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Status of the  
Columbia Spotted Frog  
(Rana luteiventris)  
in Alberta

Janice D. James



Alberta Wildlife Status Report No. 17



Alberta  
ENVIRONMENTAL PROTECTION



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## PREFACE

Every five years, the Fisheries and Wildlife Management Division of Alberta Natural Resources Service reviews the status of wildlife species in Alberta. These overviews, which have been conducted in 1991 and 1996, assign individual species to 'colour' lists that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A primary objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the 1996 *Status of Alberta Wildlife* review process, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are potentially at risk in the province (Red or Blue listed), that are of uncertain status (Status Undetermined), or which are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fisheries and Wildlife Management Division of Alberta Environmental Protection, and are intended to provide detailed and up-to-date information which will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information which will assist the Alberta Endangered Species Conservation Committee to identify species that may be formally designated as endangered or threatened under the Alberta Wildlife Act. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

## EXECUTIVE SUMMARY

The Columbia Spotted Frog (Rana luteiventris) is currently on Alberta's 'Blue List' due to the limited population information, and reports of reduced numbers. In British Columbia, where there is no evidence of a widespread decline, the species is regarded as a 'Yellow-listed, conservation emphasis' species. No federal status has yet been assigned to this species. This report reviews information on the Columbia Spotted Frog in Alberta, as a step in updating the status of this species in the province.

Formerly known as the 'Spotted Frog' or the 'Western Spotted Frog' (Rana pretiosa), this species has been subjected to genetic analysis and the species found in Alberta is now known as the Columbia Spotted Frog (Rana luteiventris). Spotted Frogs are endemic to northwestern North America, and are most common in mountainous and high-altitude areas. In Alberta, Spotted Frogs occur within the Rocky Mountain and foothills regions, where they inhabit cool, relatively permanent water sources (Stebbins 1985, Russell and Bauer 1993).

Little can be stated regarding population trends for the Columbia Spotted Frog in Alberta. However, some recent reports suggest Alberta populations may be in decline. Specifically, apparent declines in numbers and range may have occurred in the 1970s and 1990s. Within the province, the species has a discontinuous distribution and low population densities where it does occur. Human related factors which may be limiting to Spotted Frogs include habitat loss and degradation, predation by introduced species, and the potential negative effects of increasing UV-B levels. Furthermore, these frogs undergo a relatively long developmental period before reaching sexual maturity, a trait that renders them especially susceptible to population disruption. Long-term population monitoring is essential in order to effectively assess population trends.

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## TABLE OF CONTENTS

PREFACE .....	iii
EXECUTIVE SUMMARY .....	iv
ACKNOWLEDGEMENTS .....	v
INTRODUCTION .....	1
HABITAT .....	1
CONSERVATION BIOLOGY .....	4
DISTRIBUTION .....	7
1. Alberta.....	7
2. Other Areas .....	9
POPULATION SIZE AND TRENDS .....	9
1. Alberta.....	9
2. Other Areas .....	11
LIMITING FACTORS.....	11
1. Predation by Introduced Species .....	11
2. Habitat Loss .....	12
3. Changes in Water Quality.....	12
4. Disturbance.....	13
5. Competition.....	13
6. Global Climate Changes.....	13
STATUS DESIGNATIONS.....	13
1. Alberta.....	13
2. Other Areas .....	13
RECENT MANAGEMENT IN ALBERTA .....	14
SYNTHESIS.....	14
LITERATURE CITED .....	16
APPENDIX 1.....	20

## INTRODUCTION

Since 1991, Spotted Frogs have been on Alberta's 'Blue List\*' of species that current knowledge suggests may be at risk of declining to non-viable population levels in the province (Alberta Fish and Wildlife 1991, Alberta Wildlife Management Division 1996). The population status remains uncertain and investigation is required to determine if a possible decline in numbers or numbers of populations is occurring (Alberta Wildlife Management Division 1996). The federal status of the species is currently under review by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; K. Ovaska, in prep.).

The species of Spotted Frog that occurs in Alberta was previously classified, along with all Spotted Frogs in North America, as Rana pretiosa (Turner and Dumas 1972, Stebbins 1985, Russell and Bauer 1993). There has long been confusion regarding the appropriate taxonomic designation of this species (e.g. Dumas 1966, Case 1978). Although these frogs do not vary greatly in appearance over most of their range (Green et al. 1996), some life history differences have been documented between eastern and western populations (Licht 1975). Recent analysis of the genetic makeup of the Spotted Frog complex has resulted in a revision of the earlier classification (Green et al. 1997). The species of Spotted Frog which inhabits the mountainous regions of Alberta and most of British Columbia has been renamed as the Columbia Spotted

Frog (Rana luteiventris). There is only one population of the Oregon Spotted Frog (which has retained the scientific name Rana pretiosa) known to occur in Canada. It is restricted to the extreme lower mainland region of British Columbia, although the species otherwise occurs in isolated patches as far south as northern California (Green et al. 1997).

As this reclassification is very recent, much of the information available on these frogs is based upon its previous designation as a single species, simply the 'Spotted Frog'. This earlier classification is maintained throughout the report wherever it is not obvious which of the two new species the study population refers to. For this reason the geographical location from which referenced information is taken has been included whenever possible.

This report summarizes historical and recent information on the Columbia Spotted Frog in order to update the status of the species in Alberta.

## HABITAT

Spotted Frogs have regularly been described as "highly aquatic" (Stebbins 1985, Russell and Bauer 1993). They are generally associated with cool, permanent water sources such as slow-moving streams, rivers, marshes, springs, pools, and the margins of small lakes, usually with abundant aquatic vegetation (Stebbins 1985, Corkran and Thoms 1996). Turner (1960) interpreted the "highly aquatic" description to mean that the species rarely moves far from the banks of permanent streams. However, he found evidence that the species does make use of upland habitats, and will do

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\* See Appendix 1 for definitions of selected status designations



so for long periods of time if enough water and cover is available nearby. Although adults may move a considerable distance from water following breeding, they generally prefer ponds or quiet water in subalpine forests, in grassland, and in brushland of sage (Artemisia spp.) and rabbitbush (Chrysothamnus nauseosus; Stebbins 1985).

In Alberta, Holroyd and Van Tighem (1983) noted that the majority (60%) of Spotted Frog sightings in Banff and Jasper National Parks were from the lower subalpine ecoregion, in ecosites which included a range of moisture regimes. Spotted Frogs were also reported from alluvial fans and terraces in the montane ecoregions (35% of the total sightings) and even the upper subalpine ecoregion (4% of the total sightings). Salt (1979) described the general habitat preference of adult Spotted Frogs in the Rocky Mountain region of Alberta as follows:

“...they are often found along very small brooks, rills and flowing seeps with moss or taller vascular vegetation at medium and higher elevations. At the lower elevations this rill or spring environment, and the shallow margins of ponds, sloughs or even marshes with cattail, are suitable.”

Spotted Frogs in Alberta have been recorded to occur at elevations from around 995 m in the Jasper area to over 2150 m in the Kananaskis, Waterton and Crowsnest regions (Salt 1979). Williams (1994) found Spotted Frogs at elevations between 1620 and 1760 m in the

Kananaskis Valley, and at around 1760 m in the Smith-Dorien Valley. In Waterton Lakes National Park, the species ranges between approximately 1300 and 1930 m elevation (C. Wershler, unpubl. data). Unlike records from Banff and Jasper National Parks, Spotted Frogs in Waterton Lakes National Park occur primarily in the montane ecoregion, with the most significant populations being located in the foothills parkland and montane ecoregions, at elevations ranging from 1300 to 1500 m (C. Wershler, unpubl. data). Only a limited number of sightings have been located in the lower subalpine (C. Wershler, pers. comm.).

Williams (1994) reported finding adult Spotted Frogs at nine wetlands in Peter Lougheed Provincial Park in 1990. Four of these wetlands were deep ponds, two were deep lakes, one was a shallow pond, and the last was a beaver pond. The adult Spotted Frogs were found in water from 4 to 31 cm deep, or if on land, they were within 2 m of the water's edge (Williams 1994). Williams (1994) also reported finding adults near ponds with water temperatures varying from 11.5 to 23 °C and with pH values ranging from 7.8 to 9.1.

Most of the wetlands used by Columbia Spotted Frogs in Waterton Lakes National Park are spring-fed (C. Wershler, pers. comm.). Known sites include beaver ponds, pothole ponds, fens and small lakes within a variety of coniferous, mixed-wood and deciduous forest types (C. Wershler, pers. comm.). Where emergent vegetation does occur, sedges (Carex spp.) and swamp horsetail (Equisetum fluviatile) are typical, although emergent vegetation is not

always present. Occasionally, adults have been observed along slow-flowing creeklets after the breeding season has ended (C. Wershler, pers. comm.).

Spotted Frogs generally lay their eggs in the shallow, reedy water at the margins of ponds (Svihla 1935). In Alberta, Holroyd and Van Tighem (1983) stated that Spotted Frogs preferred small ponds and river lowlands as breeding sites. Salt (1979) remarked on the similarity of breeding pond preferences of Spotted Frogs and the Western Toad (Bufo boreas) in the Rocky Mountain regions. He described these breeding areas as "...shallow ponds, pools, small temporary puddles, ditches with standing water, backwaters or flood-pools of streams - the vegetation often scant, or even absent, both from bottoms and from margins". However, Salt (1979) commented that Spotted Frogs, unlike Western Toads, were not observed to breed in temporary (ephemeral) pools.

Other amphibian species which may be found along with Spotted Frogs in Alberta include the Long-toed Salamander (Ambystoma macrodactylum), Western Toad, and at lower elevations, Striped Chorus Frog (Pseudacris triseriata), Wood Frog (Rana sylvatica) and Tiger Salamander (Ambystoma tigrinum). Although Spotted Frogs have not generally been found to share breeding habitat with other Ranid species in Alberta (C. Wershler, pers. comm.) Spotted Frogs and Wood Frogs have recently been observed calling from the same wetland habitat in the Bow Valley corridor (M. and D. McIvor, pers. comm.). However, Spotted Frogs have been found to share breeding habitat with Long-toed

Salamanders in southwestern Alberta (Nelson et al. 1995), as well as in the Kananaskis Valley and Jasper National Park (Salt 1979). A recent report on the occurrence of Long-toed Salamanders in the northern and central regions did not find Spotted Frogs and Long-toed Salamanders within the same breeding ponds although three sightings of Spotted Frogs were documented (Hamilton et al. 1996).

Preferred Spotted Frog breeding areas in the Rockies are generally in shallow permanent pools. Salt (1979) reported that the depth of water in the areas where eggs were laid was between 3 and 30 cm. Williams (1994) made similar observations in Peter Lougheed Provincial Park, where egg masses were located in water that was between 1 and 41 cm deep. Nevertheless, Spotted Frogs may occasionally breed in very shallow, temporary water near more permanent water sources (C. Wershler, pers. comm.). This observation is consistent with those of Turner (1960) and Licht (1973), who suggested that desiccation may be an important factor in tadpole mortality, implying that some breeding pools used are temporary.

Temperatures in Spotted Frog breeding ponds in Alberta's Rocky Mountain region are reported to be generally between 13 and 22°C (Salt 1979, Williams 1994). Turner (1960) reported the period of highest activity for these frogs in Yellowstone National Park (Wyoming) to be between 1300 and 1900 when water temperatures are between 10 and 26°C. Spotted Frog tadpoles live in the warmest part of ponds (Corkran and Thoms 1996) and in larger breeding ponds (e.g. Leach Lake,

Jasper National Park), where the average temperature of shallow water may sometimes fall below 13°C, tadpoles may seek warmer temperatures during the night and on cooler days by moving under partly submerged logs or burrowing into the mud at the bottom of the pond (Salt 1979). Licht (1971) recorded the minimum and maximum lethal temperatures for developing Spotted Frog embryos to be 6 and 28°C, respectively (lower mainland of B.C. - may be Rana pretiosa).

### CONSERVATION BIOLOGY

Spotted Frogs are members of the Family Ranidae, or 'true frogs'. They are medium-sized (45-100 mm total head and body length) frogs that may be light or dark brown, or even grayish, dorsally with scattered spots. In Alberta, Spotted Frogs are generally dark brown dorsally, with irregular darker brown spots. The spots may have rather indistinct borders and lighter centers (Stebbins 1985). These frogs have a dark mask, running from the tip of the nose to the tympanum, although it may be faint (Stebbins 1985, Russell and Bauer 1993). A light coloured stripe along the upper jaw, running from snout to forelimb, is a distinguishing feature, along with eyes that are angled somewhat upwards (Stebbins 1985). Dorsolateral folds, distinct to Ranids, occur along the full length of the back (Turner and Dumas 1972). A red, salmon, or yellow colouring on the ventral surface, which appears almost superficially applied (Turner and Dumas 1972), also distinguishes the species. In Alberta, the throat or underside may be spotted or mottled with gray (Russell and Bauer 1993). According to Carl (1943),

Spotted Frogs can also be recognized by their "stout form" and "rough skin". Males can be distinguished from females, during the breeding season, by their nuptial pads (swollen and darkened pads at the base of the thumb). Females are generally larger than males (Turner 1960) and juveniles are considered to be difficult to differentiate from young Wood Frogs (Stebbins 1985, Russell and Bauer 1993).

Spotted Frog tadpoles are described as dark above, flecked with gold, and are iridescent bronze or pale gold below. The tail is approximately double the length of the body, with a broad, banner-like fin (Corkran and Thoms 1996). Wood Frog tadpoles, in contrast, have round, compacted bodies, a tail that is approximately one and a half times the length of the body, and a silver sheen to the belly (see Corkran and Thoms 1996 for comparison between species). Williams (1994) found Spotted Frog tadpoles in Peter Lougheed Provincial Park to range between 12 and 75 mm in length.

Adults forage for worms, insects, spiders, molluscs, and crustaceans both aquatically and terrestrially (Wright and Wright 1949, Turner 1960). Moore and Strickland (1955) reported that the stomach contents of Spotted Frogs sampled in Jasper National Park contained primarily arthropods, with Coleopterans (beetles) and Dipterans (flies) comprising the bulk of the samples. Molluscs, such as snails, made up the second largest component of the diet.

Spotted Frogs may overwinter underwater in Alberta (Roberts 1992)

and have been recorded to overwinter in their breeding ponds in the Cascade Mountains of Washington (Leonard et al. 1996) and in Montana (Middendorf 1957). Middendorf (1957) also reported finding torpid Spotted Frogs early in the breeding season by overturning rocks, "...several inches in diameter", in the shallow water (<30 cm) of known breeding ponds. Licht (1969) suggested that females may move towards breeding ponds in the fall to overwinter nearby, in preparation for the following year's breeding season.

Turner (1960) noted that Spotted Frogs may make significant migrations overland in the spring and late summer. He found that Spotted Frogs in Yellowstone National Park migrated to upland regions, with breeding adults seeking out suitable breeding pools in May, and returning to more permanent sources of water in July. Spotted Frogs were observed to move between separate stream courses, with a maximum recorded movement of 1281 m (Turner 1960). Reaser (1996) reported a 5 km upstream movement of a Spotted Frog (likely *R. luteiventris*) in Indian Creek, Nevada, indicating that this species does have the capacity to move significant distances.

Spotted Frogs begin breeding in early spring, as soon as the ice in appropriate areas has melted (Licht 1975). The males move together into a group, calling from within a few inches of one another (Licht 1969). Males call while floating at the surface of the water, near the shoreline, but discontinue calling if temperatures drop to near freezing (Middendorf 1957, Licht 1969).

Salt (1979) reported that Spotted Frogs in Alberta become vocal during the mating season, as well as for a limited time beforehand. Stebbins (1985) described the call as "...a series of faint, rapid, low-pitched clicks, increasing in intensity, [with] some 4 - 50 clicks per call", and suggests that it may be imitated by clicking one's tongue against the roof of one's mouth. It has also been described as sounding similar to a distant helicopter (M. and D. McIvor, pers. comm.). Licht (1969) remarked that the low volume of the call does not carry further than about 30 m. The relatively infrequent and low volume calls make this species difficult to detect with vocalization surveys (C. Wershler, pers. comm.). Male Spotted Frogs have been observed to call underwater, although more observations are required to assess how frequently this occurs (C. Wershler, unpubl. data). Salt (1979) suggested anecdotal evidence for regional variation of the breeding call within Alberta, but left the matter to further study.

In Alberta, Holroyd and Van Tighem (1983) reported that the earliest recorded breeding of Spotted Frogs in Banff and Jasper National Parks was 3 May, with egg masses being found until 27 May. They also stated that water temperatures must reach 10 to 11 °C before these frogs will emerge from hibernation. Williams (1994) reported Spotted Frogs calling between 15 May and 8 June in Peter Lougheed Provincial Park. Salt (1979) predicted there could be as much as a three to four week difference in breeding dates, depending on the locality. This variation in breeding appears to be the case, as M. and D. McIvor (pers. comm.) reported Spotted Frog activity on 23 April 1998 in the Yamnuska

Natural Area (Bow Valley area) and C. Wershler and W. Smith (pers. comm.) reported finding Spotted Frogs calling in Waterton Lakes National Park on 27 to 28 April 1998.

Females lay their eggs in spherical masses, piled on top of each other, in shallow water (Turner 1958, Licht 1969, Corkran and Thoms 1996). However, there are conflicting descriptions of egg deposition. Some authors report that eggs are not attached to vegetation, but float freely in the pond (Turner 1958, Licht 1969), whereas others describe egg masses as being loosely attached to bottom vegetation, though easily displaced (Salt 1979, Corkran and Thoms 1996). However, all agree that the masses may eventually float to the surface, forming a large frothy, floating mass. The upper eggs in these masses may be exposed at the surface of the water (Ross et al. 1994, Williams 1994). Eggs hatch in 7 to 23 days, depending on temperature (Morris and Tanner 1969).

Reports of the number of eggs in clutches vary from 444 to 1500 in the United States (Svihla 1935, Cuellar 1994). Williams (1994) described Spotted Frog egg masses located in Peter Lougheed Provincial Park as spherical and containing about 150 eggs each. The diameter of each mass was about 15 cm, with individual eggs measuring about 7 mm in diameter. Egg viability was calculated to be 83%.

High larval densities were estimated by Salt (1979), in the Elk Pass of Kananaskis Country, at about 150 larvae/m<sup>2</sup>, and near Honeymoon Lake, in Jasper National Park, at around 225 larvae/m<sup>2</sup>. Some very small breeding

sites (<1 m<sup>2</sup>) in Kananaskis Country have been reported to contain high numbers (10 to >60) of well-developed larvae (Salt 1979). In Peter Lougheed Provincial Park, Spotted Frog tadpoles were found between late May and early June, and mid-August (Williams 1994). Within these sites, the total number of larvae varied from 1 to 75, with numbers appearing to peak in June and early July. Metamorphosed juveniles, with retained tail stumps, had an average length of 23 mm in late August (Williams 1994).

Svihla (1935) reported that tadpoles of Spotted Frogs grow very rapidly in eastern Washington state, developing limb buds and growing from an initial length of 8 mm up to 36 mm in about 30 days. Larvae generally metamorphose in the same year, but in more northerly populations, such as in Alberta, they may overwinter as tadpoles and metamorphose the following year (Logier 1932). A large number (~100 to 200) of tadpoles, along with Long-toed Salamander larvae and two larger Spotted Frog larvae, were found together in the first week of July 1997 (R. Lauzon, pers. comm.). This observation was made in a relatively small seepage-fed puddle in the Crowsnest region. The larger tadpoles, which may have overwintered, were approximately 50 to 60 mm long compared to 20 mm for the co-occurring Spotted Frog tadpoles. The larger tadpoles also had developed all four limbs, but had retained gills (R. Lauzon pers. comm.).

Svihla (1935) suggested that at least two years are required before Rana luteiventris reaches maturity in eastern Washington state. However, Turner

(1960) determined that in Yellowstone National Park (*Rana luteiventris*), male Spotted Frogs may not breed until their fourth year, and females may not breed until their fifth or sixth year. He suggested that this may be due to their slow growth rates and apparently long life spans. Licht (1975) compared the growth rates of Spotted Frogs at low (lower mainland B.C.) and high elevations (Yellowstone National Park), and found growth rates to be much slower at higher elevations. Female Spotted Frogs at lower elevations mature at two to three years of age and breed annually, while those at higher elevations reach sexual maturity after six years, and breed only bi- or tri-annually (Turner 1960, Licht 1975). Males in lower and higher elevation populations reach maturity at two and four years of age, respectively. As Alberta populations of these frogs belong to the same species as the populations in Wyoming, and also occur at relatively higher latitudes, if not at comparable altitudes, it is likely that the populations in Alberta exhibit similarly slow growth rates and limited reproductive potentials.

## DISTRIBUTION

**1. Alberta.** - In Alberta, Spotted Frogs are found in the montane and subalpine natural regions from Waterton Lakes National Park to Jasper, and perhaps as far north as 55° N (Salt 1979, Russell and Bauer 1993, C. Wershler, pers. comm.; Figure 1). The species also inhabits areas of the Foothills Parkland ecoregion, which is part of the Foothills sub-region of the Parkland Natural Region (C. Wershler, pers. comm.).

In Alberta, populations of Columbia Spotted Frogs are roughly concentrated in the Waterton/Crowsnest region, and in the Banff/Bow Valley and Jasper National Park areas (Figure 1). No sightings have been reported north of Jasper National Park. There are a limited number of records between those in the Waterton Lakes National Park/Crowsnest Pass area, and those in the Banff National Park/Bow Valley corridor. The association of the species with the lower elevation montane regions in Alberta may reflect a bias in the relative search effort put forward in those areas. Documentation of populations in the Fort Saint John/Dawson Creek area of British Columbia suggest that Spotted Frogs may also occur in Alberta further north than currently reported (K. Ovaska, *in prep.*, and pers. comm.).

The biophysical survey of Banff and Jasper National Park described the occurrence of Spotted Frogs as follows:

“This species is uncommon in both Banff and Jasper, but it occurs more frequently in Banff. Sightings have been made in the Alexandra River, North Saskatchewan River, Mistaya River, upper Bow River, Pipestone River, Baker Creek, Altrude Creek and Spray valleys and at Vermillion Lakes and Anthracite in Banff. In Jasper all sightings are from the Athabasca River, Astoria River, Miette River, Smoky River and Whirlpool River valleys” (Holroyd and Van Tighem 1983).

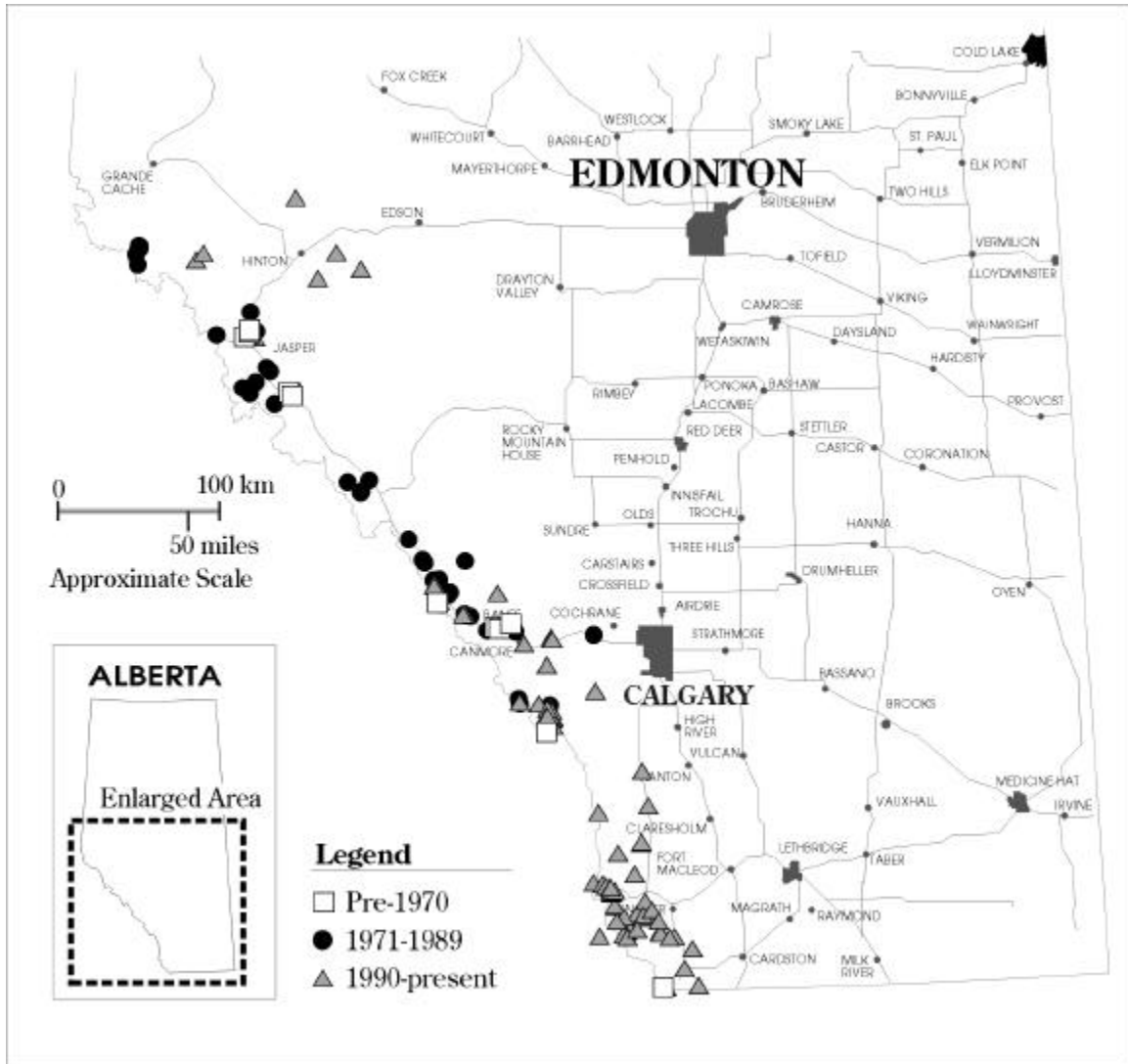


Figure 1. Distribution of the Columbia Spotted Frog (*Rana luteiventris*) in Alberta. Details of individual records can be found within the Biodiversity/Species Observation Database (Alberta Conservation Association and Alberta Environmental Protection 1998).

Overall, the distribution of this species in Alberta is considered to be discontinuous and of low density, with infrequent observations of locally distributed populations (M. and D. McIvor and C. Wershler, pers. comm.). For example, recent surveys of wetlands in Waterton Lakes National Park indicate that relatively large populations (>10 adults in summer counts) are quite localized (C. Wershler, pers. comm.).

**2. Other Areas.** - The distribution of the Spotted Frog complex extends from northern California in the south, east to central Wyoming, and north to the Alaskan panhandle (Stebbins 1985, Russell and Bauer 1993) and extreme southwestern Yukon (Mennell 1997, Figure 2). Scattered remnant populations persist further south of the main range, particularly in high altitude areas, or areas with desert springs in Nevada and Utah (Hovingh 1993). Spotted Frogs range from north-central Wyoming, west to the Pacific coast, although the species is absent from most of the mainland region adjacent to Vancouver Island (Green et al. 1997, K. Ovaska, *in prep.*). Turner and Dumas (1972) depict a limited range on the northeastern corner of Vancouver Island and a small corresponding area on the mainland, however, other authors do not corroborate these reports (e.g. K. Ovaska, *in prep.*). Earlier records of Spotted Frogs in Saskatchewan were determined to be invalid (Cook 1964). Overall, the range of the Spotted Frog complex is reflective of a northward shift in distribution since the last glaciation (Green et al. 1996).

The recently defined species, *Rana luteiventris*, occupies the largest portion

of the range of the Spotted Frog complex, occurring in the more northern and easterly portions. It inhabits isolated areas of high altitude in Nevada and Utah, and then becomes more broadly distributed to the north; particularly in Wyoming, Idaho, eastern Washington and Oregon, and western Montana (Green et al. 1997, Figure 2). In Canada, the Columbia Spotted Frog is widely distributed across British Columbia, and it is absent only in the extreme northeastern and southwestern regions of that province (Green et al. 1997).

## POPULATION SIZE AND TRENDS

**1. Alberta.** - The population size and trend of the Spotted Frog in Alberta is uncertain. Salt (1979) characterized the species in Alberta as being "...widespread in the Rockies". Since then, however, Holroyd and Van Tighem (1983) described Spotted Frog populations as "uncommon" in Banff and Jasper National Parks, and Roberts (1992) noted that this frog is "...reported to be absent from ponds where it has been found in the past and to be less abundant than before in areas where it is still found". Williams (1994) observed that Spotted Frogs were "the least abundant amphibian in [Peter Lougheed Provincial Park] in 1990". In that study, Spotted Frogs were found at only 12.2% of 74 wetlands surveyed, with breeding populations being found at only two of these sites. From this, it was stated that perhaps these low numbers may represent a reduction in Spotted Frog populations in Alberta since the 1970s (Williams 1994). This reduction in numbers is consistent with what has been perceived as a general decline in numbers and ranges of several





Figure 2. The range of the Spotted Frog complex in North America. Based on the reclassification by Green et al. (1997).

amphibian species in North America since the 1970s (Blaustein and Wake 1990, Wyman 1990). For this reason, pre-1970s observational and collection records have been distinguished from the remainder of the records in Figure 1.

A comparison of pre- and post-1990 records indicates that far fewer reports of the species have been documented in Jasper National Park and the northern half of Banff National Park in recent years (post-1990 records have also been identified in Figure 1). This indicates that the overall range has likely not changed although records in the area are becoming less common. In contrast, a greater number of sightings have been documented in the Waterton Lakes/Crowsnest Pass area in the 1990s. However, this increase is perhaps related to the recent increase in the number of surveys and awareness in the area.

**2. Other Areas.** - British Columbia populations of Spotted Frogs are well distributed over a large range, with no evidence of decline (K. Ovaska, in prep.). Recent reports (within the past five years) of records for the species in British Columbia indicate that populations of Spotted Frogs remain widespread, although population trends have not been specifically addressed by any studies (see review in K. Ovaska, in prep.). Weller and Green (1997) also reported that there does not appear to be evidence of a decline in this species in British Columbia. In Montana, the Spotted Frog is considered to be the most common frog in the western part of the state (Reichel and Flath 1995). The species is distributed over all of western Montana east to the prairie region (Black 1970). In general, most northerly

populations of the Columbia Spotted Frog are not considered to be as seriously at risk as those of its sister species, the Oregon Spotted Frog. However, given the similarity between these species, it is useful to consider the status and population trends for both Rana luteiventris and R. pretiosa.

Rana pretiosa (Oregon Spotted Frog) is found in only one locality within Canada; the extreme southwestern (lower mainland) corner of British Columbia. However, individuals from this population have not been observed since 1981 (Green et al. 1997). Similarly, a high level of concern exists for the Oregon Spotted Frog in the United States, where surveys indicate widespread decline and extirpation (McAllister et al. 1993). Oregon Spotted Frogs are estimated to have disappeared from approximately 80% of their historical geographic range (M. Hayes, pers. comm.).

## LIMITING FACTORS

Limiting factors are conditions that adversely affect the ability of a species to reproduce, disperse or survive. For the Spotted Frog, natural limiting factors such as slow developmental rate, overwintering mortality and predation may further limit the ability of populations to recover if disturbed. The following section stresses human-caused disturbance factors that may negatively affect the population growth and distribution of Spotted Frogs.

**1. Predation by Introduced Species.** - The introduction of predatory fish into previously fish-free water bodies has contributed to the decline of amphibians

in several areas of western North America (Corn 1994). For example, Reaser and Dexter (1996) associated the loss of Spotted Frog populations in previously inhabited wetlands in the Toiyabe National Forest, Nevada, with the introduction of fish. Pilliod and Peterson (1997) found a significant relationship between the absence of Spotted Frog tadpoles and Long-toed Salamander larvae with the presence of fish. They suggested that within their study lakes in Montana, fish were preventing breeding by amphibians and thereby restricting amphibians to using isolated wetlands. Williams (1994) suggested that the introduction of Rainbow Trout (*Onchorhynchus mykiss*) may have impacted the reproductive capacity of amphibians, including Spotted Frogs, in at least one wetland complex in Peter Lougheed Provincial Park. Hapeman (1995), on the other hand, reported the presence of several Spotted Frog tadpoles in Horseshoe Lake (Jasper National Park) which he noted also contained fish.

**2. Habitat Loss.** - Direct loss of habitat reduces the potential for survival and reproduction of Spotted Frogs. Valleys within the montane ecoregion are generally the most heavily impacted areas within the Rocky Mountains of Alberta. Unfortunately, significant populations of Spotted Frogs occur within these valleys. In Banff and Jasper National Parks, breeding sites were lost when ditching drained breeding ponds on the east side of the Banff-Jasper Highway in the Mistaya Valley (Holroyd and Van Tighem 1983). There is a high probability that areas such as the Bow Corridor, the Kananaskis Valley, and the Waterton/Crowsnest region have also

experienced losses and alterations of Spotted Frog habitat (C. Wershler, pers. comm.).

Urbanization and development may also become an increasingly important aspect of habitat loss for Spotted Frog populations in Alberta. Due to the considerable amount of planned development in the Westcastle area, Spotted Frog habitat is currently under threat by road construction and recreational developments (C. Wershler, pers. comm.). The rapid pace of urbanization in the lower mainland region of British Columbia, in combination with the introduction of non-native amphibian species, may have already caused the extirpation of *Rana pretiosa* from Canada (Green et al. 1997).

Habitat loss and degradation due to wetland drainage, livestock grazing and forestry practices may also impact Alberta populations of Spotted Frogs. In British Columbia, the increasing loss of wetland habitats as a result of human activities, as well as the continued disruption and landscape-level changes associated with large-scale logging practices are of particular concern for the Columbia Spotted Frog (K. Ovaska, in prep.).

**3. Changes in Water Quality.** - High concentrations of soluble salts in water occupied by Spotted Frogs may hinder spring emergence and larval development (Morris and Tanner 1969). Holroyd and Van Tighem (1983) suggested that pollution might have detrimental effects on Spotted Frog populations within Banff and Jasper National Parks and recommended minimal salting of the highways near Spotted Frog habitat.

Several locations were listed where this tactic could be employed: Highway 1A by McNair Pond, the Icefields Parkway near Herbert Lake, and along the Icefields Parkway between Norman and Rampart Creeks. Similar recommendations could be extended throughout much of the more developed areas within the Spotted Frog's Alberta range.

**4. Disturbance.** - Turner (1960) noted that one of the causes of mortality of Spotted Frogs was direct human activity. In Yellowstone National Park individual frogs were found run over by vehicles, trampled by foot traffic, killed by children and used for fish bait. In Jasper National Park, Hapeman (1995) suggested that automobile and foot traffic, surface runoff, and potential developments may present problems for Long-toed Salamanders. Comparable problems may also impact Spotted Frog populations in similar situations throughout the mountains.

**5. Competition.** - Stebbins (1985) noted that Spotted Frogs are being negatively affected by Northern Leopard Frogs and the introduction of Bullfrogs (Rana catesbeiana) in some areas. The protracted period required for sexual maturity in Spotted Frogs (4 to 6 years; Turner 1960) may leave it more vulnerable to disturbance and competition from more aggressive, faster growing introduced species. Competition from exotics has been suggested as a problem for the population of Oregon Spotted Frogs in the lower mainland of British Columbia (Green et al. 1997) and on a broad scale in the United States (Corkran and Thoms 1996), where detrimental species such as

the Bullfrog and the Green Frog (Rana clamitans) have been introduced. It would be prudent to avoid introduction or translocation of any potential competitors in Alberta.

**6. Global Climate Changes.** - Increased concern has been expressed for the susceptibility of amphibians to the effects of increasing levels of ultra-violet radiation (UV-B) at mid- and high latitudes (Ovaska 1997). The life history of Spotted Frogs may render this species particularly vulnerable as they have floating egg masses, occupy high elevation habitats, and breed early in the year when UV-B levels are high (K. Ovaska, in prep).

## STATUS DESIGNATIONS

**1. Alberta.** - The Spotted Frog has been assigned to Alberta's 'Blue List' of species in both the 1991 (Alberta Fish and Wildlife 1991) and the 1996 (Alberta Wildlife Management Division 1996) wildlife status reviews. The species is described as one of unknown population status with an "extremely limited distribution", for which investigation of a possible decline is required (Alberta Wildlife Management Division 1996). As a non-game species, Spotted Frogs in Alberta are protected from hunting, killing, molestation, and possession under the provincial Wildlife Act. No previous report on the status of this species has been prepared in Alberta.

**2. Other Areas.** - In British Columbia, the Columbia Spotted Frog has been designated as 'Yellow listed, conservation emphasis', meaning that although the species is not considered to be at any immediate risk, it warrants

more concern than more general Yellow-listed species (L. Friis, pers. comm.). A COSEWIC report on the status of the Columbia Spotted Frog (Rana luteiventris) from a national perspective is currently being prepared (K. Ovaska, pers. comm.). This report suggests a 'not at risk' status for the species in general within Canada, but expresses some concern for Alberta populations due to reports of their decline (K. Ovaska, in prep.).

The Nature Conservancy (1998) ranks Rana luteiventris as 'G4' which refers to species that are not rare and apparently secure, but with cause for long-term concern for their status. There is increasing concern for the Columbia Spotted Frog in the U.S., however, where biologists are recommending the rank of 'G3' (E. Gaines, pers. comm.). Ranks from individual states where the Columbia Spotted Frog occurs, range from 'S4' (apparently secure) to 'S2' (imperiled). The more isolated southern populations of Rana luteiventris, in Utah and Nevada, are candidates for federal listing under the Endangered Species Act in the United States (K. McAllister, pers. comm.). However, there does not appear to be evidence of a decline in most populations of the Columbia Spotted Frog in more northerly parts of the continental United States (K. McAllister, pers. comm.).

The rank of 'S1' has been assigned to Rana pretiosa in California, Washington and British Columbia indicating that the species is regarded as 'critically imperiled' in those areas. The Oregon Spotted Frog is currently a candidate for endangered species status within the

state of Washington (K. McAllister, pers. comm.).

## RECENT MANAGEMENT IN ALBERTA

No direct management of Spotted Frog populations in Alberta has taken place. Volunteer amphibian monitoring has been initiated at a provincial level (Powell et al. 1996, Yaremko 1996), as well as in both Banff (C. Pacas, M. and D. McIvor, pers. comm.) and Waterton Lakes National Parks (C. Wershler, pers. comm.). These efforts may improve the success of tracking amphibian numbers in those areas. In 1997, an amphibian monitoring survey was initiated in Waterton Lakes National Park which includes surveys at five sites inhabited by Spotted Frogs, with at least two of the sites appearing to be major breeding habitats (C. Wershler, pers. comm.).

## SYNTHESIS

In Alberta, relatively little is known of the current distribution and population status of the Columbia Spotted Frog. There have been suggestions that the provincial populations may be in decline and it is speculated that marked declines in numbers and range occurred during the 1970s and in the 1990s. However, without monitoring, it is impossible to confidently outline population trends. In light of the apparent decline in Alberta and the drastic decline of Rana pretiosa in the United States, it is suggested that long-term population monitoring be initiated to determine the status of this species in Alberta. Furthermore, the species should be looked for outside of its currently defined range. For instance, the presence of the species in the area

west of Fairview (north of the currently known range) should be investigated. Also, Columbia Spotted Frogs should be looked for east of Jasper National Park.

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APPENDIX 1. Definitions of selected legal and protective designations.

**A. Status of Alberta Wildlife colour lists (after Alberta Wildlife Management Division 1996)**

Red	Current knowledge suggests that these species <u>are</u> at risk. These species have declined, or are in immediate danger of declining, to nonviable population size
Blue	Current knowledge suggests that these species <u>may be</u> at risk. These species have undergone non-cyclical declines in population or habitat, or reductions in provincial distribution
Yellow	Species that are not currently at risk, but may require special management to address concerns related to naturally low populations, limited provincial distributions, or demographic/life history features that make them vulnerable to <u>human-related</u> changes in the environment
Green	Species not considered to be at risk. Populations are stable and key habitats are generally secure
Undetermined	Species not known to be at risk, but insufficient information is available to determine status

**B. Alberta Wildlife Act**

Species designated as ‘endangered’ under the Alberta Wildlife Act include those defined as ‘endangered’ or ‘threatened’ by *A Policy for the Management of Threatened Wildlife in Alberta* (Alberta Fish and Wildlife 1985):

Endangered	A species whose present existence in Alberta is in danger of extinction within the next decade
Threatened	A species that is likely to become endangered if the factors causing its vulnerability are not reversed

**C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 1996)**

Extirpated	A species no longer existing in the wild in Canada, but occurring elsewhere
Endangered	A species facing imminent extirpation or extinction
Threatened	A species likely to become endangered if limiting factors are not reversed
Vulnerable	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events
Not at Risk	A species that has been evaluated and found to be not at risk
Indeterminate	A species for which there is insufficient scientific information to support status designation

**D. United States Endangered Species Act (after National Research Council 1995)**

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range

**E. Natural Heritage Element Rarity Ranks (after The Nature Conservancy 1998)**

Global or G-rank: Based on the range-wide status of a species.

Sub-national or S-rank: Based on the status of a species in an individual state or province. S-ranks may differ between states or provinces based on the relative abundance of a species in each state or province.

<b>Rank</b>	<b>Definition</b>
G1 S1	Critically imperilled globally because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction.
G2 S2	Imperilled globally because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range.
G3 S3	Either very rare or local throughout its range, or found locally in a restricted range (21 to 100 occurrences).
G4 S4	Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery.
G5 S5	Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

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(as of January 1999)

- No. 1 Status of the Piping Plover (Charadrius melodus) in Alberta, by David R. C. Prescott. 19 pp.
- No. 2 Status of the Wolverine (Gulo gulo) in Alberta, by Stephen Petersen. 17 pp.
- No. 3 Status of the Northern Long-eared Bat (Myotis septentrionalis) in Alberta, by M. Carolina Caceres and M. J. Pybus. 19 pp.
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- No. 17 Status of the Spotted Frog (Rana luteiventris) in Alberta, by Janice D. James. 21 pp.
- No. 18 Status of the Ferruginous Hawk (Buteo regalis) in Alberta, by Josef K. Schmutz. In preparation.