Management Plan for the Western Toad (*Anaxyrus boreas)* in British Columbia

Prepared by the Provincial Western Toad Working Group

BRITISH COLUMBIA | Ministry of Environment

September 2014

About the British Columbia Management Plan Series

This series presents the management plans that are prepared as advice to the Province of British Columbia. Management plans are prepared in accordance with the priorities and management actions assigned under the British Columbia Conservation Framework. The Province prepares management plans for species' that may be at risk of becoming endangered or threatened due to sensitivity to human activities or natural events.

What is a management plan?

A management plan identifies a set of coordinated conservation activities and land use measures needed to ensure, at a minimum, that the target species does not become threatened or endangered. A management plan summarizes the best available science-based information on biology and threats to inform the development of a management framework. Management plans set goals and objectives, and recommend approaches appropriate for species or ecosystem conservation.

What's next?

Direction set in the management plan provides valuable information on threats and direction on conservation measures that may be used by individuals, communities, land users, conservationists, academics, and governments interested in species and ecosystem conservation.

For more information

To learn more about species at risk recovery planning in British Columbia, please visit the Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

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The Western Toad cover photograph was provided by Jared Hobbs.

Additional copies

Additional copies can be downloaded from the B.C. Ministry of Environment Recovery Planning webpage at:

<http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm>

Disclaimer

The Provincial Western Toad Working Group has prepared this management plan, as advice to the responsible jurisdictions and organizations that may be involved in managing the species.

This document identifies the management actions that are deemed necessary, based on the best available scientific and traditional information, to prevent Western Toad populations in British Columbia from becoming endangered or threatened. Management actions to achieve the goals and objectives identified herein are subject to the priorities and budgetary constraints of participatory agencies and organizations. These goals, objectives, and management approaches may be modified in the future to accommodate new objectives and findings.

The responsible jurisdictions and all members of the Working Group have had an opportunity to review this document. However, this document does not necessarily represent the official positions of the agencies or the personal views of all individuals on the Working Group.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that may be involved in implementing the directions set out in this management plan. The B.C. Ministry of Environment encourages all British Columbians to participate in the conservation of Western Toad.

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EXECUTIVE SUMMARY

The Western Toad (*Anaxyrus boreas;* syn. *Bufo boreas*) is listed as Special Concern in Canada on Schedule 1 of the *Species at Risk Act* (SARA) due to population declines in the Georgia Depression and south-coastal British Columbia. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recognizes two populations for this species: the Calling and Non-calling populations. Both these units were designated as Special Concern by COSEWIC in November 2012.

In B.C., the Western Toad is ranked S3S4 (special concern, vulnerable to extirpation or extinction to apparently secure) by the Conservation Data Centre and is on the provincial Yellow list. The B.C. Conservation Framework ranks the Western Toad as a priority 2 under goal 2 (Prevent species and ecosystems from becoming at risk) and as a priority 3 under goal 1 (Contribute to global efforts for species and ecosystem conservation). This management plan includes all Western Toads in B.C. (i.e., both the Calling and Non-calling populations).

Western Toads have stocky bodies, relatively short legs, dry, warty skin, and a pronounced oval protuberance (cheek or parotoid gland) on each side of the head. Adult Western Toads are 5–14 cm in body length and may be green, tan, brown, or black, usually with a light line along the mid-back. The tadpoles (larvae) have black or charcoal bodies with a translucent tail fin and often form very large feeding aggregations along shorelines from late April to early September.

The species has a wide distribution in western North America. In Canada it occurs throughout most of B.C., including Vancouver Island and Haida Gwaii; in the Rocky Mountains of Alberta; and in the southern Yukon. It requires waterbodies, for laying eggs and larval growth, and uplands for adult foraging and hibernation. The Western Toad can occur from sea level to alpine areas in a great variety of habitats including grasslands, meadows and many different forest types.

High and moderate impact threats to the species in B.C. include urban development, road mortality, livestock impacts on wetlands, forestry practices, oil and gas developments, invasive species, disease epidemics (chytrid fungus *Batrachochytrium dendrobatidis*), and climate change.

The management goal is to maintain self-sustaining populations of the Western Toad distributed throughout the species' present range in B.C.

The following management objectives will be achieved through habitat protection and stewardship, management of threats, outreach, research, and monitoring.

1. Survey to identify regionally important breeding sites throughout B.C.
2. Identify and protect a minimum of 10 additional, sustainable breeding sites of Western Toad distributed across the range in both the Lower Mainland and Vancouver Island.
3. Clarify threats and initiate actions to mitigate high and moderate impact threats to regionally important Western Toad breeding sites including residential development, agriculture, energy production, transportation corridors, biological resource use, invasive and problematic species, and climate change.

4. Address the following key knowledge gaps: metapopulation structure and function, movement patterns, disease, and short-term population trends.

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1 COSEWIC* SPECIES ASSESSMENT INFORMATION

Assessment Summary - November 2012
Common name: ****** Western Toad, Non-calling population
Scientific name: *Anaxyrus boreas*
Status: Special Concern
Reason for designation: This species has suffered population declines and population extirpations in the southern part of its range in British Columbia, as well as in the USA. The toads are particularly sensitive to emerging skin disease caused by the amphibian chytrid fungus, which has been linked to global amphibian declines. It is relatively intolerant of urban expansion, conversion of habitat for agricultural use, and habitat fragmentation resulting from resource extraction and road networks. Life history characteristics, including infrequent breeding by females, aggregation at communal, traditionally used breeding sites, and migrations to and from breeding sites, make populations vulnerable to habitat degradation and fragmentation. The species remains widespread, but declines are suspected and projected based on known vulnerabilities and threats.
Occurrence: Yukon, Northwest Territories, British Columbia, Alberta
Status history: The species was considered a single unit and designated Special Concern in November 2002. Split into two populations in November 2012. The Non-calling population was designated Special Concern in November 2012.

Assessment Summary - November 2012
Common name: ****** Western Toad Calling population
Scientific name: *Anaxyrus boreas*
Status: Special Concern
Reason for designation: Almost the entire range of the calling population is within Canada. The toads are particularly sensitive to emerging skin disease caused by the amphibian chytrid fungus, which has been linked to global amphibian declines. This species is relatively intolerant of urban expansion, conversion of habitat for agricultural use, and habitat fragmentation resulting from resource extraction and road networks. Life history characteristics, including infrequent breeding by females, aggregation at communal, traditionally used breeding sites, and migrations to and from breeding sites, make populations vulnerable to habitat degradation and fragmentation. The species remains widespread throughout much of their historic range in Alberta and may be expanding their range eastwards. However, declines are suspected and projected based on known vulnerabilities and threats.
Occurrence: British Columbia, Alberta
Status history: species was considered a single unit and designated Special Concern in November 2002. Split into two populations in November 2012. The Calling population was designated Special Concern in November 2012.

*Committee on the Status of Endangered Wildlife in Canada.
** Common and scientific names reported in this management plan follow the naming conventions of the B.C. Conservation Data Centre, which may be different from names reported by COSEWIC.

2 SPECIES STATUS INFORMATION

Western Toad[a]		
Legal Designation		
FRPA:[b] No OGAA:[b] No	B.C. *Wildlife Act*:[c] Schedule A	SARA:[d] Schedule 1 –Special Concern (2005)
Conservation Status[e]		
B.C. List: Blue B.C. Rank: S3S4 (2010) National Rank: N4 (2011) Global Rank: G4 (2008)		
Other Subnational Ranks:[f] NWT: S2S3; YU: S3; AB: S3; WA: S3 and OR: S3		
B.C. Conservation Framework (CF)[g]		
Goal 1: Contribute to global efforts for species and ecosystem conservation.		Priority:[g] 3
Goal 2: Prevent species and ecosystems from becoming at risk.		Priority: 2
Goal 3: Maintain the diversity of native species and ecosystems.		Priority: 4
CF Action Groups	Compile Status Report; Monitor Trends; Planning; Habitat Protection; Habitat Restoration; Land Stewardship; Species and Population Management	

[a] Data source: B.C. Conservation Data Centre (2014) unless otherwise noted.
[b] No = not listed in one of the categories of wildlife that requires special management attention to address the impacts of forest and range activities on Crown land under the *Forest and Range Practices Act* (FRPA; Province of British Columbia 2002) and/or the impacts of oil and gas activities on Crown land under the *Oil and Gas Activities Act* (OGAA; Province of British Columbia 2008).
[c] Schedule A = designated as wildlife under the B.C. *Wildlife Act*, which offers it protection from direct persecution and mortality (Province of British Columbia 1982).
[d] Schedule 1 = found on the List of Wildlife Species at Risk under the *Species at Risk Act* (SARA).
[e] S = subnational; N = national; G = global; B = breeding; X = presumed extirpated; H = possibly extirpated; 1 = critically imperiled; 2 = imperiled; 3 = special concern, vulnerable to extirpation or extinction; 4 = apparently secure; 5 = demonstrably widespread, abundant, and secure.
[f] Data source: NatureServe (2014).
[g] Data source: B.C. Ministry of Environment (2010).
[h] Six-level scale: Priority 1 (highest priority) through to Priority 6 (lowest priority).

3 SPECIES INFORMATION

3.1 Species Description

The Western Toad (*Anaxyrus boreas)* is the only true toad (Anura: Bufonidae) found in British Columbia (B.C.). Toads are easily identified by their stocky bodies; relatively short legs; dry, warty skin; and pronounced oval protuberance (cheek or parotoid gland) on each side of the head (Jones *et al.*, eds. 2005; Corkran and Thoms 2006; Matsuda *et al.* 2006). Adult Western Toads vary from about 5.5 to 14.5 cm in body length, while newly metamorphosed toadlets are less than 1 cm long. The back is solid in colour or variously mottled and may be green, tan, brown, or black (see cover photograph). There is often a light line along the mid-back. The belly is light-coloured and often mottled. The tadpole (larva) has a vent that opens straight back, with a symmetrical, uniformly black or charcoal body and a translucent or charcoal tail fin (Corkran and Thoms 2006). Tadpoles often form feeding aggregations or clumps with very large numbers of individuals. Larvae grow to a length of 25–30 mm before metamorphosing (Matsuda *et al.* 2006). Larvae can be seen from late April to early September but are most commonly seen in June and July (Ministry of Environment 2007). Eggs are laid in strings of jelly (Corkran and Thoms 2006).

Two populations are recognized by COSEWIC (2012): the Calling population and the Non-calling population. This management plan includes all Western Toads in B.C. and does not differentiate between Calling and Non-calling populations.

3.2 Populations and Distribution

The Western Toad has a wide distribution in western North America (Figure 1), ranging from Alaska, the Yukon Territory and the Northwest Territory to northern California and Nevada and from the Pacific coast to the Rocky Mountains of Alberta, western Montana, Colorado, and Utah (COSEWIC 2012). The global population is unknown but NatureServe (2009) conservatively estimates there are 100,000 to 1,000,000 adults. No global trend data are available but NatureServe (2009) estimates declining trends of 10% to 30% in the short term (past 10 years or 3 generations) and 25–50% in the long term (past 200 years). Severe declines have occurred in the southern Rocky Mountains and Sierra Nevada.

Figure 1. Western Toad distribution in North America. Prepared by R. Gau, Northwest Territories Department of Environment and Natural Resources, 2010.

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In Canada, the Western Toad occurs across most of B.C., western Alberta, the southern Yukon (COSEWIC 2002) and into the Northwest Territories (Government of the Northwest Territories (2011). In B.C. (Figure 2), it occurs throughout most of the mainland, Haida Gwaii and Vancouver Island (COSEWIC 2002). The lack of records in northern B.C. is likely due to limited access, search effort and availability of unpublished data (Brian Slough pers. comm. 2011). B.C. has an estimated 30% of the global population, based on area (Figure 1). Population estimates for B.C. are not available. Population trends are not available for B.C. but declines and local extirpations have been recorded at a large marsh complex on southern Vancouver Island (Davis and Gregory 2003) and in the Lower Mainland where recent records are scarce (COSEWIC 2002). Threats persist and declines are continuing (P. Govindarajulu, pers. comm., 2010). Rates of population decline are not available. It still appears to be widespread and common in the interior and northern B.C. (COSEWIC 2002), although individual sites likely have been impacted.

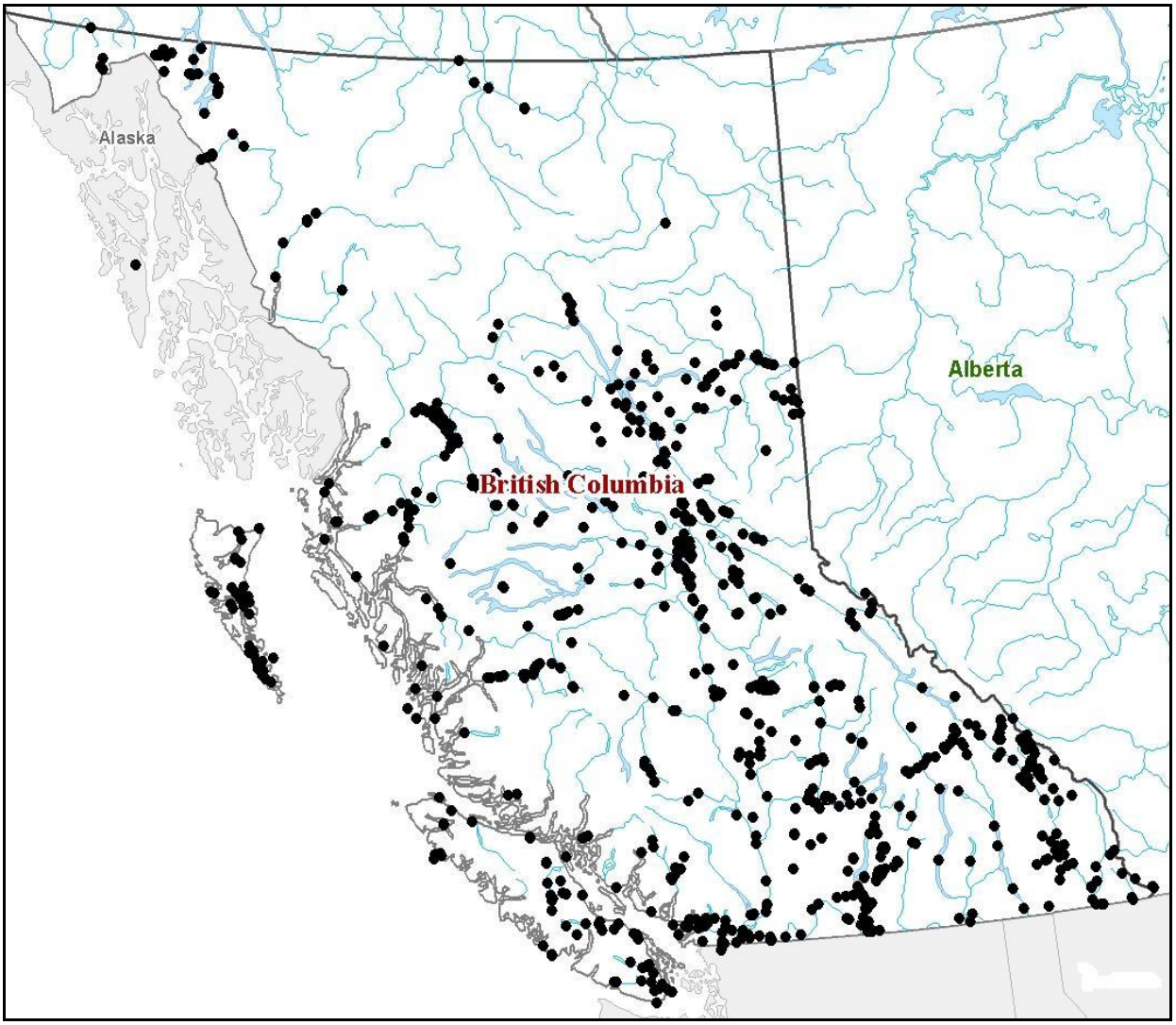

Figure 2. Western Toad distribution in British Columbia, compiled by the B.C. Ministry of Environment for this plan, 2010.

3.3 Habitat and Biological Needs of the Western Toad

Like other anurans in Canada, the Western Toad has a biphasic life cycle consisting of aquatic eggs and tadpoles and terrestrial juveniles and adults. They can be found in many biogeoclimatic zones: Bunchgrass, Ponderosa Pine, Interior Douglas-fir, Coastal Douglas-fir, Boreal White and Black Spruce, Coastal Western Hemlock, Interior Cedar–Hemlock, Sub-Boreal Spruce, Spruce–Willow–Birch, and Engelmann Spruce - Subalpine Fir and Alpine Tundra (B.C. CDC 2014). They occur from sea level to at least 2250 m above sea level (B.C. Ministry of Water, Land and Air Protection 2002).

In spring, adults congregate in great numbers at breeding sites, where mating and egg laying take place during a brief period of 1–2 weeks. The toads breed in a variety of waterbodies, ranging from temporary pools, ditches, road ruts, and slow-flowing portions of streams to shallow margins of large lakes (COSEWIC 2002). They also can breed in reservoirs, stock ponds, and other artificial waterbodies (Jones *et al.*, eds. 2005). Although males in some populations produce an advertisement call, they appear to be silent in most of B.C. and actively search for mates (Matsuda *et al.* 2006). Females reach maturity at 4 or 5 years and may breed only every 2 or 3 years, while males reach maturity within 3 years and can breed annually (Matsuda *et al.* 2006). Maximum longevity is thought to be 9–11 years (COSEWIC 2002). Females lay a large number of eggs (5,000–15,000) in long, thin double strands amidst submerged vegetation or, where vegetation is lacking, unattached on the bottom substrate. Females frequently oviposit communally, resulting in aggregations of hundreds of thousands or even millions of eggs within small areas of a breeding site (Jones *et al.*, eds. 2005). The eggs hatch within 3 to 12 days, and larval development takes 1 to 3 months, depending on water temperature and other conditions. B.C. larval observation dates range from April 27 to September 14 but most (73%, N = 209) are reported in June and July (Ministry of Environment 2007).

Newly metamorphosed toads form large aggregations near the shoreline and then move en masse to terrestrial habitats, where they forage for several years before returning to breed. Terrestrial habitats include a variety of grassland, forest, shrub, marsh, and meadow habitats, which at higher elevations include avalanche slopes and subalpine meadows (COSEWIC 2002). The toads may move 1 km or more from breeding sites to foraging and hibernation areas (Davis 2000, 2002). Movements up to about 7 km from breeding sites have been recorded on Vancouver Island (Davis 2000). Experimentally displaced adult toads return to their home ranges in the summer and spring, suggesting site fidelity (Tracy and Dole 1969; Davis 2000). The species is thought to exist as metapopulations, or a series of relatively independent subpopulations linked by dispersal and immigration (Davis 2002), but little specific information on dispersal movements and gene flow are available.

Hibernation takes place in underground burrows or crevices in terrestrial habitats and in at least some areas is communal (Browne 2010).

3.4 Ecological Role

Adult Western Toads are predators of ground-dwelling invertebrates and larvae consume aquatic algae, detritus, and carrion (COSEWIC 2002). The adults provide a food source to mammals,

birds and snakes, despite toxins produced by the parotoid glands and warts (COSEWIC 2002). Eggs and tadpoles provide food for many birds, snakes, and invertebrates. A single female can produce 5,000 to 15,000 eggs (COSEWIC 2002) and, given this species' large range distribution in B.C., it can contribute a substantial amount of biomass to local food webs.

3.5 Limiting Factors

Limiting factors are generally not human induced and include characteristics that make the species less likely to respond to conservation efforts.

Amphibians have relatively permeable skin, which may make them vulnerable to pesticides, ultraviolet radiation, fungal infection (i.e., *Batrachochytrium dendrobatidis*), disease, or desiccation (COSEWIC 2002). Egg-laying and larval growth must be completed in water and may be affected by climatic shifts that result in water shortages or early drying trends. Behaviours such as communal egg-laying, larval aggregation, mass migrations, and post-metamorphic aggregations increase the potential for large scale population impacts from single threat events. These concentrations of toads are vulnerable to loss or degradation of habitat at small but seasonally important areas. Toads migrate to and from egg-laying sites and are vulnerable to road kill, predation, and barriers to movement during this time, especially in fragmented landscapes. Their tendency to wander far from breeding sites may increase their exposure to human activities and developments. Post-metamorphic aggregations of young toads are extremely vulnerable to disturbance, accidental mortality, and habitat degradation, which could result in the loss of entire cohorts from local populations (COSEWIC 2002).

4 THREATS

Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational) (adapted from Salafsky *et al.* 2008). For purposes of threat assessment, only present and future threats are considered.[1] Threats do not include limiting factors[2] which are presented in Section 3.5.

For the most part, threats are related to human activities, but they can also be natural. The impact of human activity may be direct (e.g., destruction of habitat) or indirect (e.g., invasive species introduction). Effects of natural phenomena (e.g., fire, flooding) may be especially important when the species is concentrated in one location or has few occurrences, which may be a result of human activity (Master *et al.* 2012). As such, natural phenomena are included in the definition of a threat, though they should be considered cautiously. These stochastic events should only be considered a threat if a species or habitat is damaged from other threats and has lost its resilience, and is thus vulnerable to the disturbance (Salafsky *et al.* 2008) such that these types of events

[1] Past threats may be recorded but are not used in the calculation of Threat Impact. Effects of past threats (if not continuing) are considered when determining long-term and/or short-term trend factors (Master *et al.* 2012).
[2] It is important to distinguish between limiting factors and threats. Limiting factors are generally not human induced and include characteristics that make the species less likely to respond to conservation efforts.

would have a disproportionately large effect on the population compared to the effect it would have had historically.

4.1 Threat Classification

The threat classification below is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system and is consistent with methods used by the B.C. Conservation Data Centre. For a detailed description of the threat classification system see the CMP website (CMP 2010). For information on how the values are assigned or overall impact is calculated, see Master *et al.* (2012) and table footnotes for details. Threats for the Western Toad were assessed for the entire province (Table 1) and separately for southwestern B.C. (Vancouver Island, Lower Mainland, Sunshine Coast) (Table 2). The reason for separate assessments was to highlight threats in southwestern B.C., where observed declines contributed to the national listing of the species as "Special Concern" (COSEWIC 2002, 2012).

Table 1. Threat classification table for Western Toad in British Columbia.

Threat #[a]	Threat description	Impact[b]	Scope[c]	Severity[d]	Timing[e]
1	Residential & commercial development	Negligible	Negligible (<1%)	Extreme (71-100%)	High
1.1	Housing & urban areas	Negligible	Negligible (<1%)	Extreme (71-100%)	High
1.2	Commercial & industrial areas	Negligible	Negligible (<1%)	Extreme (71-100%)	High
1.3	Tourism & recreation areas	Negligible	Negligible (<1%)	Moderate (11-30%)	High
2	Agriculture & aquaculture	Low	Large (31-70%)	Slight (1-10%)	High
2.1	Annual & perennial non-timber crops	Negligible	Negligible (<1%)	Serious (31-70%)	High
2.3	Livestock farming & ranching	Low	Large (31-70%)	Slight (1-10%)	High
3	Energy production & mining	Low	Small (1-10%)	Serious (31-70%)	High
3.1	Oil & gas drilling	Low	Small (1-10%)	Serious (31-70%)	High
3.2	Mining & quarrying	Negligible	Negligible (<1%)	Serious (31-70%)	High
3.3	Renewable energy	Negligible	Negligible (<1%)	Slight (1-10%)	High
4	Transportation & service corridors	Low	Restricted (11-30%)	Moderate (11-30%)	High
4.1	Roads & railroads	Low	Restricted (11-30%)	Moderate (11-30%)	High
4.2	Utility & service lines	Negligible	Negligible (<1%)	Slight (1-10%)	High
5	Biological resource use	Low	Small (1-10%)	Moderate-Slight (1-30%)	High
5.3	Logging & wood harvesting	Low	Small (1-10%)	Moderate-Slight (1-30%)	High
6	Human intrusions & disturbance	Negligible	Negligible (<1%)	Slight (1-10%)	High
6.1	Recreational activities	Negligible	Negligible (<1%)	Slight (1-10%)	High
7	Natural system modifications	Low	Small (1-10%)	Slight (1-10%)	High
7.1	Fire & fire suppression	Low	Small (1-10%)	Slight (1-10%)	High
7.2	Dams & water management/use	Negligible	Negligible (<1%)	Slight (1-10%)	High
7.3	Other ecosystem modifications	Negligible	Negligible (<1%)	Slight (1-10%)	High
8	Invasive & other problematic species & genes	Medium-Low	Pervasive (71-100%)	Moderate-Slight (1-30%)	High
8.1	Invasive non-native/alien species	Medium-Low	Pervasive (71-100%)	Moderate-Slight (1-30%)	High

Threat #[a]	Threat description	Impact[b]	Scope[c]	Severity[d]	Timing[e]
9	Pollution	Low	Small (1-10%)	Slight (1-10%)	High
9.1	Household sewage & urban waste water	Negligible	Negligible (<1%)	Slight (1-10%)	High
9.2	Industrial & military effluents	Negligible	Negligible (<1%)	Slight (1-10%)	High
9.3	Agricultural & forestry effluents	Negligible	Negligible (<1%)	Slight (1-10%)	High
9.5	Air-borne pollutants	Low	Small (1-10%)	Slight (1-10%)	High
11	Climate change & severe weather	Unknown	Unknown	Unknown	High
11.2	Droughts	Unknown	Unknown	Unknown	High

Table 2. Threat classification table for Western Toad for Vancouver Island, British Columbia.

Threat #[a]	Threat description	Impact[b]	Scope[c]	Severity[d]	Timing[e]
1	Residential & commercial development	Negligible	Negligible (<1%)	Extreme (71-100%)	High
1.1	Housing & urban areas	Negligible	Negligible (<1%)	Extreme (71-100%)	High
1.2	Commercial & industrial areas	Negligible	Negligible (<1%)	Extreme (71-100%)	High
1.3	Tourism & recreation areas	Negligible	Negligible (<1%)	Moderate (11-30%)	High
2	Agriculture & aquaculture	Negligible	Negligible (<1%)	Serious (31-70%)	High
2.1	Annual & perennial non-timber crops	Negligible	Negligible (<1%)	Serious (31-70%)	High
2.3	Livestock farming & ranching	Negligible	Negligible (<1%)	Negligible (<1%)	High
2.4	Marine & freshwater aquaculture	Negligible	Negligible (<1%)	Negligible (<1%)	High
3	Energy production & mining	Negligible	Negligible (<1%)	Serious (31-70%)	High
3.1	Oil & gas drilling				High
3.2	Mining & quarrying	Negligible	Negligible (<1%)	Serious (31-70%)	High
3.3	Renewable energy	Negligible	Negligible (<1%)	Slight (1-10%)	High
4	Transportation & service corridors	Medium - Low	Large - Restricted (11-70%)	Moderate (11-30%)	High
4.1	Roads & railroads	Medium - Low	Large - Restricted (11-70%)	Moderate (11-30%)	High
4.2	Utility & service lines	Negligible	Negligible (<1%)	Slight (1-10%)	High
5	Biological resource use	Low	Small (1-10%)	Moderate - Slight	High
5.3	Logging & wood harvesting	Low	Small (1-10%)	Moderate - Slight (1-30%)	High
6	Human intrusions & disturbance	Negligible	Small (1-10%)	Negligible (<1%)	High
6.1	Recreational activities	Negligible	Small (1-10%)	Negligible (<1%)	High
6.3	Work & other activities	Negligible	Small (1-10%)	Negligible (<1%)	High

Threat #[a]	Threat description	Impact[b]	Scope[c]	Severity[d]	Timing[e]
7	Natural system modifications	Negligible	Negligible (<1%)	Moderate (11-30%)	High
7.1	Fire & fire suppression	Negligible	Negligible (<1%)	Moderate (11-30%)	High
7.2	Dams & water management/use	Negligible	Negligible (<1%)	Moderate (11-30%)	High
8	Invasive & other problematic species & genes	High - Medium	Pervasive (71-100%)	Serious - Moderate (11-70%)	High
8.1	Invasive non-native/alien species	High - Medium	Pervasive (71-100%)	Serious - Moderate (11-70%)	High
9	Pollution	Negligible	Negligible (<1%)	Slight (1-10%)	High
9.1	Household sewage & urban waste water	Negligible	Negligible (<1%)	Slight (1-10%)	High
9.2	Industrial & military effluents	Negligible	Negligible (<1%)	Slight (1-10%)	High
9.3	Agricultural & forestry effluents	Negligible	Negligible (<1%)	Slight (1-10%)	High
9.5	Air-borne pollutants	Unknown	Unknown	Unknown	High
11	Climate change & severe weather	Unknown	Unknown	Unknown	High
11.2	Droughts	Unknown	Unknown	Unknown	High

[a] Threat numbers are provided for Level 1 threats (i.e., whole numbers) and Level 2 threats (i.e., numbers with decimals).

[b] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on severity and scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population. The median rate of population reduction for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment time (e.g., timing is insignificant/negligible [past threat] or low [possible threat in long term]); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[c] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[d] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or 3-generation timeframe. For this species a generation time of 6.5 years was used resulting in severity being scored over about a 20-year timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit $\geq$ 0%).

[e] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

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4.2 Description of the Threats

The overall province-wide Threat Impact for this species is High-Medium.[3] This overall threat considers the cumulative impacts of multiple threats. Details regarding the threats and their impacts to the Western Toad on a provincial scale (Table 1), as well for the area of Vancouver Island[4] (Table 2) are discussed below listed under the IUCN-CMP Level 1 headings.

IUCN-CMP Threat 1. Residential & commercial development (negligible impact)
Urban and rural housing developments are encroaching on toad habitats in the B.C. southwestern but are of minor concern to the species elsewhere in the province. On Vancouver Island and the Lower Mainland, approximately 75% of low elevation wetlands have been lost, and habitats continue to diminish with pressures on land from expanding human population (COSEWIC 2002). Matsuda *et al.* (2006) noted that the species is absent or scarce in urbanized landscapes but can persist in some rural farming areas.

IUCN-CMP Threat 2. Agriculture & aquaculture (low impact overall in B.C., negligible impact on Vancouver Island)
Ranching is widespread in the B.C. interior and includes free-ranging cattle throughout Crown lands and on large private ranches. Cattle congregate in riparian areas, changing ecological processes and damaging these sensitive areas (Fleischner 1994). In the B.C. Interior, signs of cattle activity can be found along most waterbodies at lower elevations; higher elevation habitats are less affected. Intensive livestock grazing and trampling at amphibian breeding sites degrade shoreline habitats and wetlands (COSEWIC 2002). Trampling at traditional communal egg-laying sites may cause direct mortality of eggs during the oviposition period, and trampling of adults and juveniles has been observed in other toad species in the transition habitat as toads enter and leave breeding sites (Jofre *et al.* 2007). Post-metamorphic aggregations of toads are extremely vulnerable to accidental mortality, predation, dehydration, and entrapment, all of which may increase as a result of cattle activities in riparian areas. Conversion of lands into agriculture and intensification of agricultural uses are contributing to the loss and degradation of toad habitats in the Okanagan and Lower Mainland due to wetland drainage and fragmentation of terrestrial habitats (COSEWIC 2002).

IUCN-CMP Threat 3. Energy production & mining (low impact overall in B.C., negligible impact on Vancouver Island)
Oil and gas exploration and extraction are largely confined to the Boreal White and Black Spruce biogeoclimatic zone in the Peace River country in the northeast of the province (Austin *et al.*, eds. 2008). The BC Oil and Gas Commission (2013) reported that just over 2% (375,600 ha) of

[3] The overall threat impact for B.C. was calculated following Master *et al.* (2012) using the number of Level 1 Threats assigned to this species where timing = High or Moderate, which included 1 Medium-Low, Medium, 6 Low, and 1 Unknown (Table 1).
[4] The overall threat impact for Vancouver Island was calculated following Master *et al.* (2012) using the number of Level 1 Threats assigned to this species where timing = High or Moderate, which included 1 High-Medium, 1 Medium-Low, 1 Low, and 1 Unknown (Table 2).

the total area of Northeast B.C. (17.5 million ha) was used for oil and gas activities. Where they occur, oil and gas exploration and extraction have the potential to severely modify toad habitats both directly through ecosystem conversion and degradation and indirectly through contamination of air and water. Their greatest effects are probably from habitat fragmentation and from the creation of road networks over large tracts of previously undisturbed forest (see Transportation & service corridors, following).

IUCN-CMP Threat 4. Transportation & service corridors (low impact overall in B.C., medium-low impact on Vancouver Island)

Roads have fragmented habitats throughout B.C. and continue to expand and encroach to new areas (combined linear road length > 570,000 km in 2005; increase of 48% in 1988–2000 and 23% in 2000–2005) (Austin *et al.,* eds. 2008). Ecological effects of roads affect a much wider area than the road surfaces themselves; by some estimates the area of influence is 20 times larger than the area of land covered (Austin *et al.*, eds. 2008). In B.C., road densities are expanding concomitantly with human population growth in the central interior and southwest, with gas and oil exploration in the northeast, and with forestry throughout much of the province. For amphibians, roads can act as barriers to movements, which disrupt metapopulation dynamics, increase mortality, and decrease habitat (Fahrig *et al.* 1995). The Western Toad is vulnerable to road mortality during mass migrations to and from breeding sites and during its extensive movements in upland habitats. Highly mobile amphibian species are more susceptible to road mortality than are more sedentary species (Carr and Fahrig 2001).

Road mortality has been shown to depress local abundance of amphibians, including other species of *Anaxyrus*/*Bufo* (Fahrig *et al.* 1995 and references therein; Eigenbrod *et al.* 2008), but no studies are available on the Western Toad. In B.C., several reports exist of road mortality of juvenile toads during mass migrations including mass mortality of a large post-metamorphic aggregation was reported on the Stewart-Cassiar Highway in northern B.C. in 1998, probably as a result of a heat-wave and entrapment on the road (COSEWIC 2002). Road impacts are thought to have a greater impact in the Lower Mainland and Vancouver Island, associated with higher population density.

IUCN-CMP Threat 5. Biological resource use (low impact overall in B.C., low impact on Vancouver Island)

Timber has been or is expected to be harvested from almost half of the forests in B.C. (Austin *et al.*, eds. 2008) and continues to alter toad habitats throughout the province. The total area logged since 1970s represents about 9% of the land area of B.C., with highest percentages of logging in Sub-boreal Spruce (23%), Interior Douglas-fir (22%), and Montane Spruce (21%) biogeoclimatic zones (Austin *et al.*, eds. 2008). The total annual timber harvest has increased greatly within the past 30 years and continues to be high (Fig. 41 in Austin *et al.,* eds.2008). Nearly all of the Coastal Douglas-fir zone was logged in the early 1900s (Austin *et al.,* eds. 2008). The Western Toad appears to be relatively tolerant to logging and may even benefit from warmer conditions in cutover areas, at least over the short term (Gyug 1996, Davis 2000; Deguise and Richardson 2009b). However, it is unclear whether breeding sites in recently logged areas contribute recruits to the local population or act as reproductive sinks (COSEWIC 2002). Dense second growth stands do not provide suitable habitat for Western Toads and on Vancouver Island, second pass

logging is removing needed course woody debris. Forestry roads may increase road mortality; road ruts may trap and increase mortality, particularly for toadlets; and openings may increase predators and therefore predation (COSEWIC 2002).

IUCN-CMP Threat 6. Human intrusions & disturbance (negligible impact)
Recreational activities such as all-terrain vehicle use and mud-bogging can degrade riparian habitats and small waterbodies, and thus have the potential to damage toad breeding habitats and cause mortality to young toads in post-metamorphic aggregations. This is a localized These activities occur mainly in the interior of the province and therefore pose more of a threat to subpopulations in that region compared to coastal regions.

IUCN-CMP Threat 7. Natural system modifications (low impact overall in B.C., negligible impact on Vancouver Island)
The number and size of fires across B.C. each year varies. The total hectares burned in B.C. varied from 12,500 to 331,000 hectares/year between the years 2008 and 2012 (Huffingtonpost B.C. 2012). High intensity stand-level fires are increasingly prevalent in the arid B.C. Interior due to past fire suppression, augmented by climate change. Longer-term effects of fires are expected to be greater on amphibians that are habitat specialists than those that use a wide range of habitats (Pilliod *et al.* 2003). Hence, for the Western Toad, immediate mortality might be of more concern than effects on habitat, but no empirical data are available. Wildfires are most prevalent in the summer when toads are dispersed in terrestrial habitat and are potentially vulnerable to mortality from high intensity fires that penetrate deep into the ground.

Dams and water management can have either positive or negative effects on toad populations. The Western Toad is known to breed in water reservoirs (e.g., on Vancouver Island). Positive effects accrue from maintenance of water levels over drought periods, while negative effects accrue from artificial increases in water levels, which can result in loss of shallow water areas preferred by tadpoles, or rapid drops in water levels, which can strand eggs or tadpoles.

Other ecosystem modifications include creation of sink breeding habitats as part of construction projects or incidentally. Human-created roadside ponds appear to act as population sinks rather than sources of recruits in Alberta (Stevens *et al.* 2006). In the Okanagan, observations suggest that tire ruts from vehicles attract breeding toads but may dry up before development is completed (Gyug 1996).

IUCN-CMP Threat 8. Invasive & other problematic species & genes (medium-low impact overall in B.C., high-medium impact on Vancouver Island/Lower Mainland)
The Western Toad is particularly vulnerable to pathogens and epidemic disease (COSEWIC 2002). The chytrid fungus *Batrachochytrium dendrobatidis* has been implicated in declines of this and other amphibian species in western United States (Carey 1993; Muths *et al.* 2003), as well as in amphibian declines globally (Daszak *et al.* 1999; Stewart *et al.* 2004). In B.C., *B. dendrobatidis* has been isolated from the Western Toad (Deguise and Richardson 2009a; Slough 2009) and other anurans (*Rana catesbeiana*; Garner *et al.* 2006). Although *B. dendrobatidis* appears to be widespread in the province, pathogenicity has been observed only in few cases and

mass mortalities have not been observed (Govindarajulu, 2008–2009, unpublished data). In the Lower Mainland, Deguise and Richardson (2009a) reported that infected toads showed no physical signs of infection. There is one record of chytrid-related mortality of an individual Western Toad from the interior (P. Govindarajulu, pers. comm., 2010). It is unknown whether co-factors need to be present for epidemics to occur or whether the strain of *B. dendrobatidis* in B.C. is different from that farther south. However, even large-scale mortalities can remain undetected unless populations are closely monitored, and chytridiomycosis needs to be considered a serious threat to toad populations across the province.

Introduced vertebrates are widespread in B.C. and can depress Western Toad populations through predation, competition for resources, or role as vectors for disease organisms (COSEWIC 2002). Sport fish have been introduced to waterbodies throughout B.C., including previously fishless lakes. Toads and their tadpoles are unpalatable to fish but may be susceptible to disease organisms carried by fish (COSEWIC 2002 and references therein). Similarly, the introduced Bullfrog (*Rana catesbeiana*) might spread pathogens, including chytrid fungi, to native amphibian populations. The Bullfrog is well established on Vancouver Island and the Lower Mainland and is rapidly expanding its distribution in southwestern B.C. Bullfrogs have not spread to other parts of B.C., other than a small south Okanagan population, so the severity of the threat is more serious in southwestern B.C. than it is overall for the province. Raccoons (*Procyon lotor*) have been introduced to Haida Gwaii where they are locally abundant and prey on Western Toads (Johnston 2006). Two species of amphibians native to mainland B.C., the Pacific Chorus Frog (*Pseudacris regilla*) and the Northern Red-legged Frog (*Rana aurora*), have been introduced to Haida Gwaii, with unknown effects on the native Western Toad.

IUCN-CMP Threat 9. Pollution (low impact overall in B.C., negligible impact on Vancouver Island)

Contamination of toad breeding sites from agricultural fertilizers, pesticides, and herbicides is a concern mainly in the Lower Mainland and parts of the Southern Interior. Harmful chemicals, including endocrine disrupting substances, from household sewage and urban waste water may also be contributors, especially in heavily urbanized areas in the southwest (COSEWIC 2002).

Deformities in metamorphs of the Western Toad have been reported from several areas of B.C. including Alberni, Kamloops, Shuswap, and the Kootenays; deformities might be associated with contaminants or high parasite loads (COSEWIC 2002). However, contamination levels at breeding sites and effects on local populations are unknown. Glyphosate herbicides are used widely for conifer release in northern B.C. (approximately 20,000 ha of forested land are affected, mostly in the Northern Interior Forestry Region) (Govindarajulu 2008). Recent evidence suggests that amphibians as a group are susceptible to both lethal and sublethal effects from glyphosate herbicides; the effects result mainly from the surfactants rather than from the active ingredients (Govindarajulu 2008 and references therein). Western Toad exposure to glyphosate applications is potentially high because the toads' use of regenerating forests and because metamorphs form large aggregations that are vulnerable to direct spraying of the herbicide (Govindarajulu 2008).

In mining areas, toads breeding in tailings ponds are exposed to toxic heavy metals (Brinkman 1998). Exposure to heavy metals or pesticides has been shown to increase mortality and alter

growth rates of amphibians, so indirectly reducing survival (Bridges 2000; Brinkman 1998). Synergistic interactions among predators, various pesticides, and stress magnify adverse effects in some amphibians (Relyea 2005).

Atmospheric pollutants that could contaminate toad breeding sites include aerial spraying of Btk, for Gypsy Moth eradication (B.C. Ministry of Forests and Range 2010) or mosquito control programs for the West Nile virus prevention (Phippen and Phippen 2008); and airborne drift mostly from agricultural sources in the South-central Interior (Ashpole *et al.* 2005). Oil and gas extraction in the northeast of B.C. can increase wind deposition of sulphur, which in turn can increase acidification of waterbodies and reduce foliage cover (Austin *et al.*, eds. 2008). Indirect effects of fire fighting on forestry lands include broadcasting large quantities of ammonia-based fire retardants and surfactants known to be toxic to some aquatic organisms, but their effects on amphibians are unknown (Pilliod *et al.* 2003).

Eggs and tadpoles of the Western Toad are susceptible to UV-B-radiation. Some studies have found an association between mortality and abnormal development under ambient levels of solar UV-B (Blaustein *et al.* 1994a, 1994b; Hays *et al.* 1996), whereas other studies have found no effects (Corn 1998). Together with other stressors, UV-B exposure might increase susceptibility of toads to pathogens (COSEWIC 2002).

IUCN-CMP Threat 11. Climate change & severe weather (unknown impact)
Increased frequency and duration of droughts predicted under climate change scenarios (IPCC 2001) can decrease both the persistence of aquatic breeding sites and the availability of moist refuges for toads in terrestrial habitats which would be detrimental. Impacts of climate change can be expected to be most pronounced in landscapes already fragmented by human developments. Trends over a 30-year period (1971–2000) show that climate changes are already taking place in B.C. (Austin *et al.* 2008). Climate change predictions estimate temperature changes from 2.5 to 10 ^{o}C, depending on the models used, which will increase evaporation rates and wetland drying (Austin *et al.*, eds. 2008). Precipitation is expected to increase from 9 to 18%, with more in the winter and less in the summer (Austin *et al.*, eds. 2008). Warmer, wetter springs may permit earlier breeding for the Western Toad that could be beneficial. Changes to the size and depth of lakes are expected, with smaller wetlands having the greatest impact. Interior wetlands are expected to have increased drying trends (Austin *et al.*, eds.2008). The overall impact of climate change on the Western Toad is unknown.

5 MANAGEMENT GOAL AND OBJECTIVES

5.1 Population and Distribution Goal

Maintain self-sustaining populations of the Western Toad distributed throughout the species' present range in British Columbia.

5.2 Rationale for Population and Distribution Goal

Quantifying population and habitat targets is not feasible at this time due to lack of baseline information. The Western Toad is widespread throughout much of B.C. and, provided that threats are reduced and further declines are prevented, the present number of localities and mature individuals are probably sufficient to maintain viability. A change in COSEWIC designation to "not at risk" may be possible if it can be demonstrated that populations are stable over the long term and/or threats facing populations in different regions are adequately mitigated.

5.3 Management Objectives

1. Identify regionally important breeding sites throughout B.C.
2. Protect[5] a minimum of 10 additional, sustainable breeding sites of Western Toad distributed across the range in both the Lower Mainland and Vancouver Island.[6]
3. Clarify threats and initiate actions to mitigate high and moderate impact threats to regionally important Western Toad breeding sites including residential development, agriculture, energy production, transportation corridors, biological resource use, invasive and problematic species, and climate change.
4. Address the following key knowledge gaps, specifically metapopulation structure and function, movement patterns, disease, and short-term population trends.

6 APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Underway

The following actions have been categorized by the action groups of the B.C. Conservation Framework (Ministry of Environment 2010). Status of the action group for this species is given in parentheses.

Compile Status Report (complete)

- COSEWIC report completed (COSEWIC 2002, 2012).

Planning (complete)

- B.C. Management plan completed (this document, 2014).

Habitat Protection and Private Land Stewardship (in progress)

- Development of best management practices for amphibians and reptiles in urban and rural environments (Ovaska *et al.* 2004).
- Western Toads are found in private conservancies (e.g The Nature Trust Brock property), several provincial parks (e.g., Garibaldi, Manning, Goldstream, Pinecone Burke, Mt Assiniboine, and Bugaboo Provincial Parks; Kitlope Protected Area; Purcell Wilderness

[5] Protection can be achieved through various mechanisms including: voluntary stewardship agreements, conservation convenants, sale by willing vendors on private lands, land use designations, and protected areas.

[6] The initial target of 10 sites for protection is based on incomplete knowledge and will be revised when knowledge gaps related to metapopulation dynamics, including amount and configuration of habitat needed to maintain viable populations, are addressed.

Conservancy Provincial Park and Protected Area), as well as Checleset Bay Ecological Reserve; which is afforded protection through the legal provisions of the *Parks Act* and the *Ecological Reserve Act*.

- Western Toads are found in national parks which offer protection of habitat on Vancouver Island (Pacific Rim National Park Reserve), Haida Gwaii (Gwaii Haanas National Park Reserve and Haida Heritage Site) and on the mainland at the far northern portion of the Western Toad's range in BC in Chilkoot Trail National Historic Site as well as Glacier National Park, Kootenay National Park, Mount Revelstoke National Park and Yoho National Park.
- 19 breeding ponds occupied by Western Toads are within the boundaries of 14 Wildlife Habitat Areas (WHAs) that have been established in the Cariboo region for Great Basin Spadefoots and Badgers under the *Forests and Range Practices Act* (FRPA), (R. Packham, pers. comm.; 2010, E. Prescott, pers. comm., 2010) These WHAs will also maintain habitat for Western Toads.
- Numerous Western Toad breeding ponds have been located in the Cariboo region during Great Basin Spadefoot auditory surveys during the past 5 years (2006–2010). Surveys are also planned for 2010 (Nicolson and Packham 2008; Kline and Packham 2009; Crosby and Packham 2010; Garner and Packham 2011).
- Identification of research priorities for B.C. populations (Davis 2002).
- Research into ecology and movements on Vancouver Island (Davis 2000), movement patterns of adults in southwestern B.C. (Deguise and Richardson 2009b), and larval growth and development in relation to sedimentation (Wood and Richardson 2007).

Monitor Trends (in progress)

- Existing distribution records collated and mapped for B.C. (Ministry of Environment 2007).
- Inventory in East Kootenays (Ohanjanian *et al.* 2006); Mount Revelstoke National Park (Adama and Ohanjanian 2005); Okanagan, Cariboo, Peace River, Prince George Forest District, Fraser River lowlands, Vancouver Island (COSEWIC 2002).
- Draft monitoring program for Western Toads in B.C. completed and in testing (Wind 2007).
- A long term pond-breeding amphibian monitoring program is in development for Mount Revelstoke and Glacier National Parks. Repeat surveys at core monitoring sites were completed in 2009 and 2010 (L. Larson, pers. comm., 2011).
- Research into chytrid infection distribution of B.C. amphibians (P. Govindarajulu, pers. comm., 2010).
- B.C. Frogwatch website established (updated 2010).

Species and Population Management (in progress)

- Bullfrog management on Vancouver Island and in Okanagan (P. Govindarajulu, pers. comm., 2010)

6.2 Knowledge Gaps

Monitor Trends

- Population trends in different parts of B.C. are unavailable and required to assess population stability and importance.

Habitat Protection, Habitat Restoration, and Private Land Stewardship

- Range and distribution information in B.C. needs refinement to identify regionally important metapopulations.
- Metapopulation dynamics, including the amount and configuration of habitat needed to maintain viable populations, is not available and is necessary to effectively direct conservation.
- The effects of forestry activities on population dynamics require clarification to improve best management practices.
- The location of breeding sites and threat assessment is required for conservation prioritization and to facilitate application of best management practices.
- Movement distances and dispersal patterns, especially in fragmented landscapes, are required for conservation prioritization and to improve best management practices.
- Terrestrial habitat use, especially by metamorphs and juveniles, and characteristics of hibernation sites are not well understood and are needed to assess population viability and improve best management practices.
- The potential impacts of climate change have not been assessed at an appropriate scale to adapt to expected changes, regionally.

Species and Population Management

- The prevalence and significance of disease, road mortality including locations of high impact areas, and introduced species requires clarification for local and regional populations.
- The effectiveness and necessity of mitigation measures to reduce amphibian mortality along transportation corridors has not been assessed and is required to improve best management practices.

6.3 Recommended Management Actions

Table 3. Recommended management actions and suggested implementation schedule for the Western Toad in British Columbia.

Objective	Conservation Framework action group	Recommended management action	Threat or concern addressed	Priority	Time-line
1, 2, 3, 4	Planning	Establish a working group to coordinate actions, effectively use resources, and ensure actions are completed.	1.1, 2.3, 3.1, 4.1, 5.3, 8.1, 11.2, Knowledge gaps	1	2014
1, 2, 3, 4	Monitor Trends	Develop and test a prioritized monitoring strategy for populations, invasive species, mass mortalities, and threats at strategic sites throughout B.C.	1.1, 2.3, 3.1, 4.1, 5.3, 8.1, 11.2, Knowledge gaps	1	2015 to 2016
		Implement a Western Toad monitoring strategy at strategic sites throughout B.C.		1	2017 to 2019
1, 2, 3, 4	Habitat Protection and Private Land Stewardship	Identify regionally important breeding sites through analysis of existing distribution data and new surveys, habitat mapping, protected areas, and high impact zones, starting with the Lower Mainland and Vancouver Island.	Knowledge gaps	1	2015 to 2016
1		Assess the expected impact of climate change on Western Toad to assist with developing adaptation strategies and identifying regionally important breeding sites that will remain resilient to climate change.	11.2, Knowledge gaps	2	2015 to 2019
4		Clarify movement and dispersal patterns, terrestrial and hibernation habitat use, metapopulation structure and function, and population viability parameters to inform habitat protection priorities and improve best management practices.	Knowledge gaps	3	2015 to 2019
2		Protect regionally important breeding sites and associated terrestrial habitats, in the Lower Mainland and Vancouver Island areas where declines have been documented.	1.1, 2.3, 4.1, 5.3, 8.1	1	2015 to 2019
3		Clarify and mitigate impacts of logging and wood harvesting on Vancouver Island and the Lower Mainland where declines have been observed through detailed analysis of impacts, protected areas, and best management practices.	5.3 Knowledge gaps	2	2015 to 2019
2, 3		Integrate consideration of the species' needs into land use plans, best management practices, and other documents.	All threats	2	2015 to 2019
3		Encourage stewardship activities that mitigate impacts from livestock on breeding	2.3	3	2016 to

Objective	Conservation Framework action group	Recommended management action	Threat or concern addressed	Priority	Time-line
		sites and associated terrestrial habitat through discussions with the BC Cattlemen's Association, Environmental Farm Planning, and best management practices. Protect regionally important breeding sites in mainland B.C. from disturbance by cattle when necessary through altering range practices, fencing, or other effective techniques.			2019
3		Mitigate impacts from oil and gas development in northern B.C through detailed analysis of impacts, protected areas and best management practices.	3.1	2	2015 to 2019
2, 3		Conduct targeted private landowner contact in the Lower Mainland and Vancouver Island where declines have been observed, to encourage protection of Western Toad habitat and Bullfrog prevention and eradication on private land through best management practices.	1.1, 8.1	2	2015 to 2019
3		Conduct targeted landowner contact at regionally important sites in the interior of B.C., if necessary, to encourage habitat protection and invasive species management.	1.1, 8.1	3	2015 to 2019
3	Species & Population Management	Control Bullfrogs and other invasive, introduced species (e.g., Raccoons on Haida Gwaii) where they cause important threats and prevent new introductions where possible through outreach and enforcement of regulations.	8.1	1	2014 to 2019
3		Identify problem areas for road mortality at regionally important sites, with a priority on Vancouver Island and the Lower Mainland, mitigate impacts, monitor effectiveness and improve best management practices.	4.1	2	2014 to 2019

6.4 Narrative to Support Management Actions Table

It is recommended that a provincial amphibian working group, with regional representation, the B.C. species specialist, and key academic advisors, be established to implement this management plan. Specific actions should be developed and coordinated provincially, then implemented regionally through partnerships. Key partnerships may include First Nations, B.C. government staff, Canadian Wildlife Service, Parks Canada, local governments, academic institutions, cattle ranchers, Go Fish BC, climate change groups, naturalist clubs, Frogwatch participants, and land stewardship and conservation organizations.

Recommended actions have been categorized by the action groups of the Conservation Framework.

6.4.1 Monitor Trends

A population inventory and monitoring program for the Western Toad (Wind 2007) has been developed and is being tested. A comprehensive population, habitat, and threat monitoring program is required to detect population changes and habitat changes and proactively identify disease potential, particularly from invasive species and chytrid fungus, which has devastated Western Toad populations in parts of the United States and may be moving northward. Threat monitoring includes documenting the prevalence of chythridiomycosis or other diseases, and periodic assessment of habitat condition, such as extent of logging or mining activity, use of toad breeding sites by cattle, presence of invasive species, level of contamination, and presence of roads that intersect travel routes between aquatic and terrestrial habitats. Long-term (> 10 years) monitoring of breeding sites will also provide information on population responses of toads to prolonged droughts as a result of climate change.

6.4.2 Planning

It is necessary to establish a working group to implement this plan effectively by coordinating actions and resources. Planning is required to address knowledge gaps.

6.4.3 Habitat Protection

Securement of breeding sites and associated terrestrial habitat requires knowledge of the location of occupied sites, addressing knowledge gaps to help design effective conservation strategies, and taking appropriate steps to reduce threats and maintain habitat quality and connectivity between seasonal habitats. Use of individual waterbodies by Western Toads may vary over the years; hence it is important to protect all suitable wetlands within priority areas occupied by toads. This variability in use is likely to increase with climate change. Once regionally important habitats have been identified through analysis of existing records and surveys, they can be secured through purchase, stewardship agreements, or other measures.

At each regionally important site, the following should be considered:

- Ensure water quality at wetlands used for breeding or summer foraging by minimizing pollution run-off, pesticide and herbicide application, and intensive ranching activities.
- Ensure connectivity between seasonal habitats, especially between breeding sites and terrestrial foraging/overwintering habitat.
- Ensure safety of migration routes between terrestrial and aquatic habitats, for example by placing new roads away from wetlands, closing roads during mass migrations of toads, or providing underpasses.
- Maintain as much forest habitat as possible adjacent to breeding sites to allow for hibernation, foraging, and other essential life functions.
- Control human activities that disturb sensitive life history stages, including eggs and post-metamorphic aggregations of toadlets.
- Take steps to reduce introduction or spread of disease by prohibiting introduction of fish to fishless lakes, preventing establishment of Bullfrogs or other exotic species in wetlands, and enforcing strict adherence to hygiene procedures by researchers and other users of the wetlands.

6.4.4 Land Stewardship

The Western Toad occupies lands under a wide range of land uses and ownership. To effectively manage the species, communication among key stakeholders on all land tenures is essential, including consultation and cooperation with First Nations groups and self-governments, provincial and federal government agencies, local governments, private landowners, ranchers, forestry and mining companies, and conservancy organizations. The recommended steps consist of the following:

- Approach landowners in target areas using existing conservation programs and networks, such as the South Okanagan-Similkameen Conservation Program and South Coast Conservation Program.
- Provide incentives for stewardship and obtain long-term stewardship agreements for important toad habitats.
- Provide threat mitigation options to ranchers and other resource uses to protect toad habitats, including ways to minimize impacts of cattle on wetlands.
- Help landowners and land users to implement mitigation measures.

6.4.5 Species and Populations Management

Introduced species such as the Bullfrog on Vancouver Island and Raccoons on Haida Gwaii are serious threats to Western Toad and need to be addressed in specific areas. Chytrid fungus has caused severe declines in other areas of Western Toad range; monitoring and prevention are required in B.C.

- Engage in education of the public in target areas to prevent the spread of Bullfrogs and their establishment in new areas. Once established, the eradication of Bullfrogs is very difficult; hence the emphasis is on prevention.

- Minimize the spread of pathogens among waterbodies through transport by humans. This can be accomplished by providing information to resource users, sport fishers, and researchers on proper hygiene procedures and encouraging them to adopt these measures.
- Avoid introducing sport fish into previously fishless lakes, especially at regionally important sites, where they can alter ecosystem processes and have the potential to introduce new diseases.

7 MEASURING PROGRESS

Measurable for Objective 1: Regionally important populations were identified in each Ministry of Environment Region by 2019.

Measurable for Objective 2: A minimum of 10, additional, sustainable Western Toad breeding sites were protected both in the Lower Mainland and Vancouver Island portions of the species' range by 2019.

Measurable for Objective 3: Threats were clarified at regionally important populations in each Ministry of Environment Region by 2019.

Measurable for Objective 4: Knowledge gaps related to short-term population trends, metapopulation structure and function, movement patterns, and disease were addressed by 2019.

8 EFFECTS ON OTHER SPECIES

No adverse affects on other native species are expected. Benefits are expected for wetland-dependent species overlapping Western Toad habitat due to a focus on conservation of natural habitats.

9 REFERENCES

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