurrence in specific areas have been observed and thought to be due to weather variation between years (Flat-tailed Horned Lizard Interagency Coordinating Committee 2003).

Rescue effect

Although undeveloped lands, which appear to be suitable Pygmy Short-horned Lizard habitat, occur immediately south of the International Border, the closest confirmed existing populations are 60 km further south. If this population is truly the nearest then recolonization through immigration appears unlikely given the small size and limited mobility of individual Pygmy Short-horned Lizards.

LIMITING FACTORS AND THREATS

Pygmy Short-horned Lizard populations tend to be localized and are therefore susceptible to local extinction if the area is developed or some other lethal threat occurs. The restricted mobility of horned lizards also curbs their ability to cross unsuitable habitat, such as developments, and canals can create impassable barriers or ongoing sources of mortality.

The first large-scale threat that may have significantly reduced Pygmy Short-horned Lizard populations was large cattle drives that went through the Okanagan Valley from the 1860s up to the first World War (R. Manuel pers. comm.). During this period, tens of thousands of cattle were herded from Oregon to the Cariboo to sustain miners working in the gold rush (Cox 2004). The destructive impact from trampling would have been concentrated in the Okanagan due to the narrowness of the valley. It is possible that these numerous herds of livestock decimated local populations that lived on the benchlands of the valley. Normal grazing practices appear to have no effect or a

positive effect on Pygmy Short-horned Lizard habitat (Reynolds 1979), although overgrazing reduces horned lizard abundance by affecting the structural richness of the plant community (Fair and Henke 1998) and may also reduce harvester ant populations, the lizards' main food source (Rogers *et al*. 1972).

Horned lizards require an uncluttered environment to navigate through and to thermoregulate. Invasive plants, such as cheatgrass (*Bromus tectorum*), are tenacious and widespread, effectively choking interstitial spaces between native vegetation. This may make much of the habitat unusable by restricting movement. Some weeds, such as puncture vine (*Tribulus terrestris*) and longspine sandbur (*Cenchrus longispinus*) could cause physical injuries.

Unlike most other temperate-zone reptiles, Pygmy Short-horned Lizards seek only shallow subterranean refuge during winter. In years of low snowfall, extreme or prolonged cold could cause widespread mortality.

Predation may be increased through enhanced natural predator populations (e.g., ravens, crows, kestrels) and the introduction of domestic predators (e.g., dogs and cats).

Road and off-road traffic has been implicated as a source of mortality for horned lizards (Nicolai and Lovich 2000, Flat-tailed Horned Lizard Interagency Coordinating Committee 2003). Two of the anecdotal observations made in Canada were of road-killed individuals on highways (Sarell unpubl. data).

Fire suppression has changed much of the dry landscape that could be used by Pygmy Short-horned Lizards. Lack of fires has allowed trees to encroach into grasslands and fuels to accumulate. The Texas Horned Lizard has been found to have better survivorship in areas that have been burned (Moeller *et al*. 2005).

SPECIAL SIGNIFICANCE OF THE SPECIES

Horned lizards have fascinated the public and scientists for centuries and made significant impressions on Aboriginal peoples within their ranges (e.g., Monaster 1997, Sherbrooke 2003). In Canada, their presence, or past presence, is a reminder of the vanishing arid ecosystem that is often touted as Canada's only desert. If climate is a limiting factor then it is especially important to acknowledge that this was the species' ecological limit and that its physiological and behavioural tolerances may have failed here. If global warming is occurring, then there may be continued opportunities for their expansion into Canada, providing the habitat is maintained.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The Pygmy Short-horned Lizard is currently listed in Schedule 1 of the Canadian *Species at Risk Act*. This listing affords the species full protection under SARA in the

event it is rediscovered. Residence descriptions are being prepared (L. Campbell pers. comm.) and Critical Habitat is yet to be described. The Pygmy Short-horned Lizard is classified under the British Columbia *Wildlife Act* (1990) and the *Wildlife Amendment Act* (2004). Under these acts, a person must not kill, harm, harass, capture or take an individual of a species at risk or damage or destroy a residence of a species at risk, except as authorized by regulation or by a permit or agreement.

The Pygmy Short-horned Lizard is considered globally secure (G5), secure (N5) within the United States, vulnerable (S3) in Washington, apparently secure (S4) in Oregon and California, secure (S5) in Idaho, and not ranked (SNR) in Nevada (NatureServe 2005).

TECHNICAL SUMMARY

Phrynosoma douglasii
Pygmy Short-horned Lizard Iguane pygmée à cornes courtes
Range of Occurrence in Canada: south Okanagan and Similkameen valleys

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* **Unable to calculate as there are no confirmed data points**	Unknown or 0km^2
• *Specify trend in EO*	None
• *Are there extreme fluctuations in EO?*	Unlikely
• *Area of occupancy (AO) (km²)* **Unable to calculate as there are no confirmed data points**	Unknown or 0km^2
• *Specify trend in AO*	None
• *Are there extreme fluctuations in AO?*	Unknown
• *Number of known or inferred current locations*	None confirmed
• *Specify trend in #*	unknown
• *Are there extreme fluctuations in number of locations?*	No
• *Specify trend in area, extent or quality of habitat*	Habitat rapidly being converted or degraded by invasive plants and by human activities.
Population Information	
• *Generation time (average age of parents in the population)*	5 years
• *Number of mature individuals*	Unknown, likely zero
• *Total population trend:*	None
• *% decline over the last/next 10 years or 3 generations.*	Unknown
• *Are there extreme fluctuations in number of mature individuals?*	No
• *Is the total population severely fragmented?*	Probably if it exists
• *Specify trend in number of populations*	Unknown, probably none
• *Are there extreme fluctuations in number of populations?*	No
• List populations with number of mature individuals in each: unknown; probably none	
Threats (actual or imminent threats to populations or habitats)	
Loss of habitat; Lack of rescue effect	
Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* **USA: N5** Washington State: Vulnerable (S3)	
• *Is immigration known or possible?*	Possible but unlikely
• *Would immigrants be adapted to survive in Canada?*	Probably
• *Is there sufficient habitat for immigrants in Canada?*	Yes
• *Is rescue from outside populations likely?*	Unlikely
Quantitative Analysis	May already be extirpated
Current Status COSEWIC: Extirpated (1992, 2000, 2007)	

Status and Reasons for Designation

Status: Extirpated	**Alpha-numeric code**: **Not applicable**
Reasons for Designation: There have been no confirmed sightings in the past 100 years, although there have been anecdotal reports during that time.	
Applicability of Criteria **Criterion A**: (Declining Total Population): Not applicable **Criterion B**: (Small Distribution, and Decline or Fluctuation): Not applicable **Criterion C**: (Small Total Population Size and Decline): Not applicable **Criterion D**: (Very Small Population or Restricted Distribution): Not applicable **Criterion E**: (Quantitative Analysis): Not applicable	

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Mike Sarell was born and raised in the South Okanagan before earning his Bachelor of Science at the University of Victoria. Mike still resides in the South Okanagan and has been closely involved with a wide array of inventory, research, and conservation activities for reptiles, amphibians and bats. He is also participates in a resource capacity for the Southern Interior Reptile and Amphibian Recovery Team and prepared the draft Recovery Strategy for the Pygmy Short-horned Lizard.

COLLECTIONS EXAMINED

There are only two Canadian specimens ever collected in Canada. Both of these are housed at the Royal BC Museum in Victoria, BC. Both specimens are housed in the same jar. The label reads 1900-1910.

Specimen 0323.00 is an adult female (SVL 61.0 mm) and is apparently gravid with 4 sizable lumps in the abdomen.

Specimen 0324.00 is a subadult female (SVL 45.7 mm) and does not appear gravid.