



**Great  
Basin  
Spadefoot  
Toad**

*The habitat of this  
dryland-adapted  
amphibian is under  
tremendous  
development pressure.*





## Why are Great Basin Spadefoot Toads at risk?

The Great Basin Spadefoot Toad is restricted in Canada to dry grassland valleys in south-central British Columbia, with the Okanagan Valley having the largest population concentration. The low-elevation dry grasslands of the Okanagan are one of Canada's most endangered ecosystems with less than nine percent of this habitat remaining undisturbed. The region faces tremendous development pressures, both from intensive agriculture and urbanization.

The Great Basin Spadefoot Toad needs three quite separate habitats: breeding ponds, foraging areas, and hibernating sites. Dispersal routes between these habitats are also required. Perhaps the most critical variable for an amphibian living in an arid environment is the availability of water for breeding. Great Basin Spadefoot Toads typically breed in small ponds that may dry up in July or August. These ponds must last at least six weeks for larval development to take place, usually finished by the end of June. In the last 20 years the water table has dropped significantly at many sites in the Canadian range of the Great Basin Spadefoot Toad. While this drop is partly due to reduced precipitation over that time period, accelerating human development in these areas and the consequent increase in the number of wells that have been dug is undoubtedly also lowering the water table.

Water quality and temperature are also important to breeding success, and water quality is often highly variable in the small ponds used by spadefoots. The high pH of many small ponds in their range may be a limiting factor. In dry

grasslands, cattle may congregate around water sources, including the small ponds used by spadefoots for breeding. Deep cattle hoofprints can create a multitude of tiny pools as a pond dries up instead of a single, larger pool. This can increase evaporation and decrease tadpole survival. On the positive side, irrigation projects can benefit the species by providing dependable breeding ponds in otherwise dry areas. These projects, however, may seriously impact the amount and quality of foraging habitat available to spadefoots by converting natural habitat to agricultural croplands.

The quality of habitat in remaining grasslands is a more difficult question to address. Since little is known about the foraging needs of Great Basin Spadefoot Toads, the effects of grazing or other disturbances are difficult to assess. As well, almost nothing is known about the hibernating sites used by this species. Concern has been raised over the effect of soil compaction by cattle, which may reduce the water content of the soil and also make it difficult for spadefoots to burrow below the surface.

Fragmentation of foraging habitat has almost certainly disrupted traditional spadefoot toad dispersal routes between breeding, foraging and hibernating sites. The increase in the number of roads, and more importantly, the amount of traffic, may have a significant impact on spadefoot populations by increasing the number of spadefoots killed on roads.

Although adult toads have noxious skin secretions to deter predation, they are eaten by snakes and larger predators such as Great Blue Herons and Coyotes. An adult Tiger Salamander was observed eating an adult Great Basin Spadefoot Toad in captivity. Tadpoles are likely eaten by a

variety of ducks and shorebirds, while Killdeer and Common Ravens have been seen eating dying larvae in a drying pond. Painted Turtles may be important predators on larvae as well.

The nocturnal habits of the Great Basin Spadefoot Toad and its tendency to remain underground for much of the year make it a difficult species to study, and we have much to learn about its biology in British Columbia.

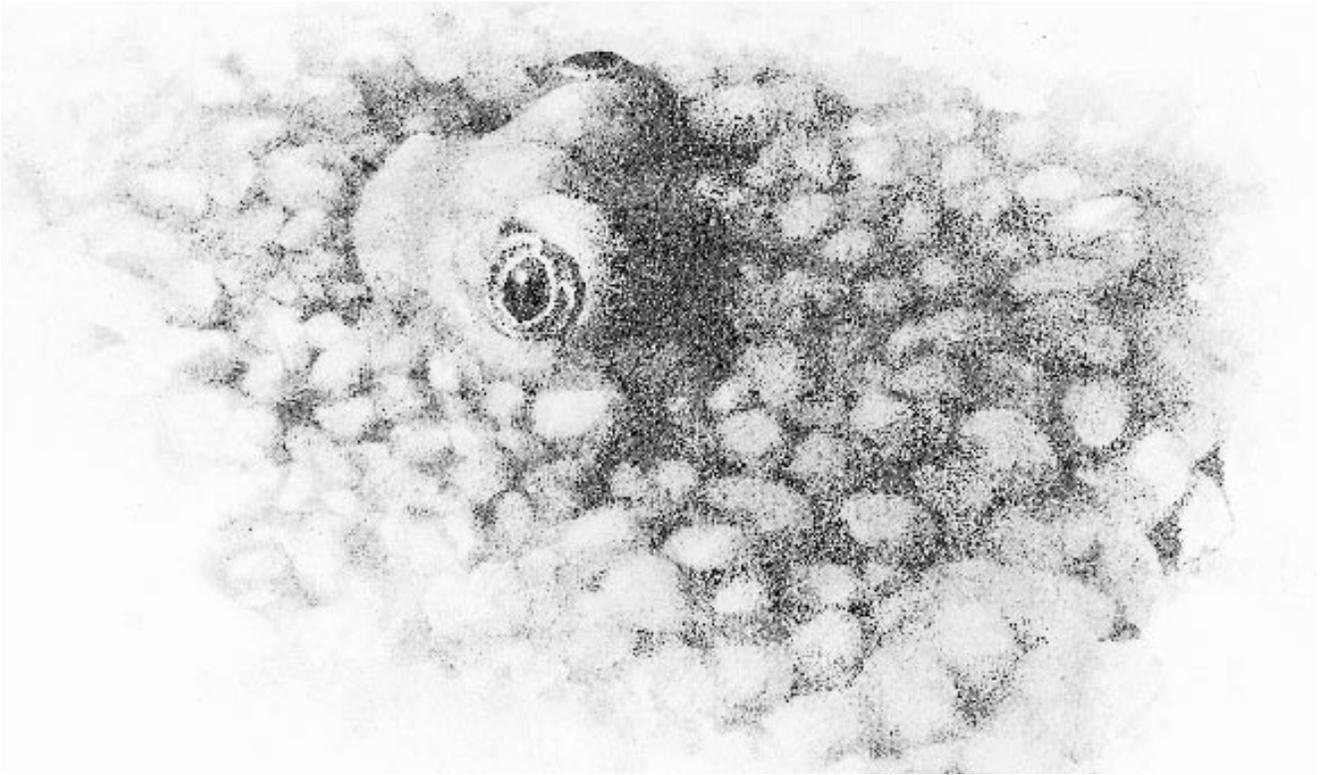
## What is their status?

Spadefoot toads are relatively widely distributed through the dry grasslands of the Southern Interior of British Columbia, but these grasslands make up only six percent of the province. Within these grasslands, spadefoots are restricted to areas with access to breeding ponds. During recent censuses, over half the calling males were found at only three sites. Two of these three significant breeding areas are protected.

Only three population surveys have been undertaken in British Columbia. The current population is probably at least 10 000. The range of the Great Basin Spadefoot Toad in British Columbia extends from the provincial border in the south, up through the Thompson and Okanagan valleys and north to 70 Mile House in the Cariboo, to Barriere along the North Thompson River and to Big Bar Creek along the Fraser River. They occur west to Princeton in the Similkameen Valley. Until recently they were unrecorded east of the Okanagan Valley, but in 1996, two adults were seen just east of Grand Forks. It is presumed that the British Columbia population has decreased due to loss of prime breeding, foraging and hibernating habitats, particularly in the Okanagan.

As a dryland amphibian at the northern edge of its range, the Great Basin Spadefoot requires a delicate balance of climatic variables. A series of hot, dry summers may cause a population decline through the reduction of low-elevation

*Spadefoot Toads may stay below ground for up to eight months each year.*



breeding sites, but may open up new habitats at higher elevations. A series of cool, wet summers might have a negative effect through the reforestation of grassland habitat, reducing the extent and quality of foraging habitat and likely increasing competition with other frogs and toads.

The Great Basin Spadefoot Toad is protected under the British Columbia *Wildlife Act*, but this legislation only covers the capture or killing of individuals, not matters affecting their habitat. It is on the provincial Blue List of species considered vulnerable. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has designated the species as Vulnerable.

The Great Basin Spadefoot Toad is not considered threatened or endangered in the United States, but the species has lost a considerable portion of its habitat there to intensive agricultural developments. It is found in dry grasslands north of the Colorado River, east of the Sierra Nevada and Cascade ranges and west of the Rocky Mountain divide.

What do they look like?

**T**he Great Basin Spadefoot Toad (*Spea intermontana*) is a small toad with a body length of 4 to 6.5 centimetres from snout to vent. It is grey-green with numerous dark brown or reddish tubercles and spots, and a greyish-white belly. Its limbs are relatively short. Its blunt snout is somewhat uptilted and a small lump or “boss” can be felt between the eyes.

Like all members of the spadefoot family, adult Great Basin Spadefoots have a characteristic black, keratinous “spade” on the sole of each hind foot that helps them dig into loose soil.

Great Basin Spadefoots also have distinctive vertical “cat’s-eye” pupils. Males – which are somewhat smaller than females – have dark throats and develop black pads on their inner three fingers during the breeding sea-

son. Spadefoot tadpoles are large and dark grey, with close-set, raised eyes.

What makes them unique?

**A**lthough amphibians are usually associated with ponds and marshes, the Great Basin Spadefoot Toad is a dry-land amphibian. All spadefoot toads occupy open, semiarid to arid habitats not normally associated with their water-loving relatives. They cope with this lack of water by burrowing underground and remaining dormant through dry or cold periods. Great Basin Spadefoot Toads may stay below ground for up to eight months each year. They emerge when a combination of warm weather and wet soil from rainfall or snowmelt provides the proper conditions for survival above ground. Spadefoots also have a variety of adaptations for living in a dry environment, including the ability to recover from extreme desiccation. They can lose up to 48 percent of their body weight in water and still survive.

The Great Basin Spadefoot Toad breeds in ponds fed by snowmelt and rainwater. Since many of these ponds dry

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up in early summer, breeding success is affected by fluctuations in water table levels, precipitation and air temperature in spring and summer. While the biology of several desert-dwelling spadefoot toad species has been intensively studied, relatively little is known about the more northern Great Basin Spadefoot Toad. Because it occupies somewhat different habitats, it may have significantly different life strategies than the desert species.

The size of breeding populations probably varies substantially from year to year depending on water table levels, temperature and rainfall. If a pond begins to dry up during larval development, older tadpoles can accelerate metamorphosis to some extent, but are thus smaller when they leave the pond, and smaller adult spadefoots lose water more quickly than larger ones.

Great Basin Spadefoot Toads go into hibernation in October in British Columbia. Some spadefoot species can theoretically remain dormant for two or more years waiting for suitable foraging and breeding conditions, but it is unknown whether the Great Basin Spadefoot Toad has or even needs this ability. The maximum longevity of the Great Basin Spadefoot Toad is unknown, but other spadefoot species can live 10 years or more.

How do they reproduce?

Spadefoot toads become sexually mature by their second or third year, when males measure about 4 cm in length and females about 4.5 cm. Adults begin to emerge from hibernation in early to mid April and move quickly to breeding ponds. There, the males begin to chant, distending their vocal sacs to produce their monotonous, grating “gwaa, gwaa” call, which says “come hither” to the females. As the males call in response to each other, they create a chorus of voices at different pitches, audible

up to 200 metres away. When mating, the smaller male grasps the female around her waist with his forearms. As the female lays her eggs, the male fertilizes them externally. The 300 to 800 black eggs are laid in clusters of 20 to 40 attached to sticks, pebbles or aquatic vegetation.

The length of the breeding season is measured by the presence of calling males. At any given site it can vary from one month to less than a week. Sites occupied earlier in the season have calling toads longer than those occupied later in the summer.

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The breeding season in the northern parts of the species’ range lasts from April to June. It may be limited by the sensitivity of eggs to high water temperatures. While this has not been studied in the Great Basin Spadefoot Toad, newly laid eggs of closely related spadefoot species perish at temperatures of 37°C.

Eggs hatch in two to three days during warm weather, but can take up to seven days or longer in cooler weather. Hatchlings are 5 to 7 millimetres long. They grow quickly, metamorphosing into toadlets when 30 to 70 mm long, six to eight weeks after hatching. Young toads average 20.5 mm long (snout-to-vent length) at metamorphosis and often still have a substantial tail when

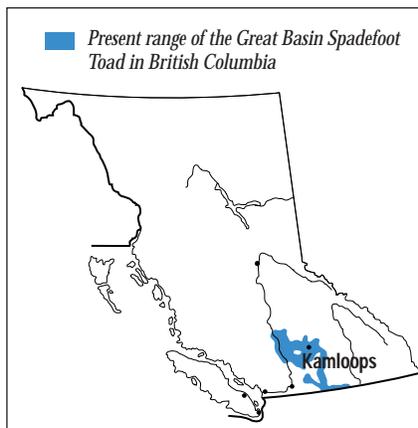


they leave the water. In British Columbia, most tadpoles are seen in May and most metamorphosed toadlets appear in July. Fungal infections may have a significant impact on the survival of eggs, but detailed information on egg and larval survival is completely lacking.

Dispersal from natal ponds can occur en masse. Hundreds of small, newly metamorphosed spadefoot toads are often seen crossing roads. There are no data on dispersal distances, nor on distances between foraging, breeding and hibernating areas.

What do they eat?

Spadefoot tadpole larvae are voracious scavengers on algae, aquatic plants, dead fish and even their own faeces. Other species of spadefoots are known to have carnivorous tadpole morphs (genetic variants) that specialize in eating brine shrimp, and sometimes become quite cannibalistic. These morphs can grow and metamorphose more quickly than the scavenging tadpoles, so are more likely to survive where small



ponds dry up quickly in early summer. It is not known whether Great Basin Spadefoot tadpoles ever exhibit this type of behaviour.

Adult spadefoot toads eat a variety of invertebrates, including earthworms, ants, beetles, crickets, grasshoppers and flies. They forage nocturnally, especially on rainy nights or nights with high humidity. Little is known about their foraging habitat requirements. Some other spadefoot species can obtain enough food energy to survive a year of dormancy in as few as seven feedings.

Where do they live?

In the United States, Great Basin Spadefoot Toads are found in a variety of grassland and open woodland habitats, including sagebrush flats, semidesert shrublands, juniper woodlands and, in the southern part of their range, open spruce-fir forests. In British Columbia they occur over a wide range of elevations, but most are found below 600 metres in bunchgrass habitats. Smaller concentrations occur in open ponderosa pine and Douglas-fir forests up to 1200 m. A few tadpoles have been found in small lakes as high as 1800 m.

Because spadefoots burrow underground to minimize water loss, they need either loose, uncompacted soil for easy burrowing, or access to rodent burrows for daytime retreats.

Detailed surveys have been carried out in the south Okanagan and the Thompson and Nicola valleys. Out of approximately 4200 singing males counted during censuses between 1993 and 1996, 60 percent of the population was found at 56 sites in the South Okanagan, 35 percent at 24 sites in the Thompson Valley, and 5 percent at 31 sites in the Nicola Valley. No surveys have been done in the north Okanagan Valley, but there are specimen and sight records from that area and suitable habitat is abundant, especially around Vernon.



THE GREAT BASIN SPADEFOOT TOAD IS ONE OF OUR MOST APPEALING AMPHIBIANS. Leah Ramsay photo

In the Thompson-Nicola area, spadefoots clustered around seepage areas where fresh water was entering small ponds. The pH was around 8.5 at the seepage sites and about 10 elsewhere in the pond where the toads were absent.

Competition with other frogs and toads, particularly the Pacific Treefrog, could exclude spadefoots from certain breeding sites. Researchers have noted adjacent ponds occupied exclusively by either treefrogs or spadefoots. This aspect of spadefoot ecology clearly needs further study. Spadefoots may also be excluded from ponds with large numbers of Painted Turtles.

What can we do?

The Great Basin Spadefoot Toad is one of a number of wildlife species at risk that live in the grasslands and open woodlands of the Southern Interior of British Columbia. Animals such as the Pigmy Short-horned Lizard, Night Snake, Gray Flycatcher and Pallid Bat, as well as a host of rare insect and plant species, are found nowhere else in Canada. As with other species at risk, the Great Basin Spadefoot Toad is limited by the availability and quality of its required habitat. Survival of these toads requires protection of breeding ponds, foraging areas and hibernating sites. The toad must also be able to travel along dispersal routes between these habitats.

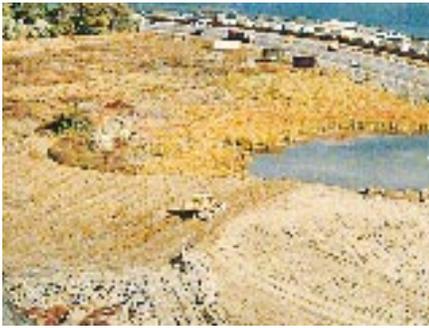
The concentration of half the population of breeding males in two areas – the Osoyoos Oxbows at the north end of Osoyoos Lake, and the Osoyoos sewage lagoon – makes protecting these local areas of critical importance. The Haynes Lease Ecological Reserve provides 100 hectares of secure habitat for the large population breeding and foraging at the north end of Osoyoos Lake. The adjacent South Okanagan Wildlife Management Area provides additional habitat for that population, but at a lower level of protection. Perhaps the most endangered population of spadefoots is the 1000 or so breeding pairs at the Osoyoos sewage lagoon which represent almost one-quarter of the known Great Basin Spadefoot Toads in Canada.

As of 1994, less than one percent of British Columbia's grasslands was protected, although this figure has risen somewhat with new protected areas being set aside by the provincial government in the Churn Creek and Lac du Bois areas. The latter area includes the third-largest known spadefoot breeding site. The Nature Trust of British Columbia has acquired several properties with spadefoot toad habi-

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tat, the most significant being the White Lake Ranch west of Okanagan Falls. Further sites in the south Okanagan-Similkameen area may be set aside as well, as part of the ongoing Okanagan-Shuswap Land and Resource Management Plan.

Water bodies of all sizes adjacent to grasslands should be maintained wherever possible throughout the species'



AMPHIBIAN HABITAT IN THE OKANAGAN IS BEING LOST TO DEVELOPMENT. *Steve Cannings photo*



GRASSLAND ADJACENT TO MARSHLAND PROVIDES GOOD SPADEFOOT HABITAT. *Steve Cannings photo*



THE "SPADE" ON THE HIND FOOT GIVES THIS SPECIES ITS NAME. *Steve Cannings photo*



WHITE LAKE IS AN IMPORTANT BREEDING AREA FOR GREAT BASIN SPADEFOOT TOADS. *Richard Cannings photo*

range in Canada. This includes temporary ponds that may only be filled with water for a short time or only in wet years. Development on privately owned land next to major breeding sites could be designed to preserve a permanent source of foraging and hibernating sites and movement corridors. Private land-owners should be encouraged to maintain and enhance habitat by fencing ponds to minimize damage by livestock. Amphibian culverts could be installed as part of new or existing roadways that cut through critical movement corridors near major breeding sites. Fish introductions should not be considered in ponds known to support breeding populations of spadefoot toads.

More basic biological information is critically needed for this species. Almost nothing is known about the habitat variables that might explain the distribution of toads in breeding ponds, including water chemistry, temperature, aquatic vegetation, competition with other species and food availability. A system of periodic

monitoring surveys should be set up to assess population levels. The surveys could be done by trained volunteers, but must be organized by wildlife conservation agencies. This could be in the form of a broader survey for all amphibian species, or could focus on spadefoot toads. These surveys should cover known concentrations, but also systematically census the North Okanagan, Similkameen, Grand Forks and Cariboo-Chilcotin areas. Information on distribution of this species is maintained by the BC Conservation Data Centre.

Information about soil characteristics and plant life of movement corridors and

hibernation and foraging areas around the large breeding ponds in the Lac du Bois region, Osoyoos sewage lagoons and Osoyoos Oxbows should also be documented. Until this research is undertaken, all native grasslands surrounding these sites should be managed for wildlife conservation, maintaining a mosaic of grassland habitats at different stages in development.

Your support for further Great Basin Spadefoot Toad research and for the protection of breeding sites, is important to the long-term survival of British Columbia's only desert-adapted amphibian. 

FOR MORE INFORMATION ON THE GREAT BASIN SPADEFOOT TOAD, CONTACT:

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BROCHURE FUNDING PROVIDED BY  
*and by Forest Renewal British Columbia*

ISBN 0-7726-7666-6  
MELP 973740.299  
FEBRUARY 1999

TEXT BY RICHARD J. CANNINGS  
ARTWORK COPYRIGHT MICHAEL HAMES  
DESIGN BY ARIFIN GRAHAM, ALARIS DESIGN  
DISTRIBUTION MAP BY RICK PAWLAS  
PROJECT COORDINATION BY LAURA FRIIS

Printed in British Columbia on recycled paper with vegetable inks  
Q.P. 4500015472

