

**Great Basin Spadefoot (*Spea intermontana*) Auditory Surveys
in the Cariboo Region of British Columbia, 2008**



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Abstract

Great Basin Spadefoots (*Spea intermontana*) were first detected during auditory surveys in the south Cariboo in 2006, and again, in auditory surveys conducted in 2007. In 2008, we conducted additional auditory surveys primarily to further document the distribution of Great Basin Spadefoots in the Cariboo Region of British Columbia. Calls of Western Toads (*Bufo boreas*), Wood Frogs (*Rana sylvatica*), Pacific Chorus Frogs (*Pseudacris regilla*) and Columbia Spotted Frogs (*Rana luteiventris*) were also recorded when detected. Surveys were conducted from the shoreline of ponds and were a minimum of 15 minutes in duration. Two hundred and fifty-five auditory surveys were conducted at 361 different sites between April 12 and June 24, 2008. One hundred and twenty of the 361 sites contained 1 or more target amphibians. Spadefoots were detected at 54 sites (15.0%), Western Toads at 16 (4.4%), Wood Frogs at 43 (11.9%), and Pacific Chorus Frogs at 7 sites (1.9%). Spadefoots were detected calling from May 5 to June 16, 2008. Spadefoots were detected at 12 sites where Western Toads and/or Wood Frogs were also detected. We did not detect Columbia Spotted Frogs at any sites surveyed. However, because the calls of Columbia Spotted Frogs are low-pitched, with little carrying power, not detected does not necessarily mean not present. Likewise, although amphibians were not detected at 241 sites, not detected does not necessarily equate to no amphibians present. Thirteen spadefoot Wildlife Habitat Areas (WHAs) were proposed to conserve spadefoot breeding habitat.

Key Words Great Basin Spadefoot, *Spea intermontana*, Cariboo Region, British Columbia, auditory call survey, distribution.

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1.0 Introduction

The Great Basin Spadefoot (Anura: Pelobatidae: *Spea intermontana*, Cope 1883) is a small amphibian, adapted to living in the arid environments of western Canada and the United States (British Columbia Southern Interior Reptile-Amphibian Recovery Team 2008). It is globally abundant (G5), but vulnerable (S3) in British Columbia (BC) based on the Conservation Data Centre (CDC) classification system (Province of British Columbia 2002). The spadefoot is designated as “Threatened” by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) due to habitat loss and degradation (British Columbia Southern Interior Reptile-Amphibian Recovery Team 2007) and Blue-listed by the BC government (Ovaska 2006) owing to limited provincial distribution. It is also ranked priority 1 for Goal 2 (prevent species and ecosystems from becoming at risk) by the Conservation Framework (Province of British Columbia 2008a) and “Identified Wildlife” under the BC Forest and Range Practices Act due to potential habitat impacts from timber harvesting and grazing practices (Ovaska 2006).

Great Basin Spadefoot distribution includes the western regions of North America from the Colorado River west to the Sierra Nevada and Cascade ranges, east across the Rocky Mountain Divide, and north to south-central British Columbia. The spadefoot’s documented range in BC is limited to the Okanagan, Similkameen, Kettle-Granby, Fraser, Thompson, and Nicola River valleys (Figure 1) (British Columbia Southern Interior Reptile and Amphibian Recovery Team 2008).

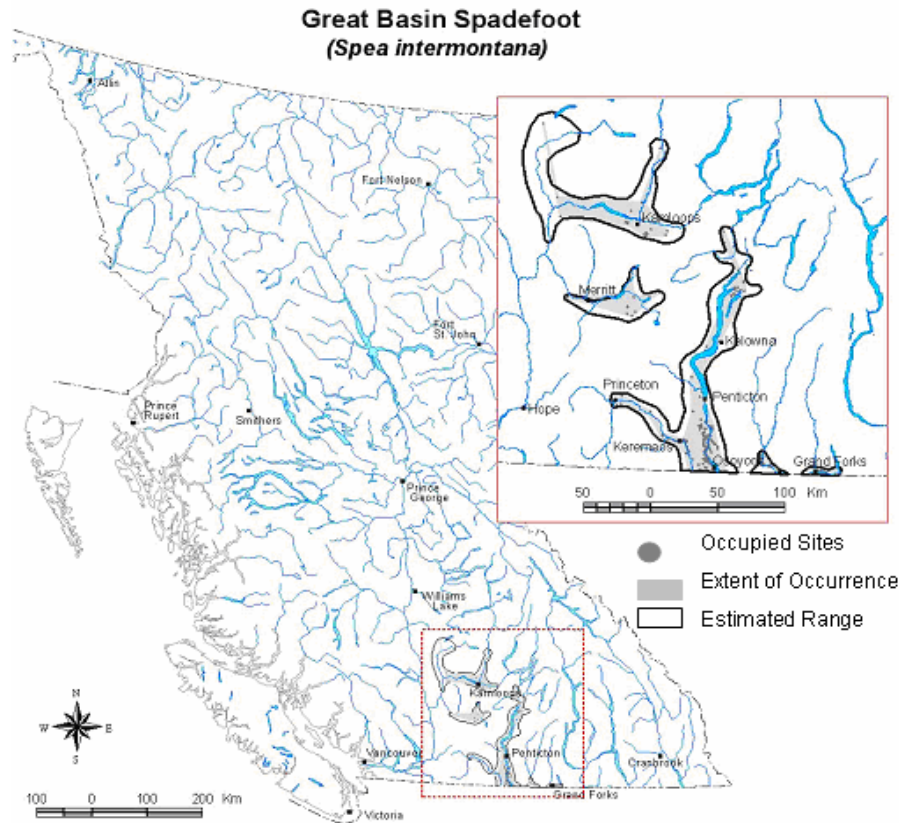


Figure 1. Known distribution of Great Basin Spadefoots in British Columbia prior to 2006 (British Columbia Southern Interior Reptile and Amphibian Recovery Team 2008).

In the Cariboo Region there were only 5 records of Great Basin Spadefoots, prior to 2006. Two historical records of spadefoots were documented in 1975 near 70 Mile House (Ovaska, pers. comm. 2006) and 3 records documented in 2005 near Meadow Lake (Ramsay and Leupin pers. comm., in Verkerk et al. unpublished 2006). Systematic auditory surveys to determine the distribution of spadefoots in the Cariboo Region began in 2006 by Verkerk et al. and continued with Nicolson and Packham in 2007. In 2008 we conducted additional auditory call surveys in the Cariboo Region during the breeding season to further document the distribution of Great Basin Spadefoots. Our surveys also included listening for calls of Western Toads (*Bufo boreas*), Wood Frogs (*Rana sylvatica*), Pacific Chorus Frogs (*Pseudacris regilla*), and Columbia Spotted Frogs (*Rana luteiventris*).

The goals of this project were to: 1) continue auditory surveys for spadefoots started in 2006 to refine our understanding of spadefoot distribution in the Cariboo; 2) conduct auditory surveys for sympatric anurans at the sites surveyed for spadefoots; and 3) utilize the spadefoot breeding habitat use data to propose wildlife habitat areas (WHAs) for conservation of this species.

2.0 Study Area

Our study area was concentrated in the south Cariboo, from Churn Creek east to Green Lake, and from Alkali Creek south to Clinton (Figure 2). The primary focus of search effort was between Meadow Lake and 70 Mile House where the highest number of spadefoot sites were detected in 2007. The survey area is located in the Central Interior ecoprovince, Fraser Plateau ecoregion, Fraser River Basin and Cariboo Basin ecosections, and the Interior Douglas-fir biogeoclimatic zone (Meidinger and Pojar 1991).

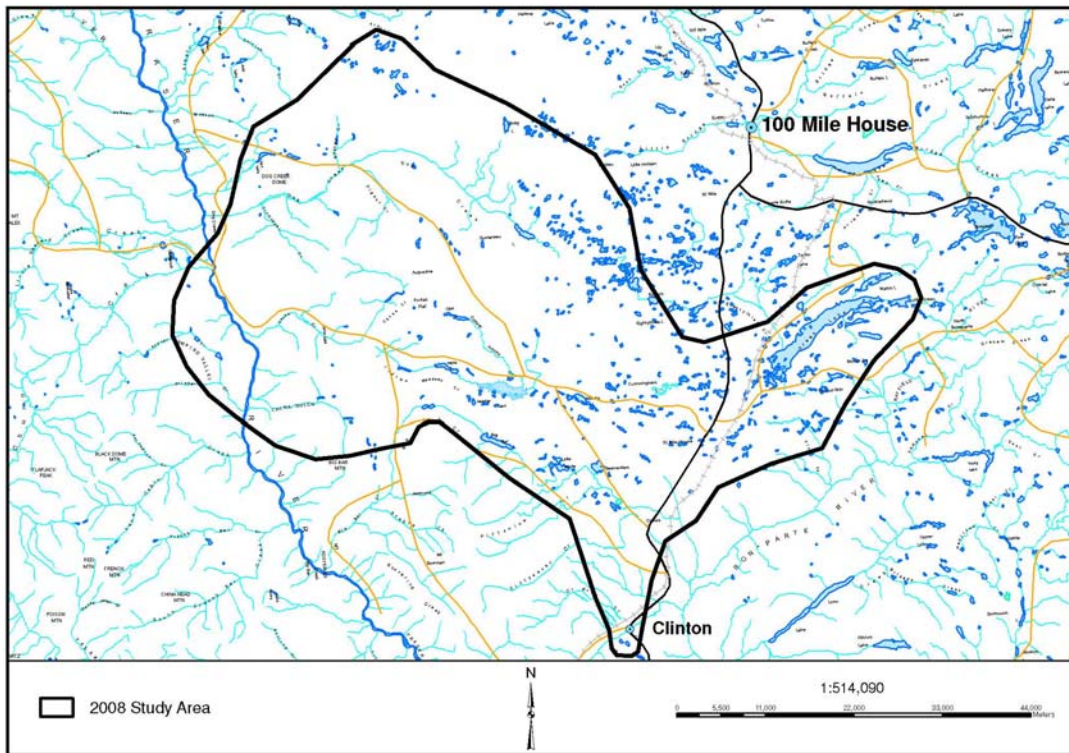


Figure 2. Study area for Great Basin Spadefoot auditory surveys in the Cariboo Region, 2008.

3.0 Methods

Auditory surveys were conducted by BC Conservation Corps employees, BC Ministry of Environment biologists and Canoe Creek Indian Band members, with the assistance of volunteers. Our methodology followed the Inventory Methods for Pond-Breeding Amphibians and Painted Turtle protocol from the Resources Inventory Branch (Province of British Columbia 1998). Our surveys were conducted at the shoreline of selected sites (ponds) and did not start until at least 30 minutes after sunset. Time of sunset was determined from the Environment Canada website for the region. We surveyed for a minimum of 15 minutes as per Pellet and Schmidt (2005) and Inventory Methods for Pond-breeding Amphibians and Painted Turtle Errata #3 (Province of British Columbia 2008b). Depending on site locations it was possible to survey more than 1 site per survey location.

For each auditory survey we recorded survey number, date, 1:20,000 mapsheet number, polygon number, Universal Transverse Mercator (UTM) location, survey start/end times (24 hr), species detected, and relative abundance. We also recorded the time of first call to refine future survey duration. Relative abundance was recorded by assigning the number of calls detected to a call index (Gartshore et al. 1992) where code 0 = no amphibians can be seen or heard; code 1 = individuals can be counted, calls not

overlapping; code 2 = some individuals can be counted, other calls overlapping; and code 3 = full chorus, calls continuous and overlapping. Environmental conditions collected during surveys included water temperature ($^{\circ}$ C), cloud cover (%), recent and ongoing precipitation (Y/N). Wind speed (km/hr), air temperature ($^{\circ}$ C), relative humidity (%), dew point ($^{\circ}$ C), barometric pressure (hPa), and altitude (m) data were collected using a Kestrel 4000 Pocket Weather Tracker (Appendix A).

We created spadefoot distribution polygons based on detection locations collected in 2006 (Verkerk et. al. unpublished 2006), 2007 (Nicolson and Packham unpublished 2007) and 2008. We then used iMapBC to measure the area of spadefoot distribution for each of the 3 years. Based on spadefoot detection locations from 2006 - 2008 auditory surveys, we generated an updated distribution map for the Cariboo Region.

The auditory survey results from the past 3 years were used to identify and propose important spadefoot breeding sites for WHA designation under the BC Forest and Range Practices Act. We proposed WHAs to conserve spadefoot habitat to incorporate pond complexes throughout known spadefoot range in different drainages and watersheds, connectivity with other WHAs where possible, locations where spadefoots were detected in more than one year; and sites where calling spadefoots were categorized as abundance code 3.

4.0 Results

Two hundred and fifty-five auditory surveys at 361 different sites were conducted. Sites were surveyed between 1 and 5 times per site. The majority (84.5%; $n = 305$) of ponds were surveyed only once, 11.4% ($n = 41$) were surveyed twice, 3.3% ($n = 12$) surveyed 3 times, 0.6% ($n = 2$) surveyed 4 times and 0.3% ($n = 1$) were surveyed 5 times. Sites surveyed more than once were sites close to roads and previously known to provide spadefoot habitat.

We conducted auditory surveys on 40 days between April 12 and June 24, 2008. We surveyed 6 days in April, 20 days in May, and 14 days in June. We commenced surveys prior to the onset of spring calling and continued surveys until spadefoots were no longer detected. Amphibians were detected on 24 of the 40 (60%) survey dates (Figure 3).

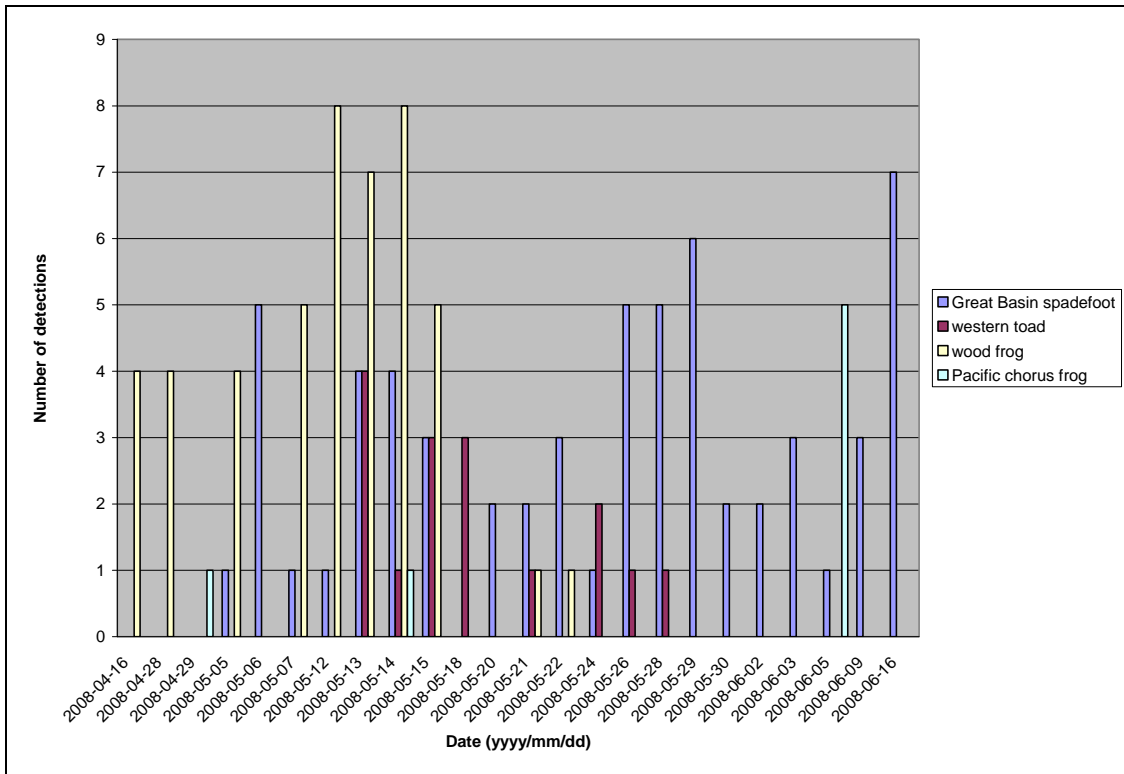


Figure 3. Number and date of detections for target amphibians in the Cariboo Region, 2008.

Amphibians were detected at 120 (33.2%) of the 361 sites surveyed (Figure 4). Spadefoots were detected at 54 (15.0%) sites (Figure 5), Western Toads at 16 (4.4%) sites (Figure 6), Wood Frogs at 43 (11.9%) sites (Figure 7), and Pacific Chorus Frogs at 7 (1.9%) sites (Figure 8). No amphibians were detected at 241 (66.8%) of the sites surveyed (Figure 9). Spadefoots were detected calling at 12 (10.0%) sites with Western Toads and/or Wood Frogs. Although Columbia Spotted Frogs were one of our target species, none were detected.

Four of the 5 target amphibians were detected 131 times in 2008. Spadefoots were detected 61 (46.6%) times, Western Toads 16 (12.2%) times, Wood Frogs 47 (35.9%) times, and Pacific Chorus Frogs 7 (5.3%) times.

Spadefoot detections varied from code 1 to code 3. Code 1 (individuals can be counted, calls not overlapping) comprised 70.5% (n = 43) of the spadefoot detections, code 2 (some individuals can be counted, other calls overlapping) comprised 19.7% (n = 12), and code 3 (full chorus, calls continuous and overlapping) comprised 9.8% (n = 6). Abundance codes were also assigned to the other amphibian species detected (Table 1).

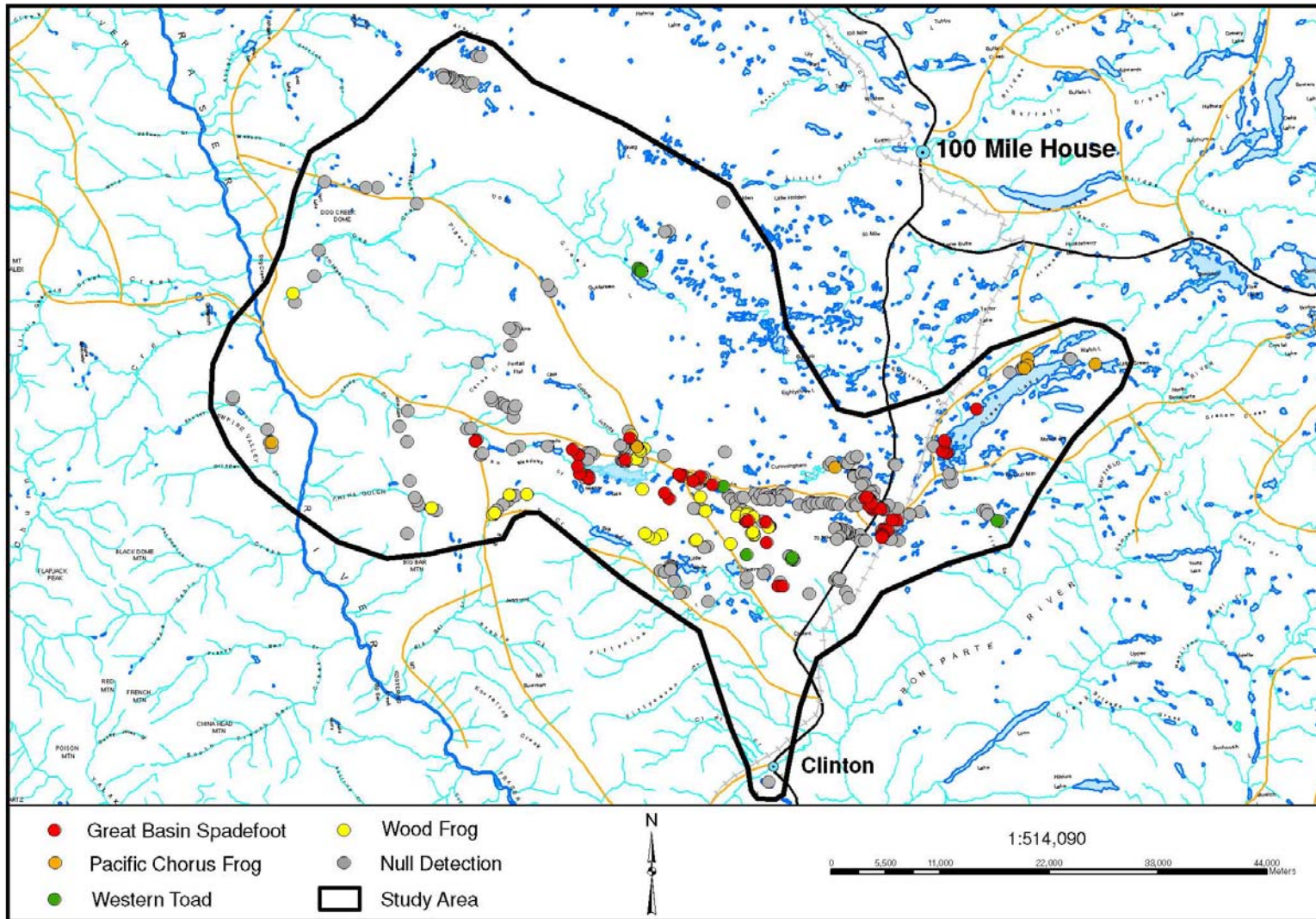


Figure 4. 2008 amphibian and null detection locations in the Cariboo Region.

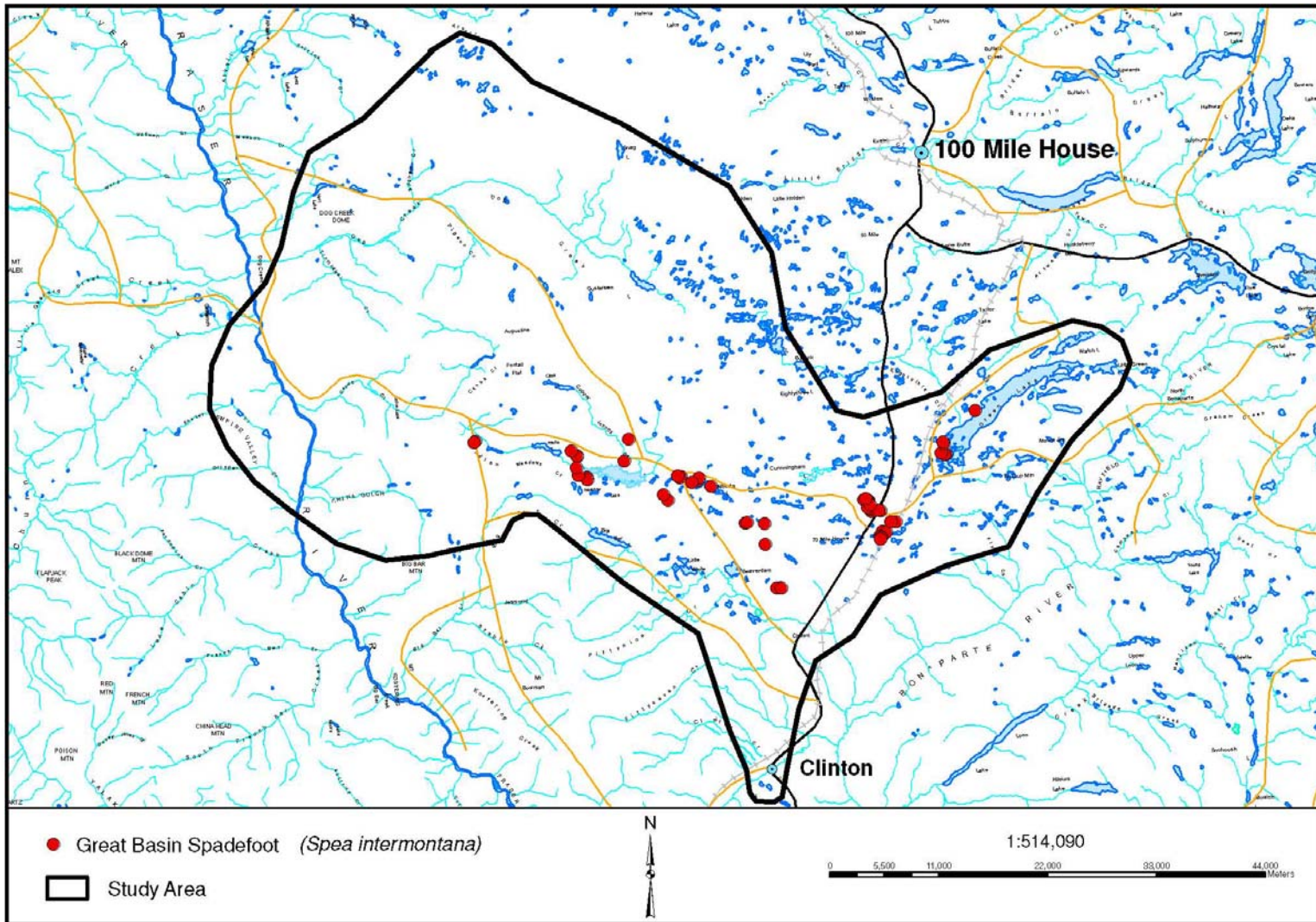


Figure 5. 2008 Great Basin Spadefoot detection locations (n = 54) in the Cariboo Region.

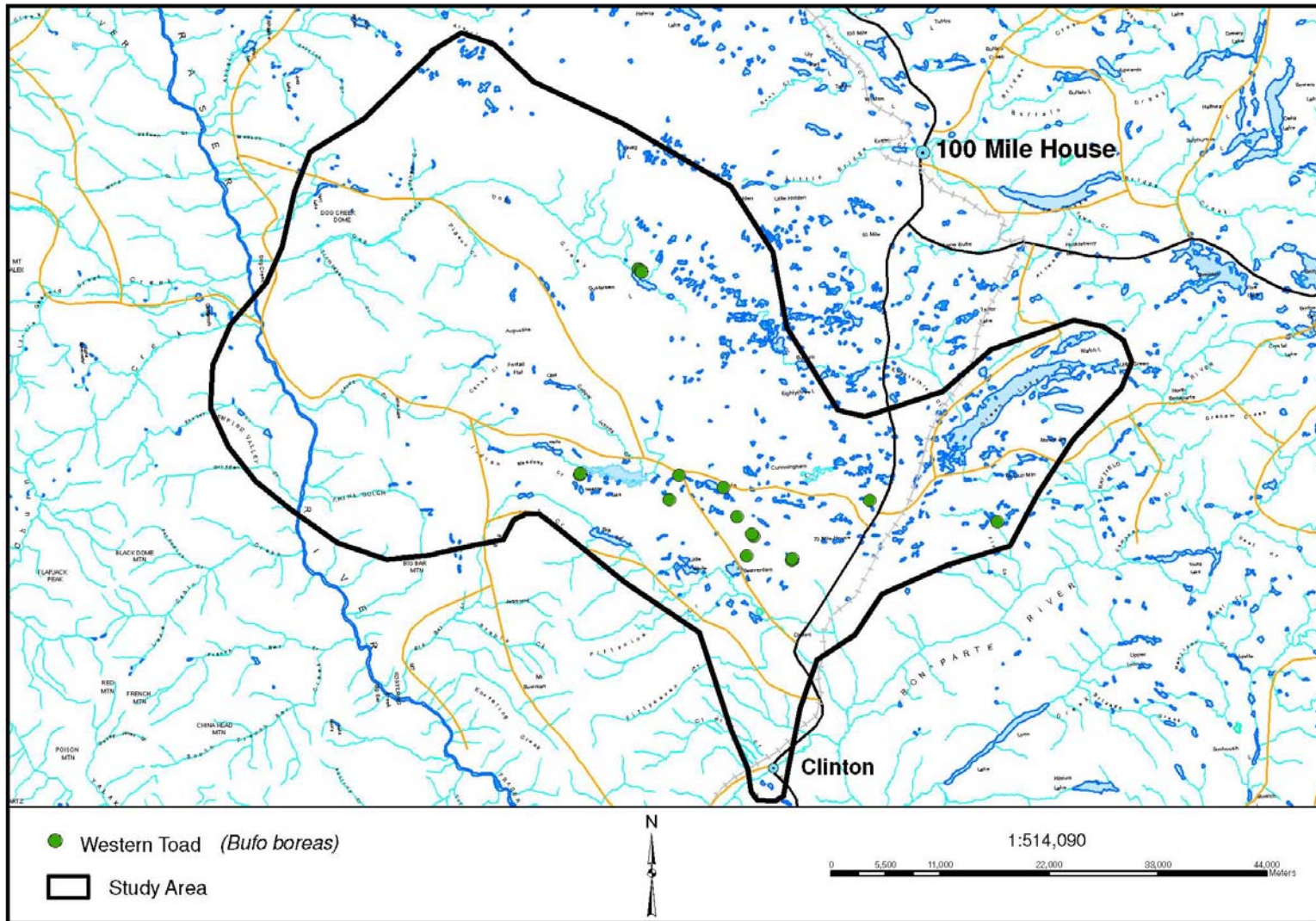


Figure 6. 2008 Western Toad detection locations (n = 16) in the Cariboo Region.

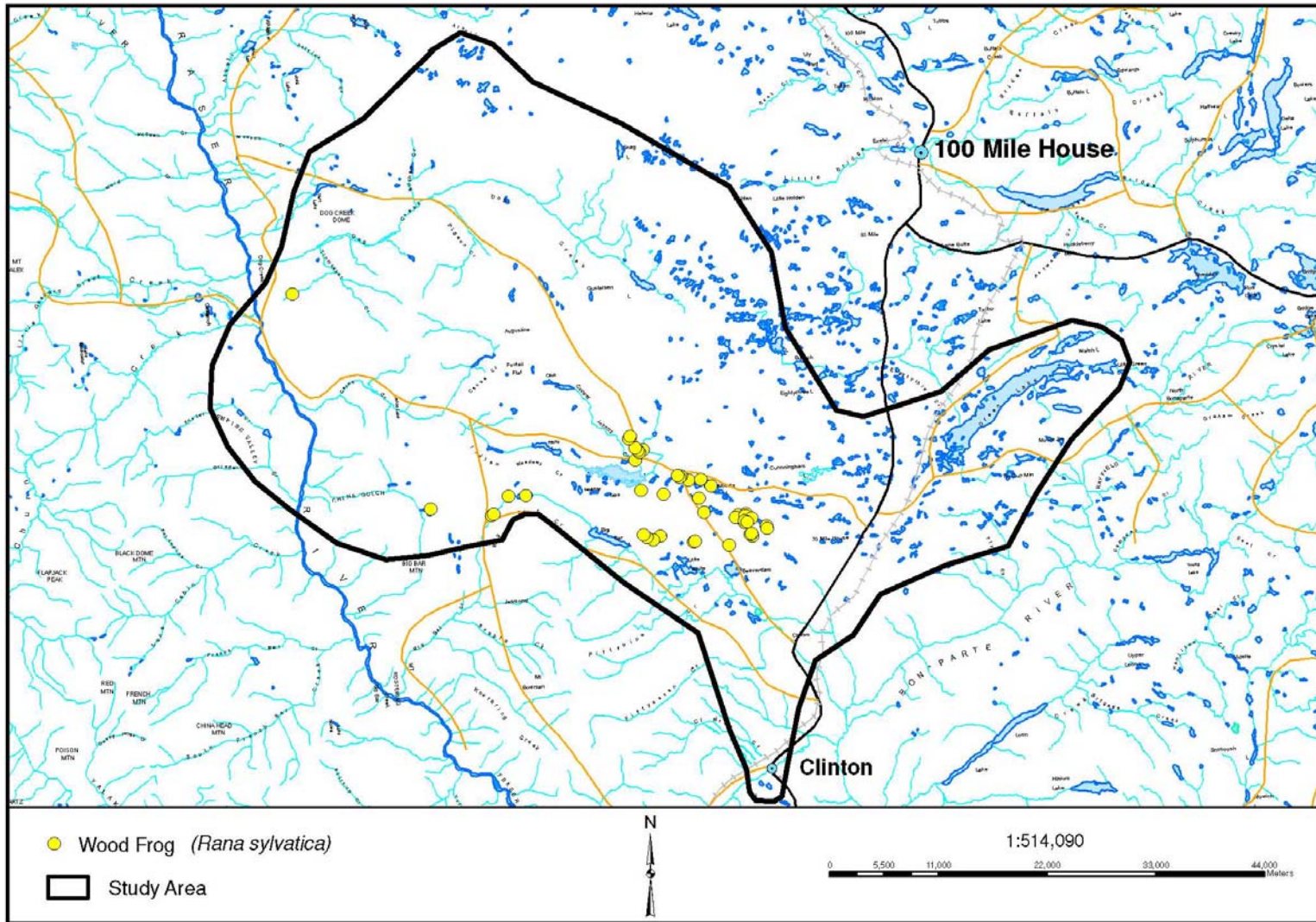


Figure 7. 2008 Wood Frog detection locations (n = 47) in the Cariboo Region.

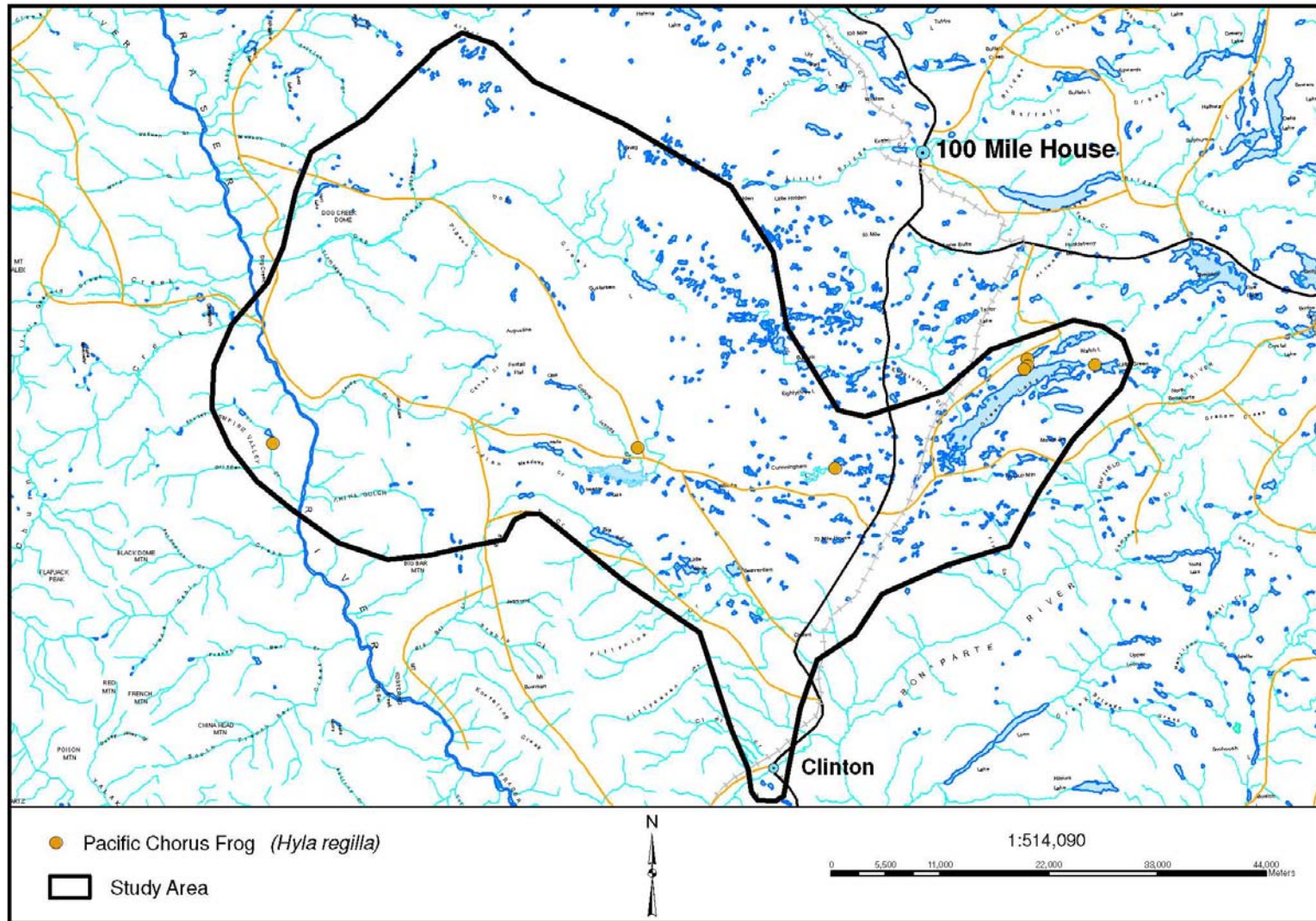


Figure 8. 2008 Pacific Chorus Frog detection locations (n = 7) in the Cariboo Region.

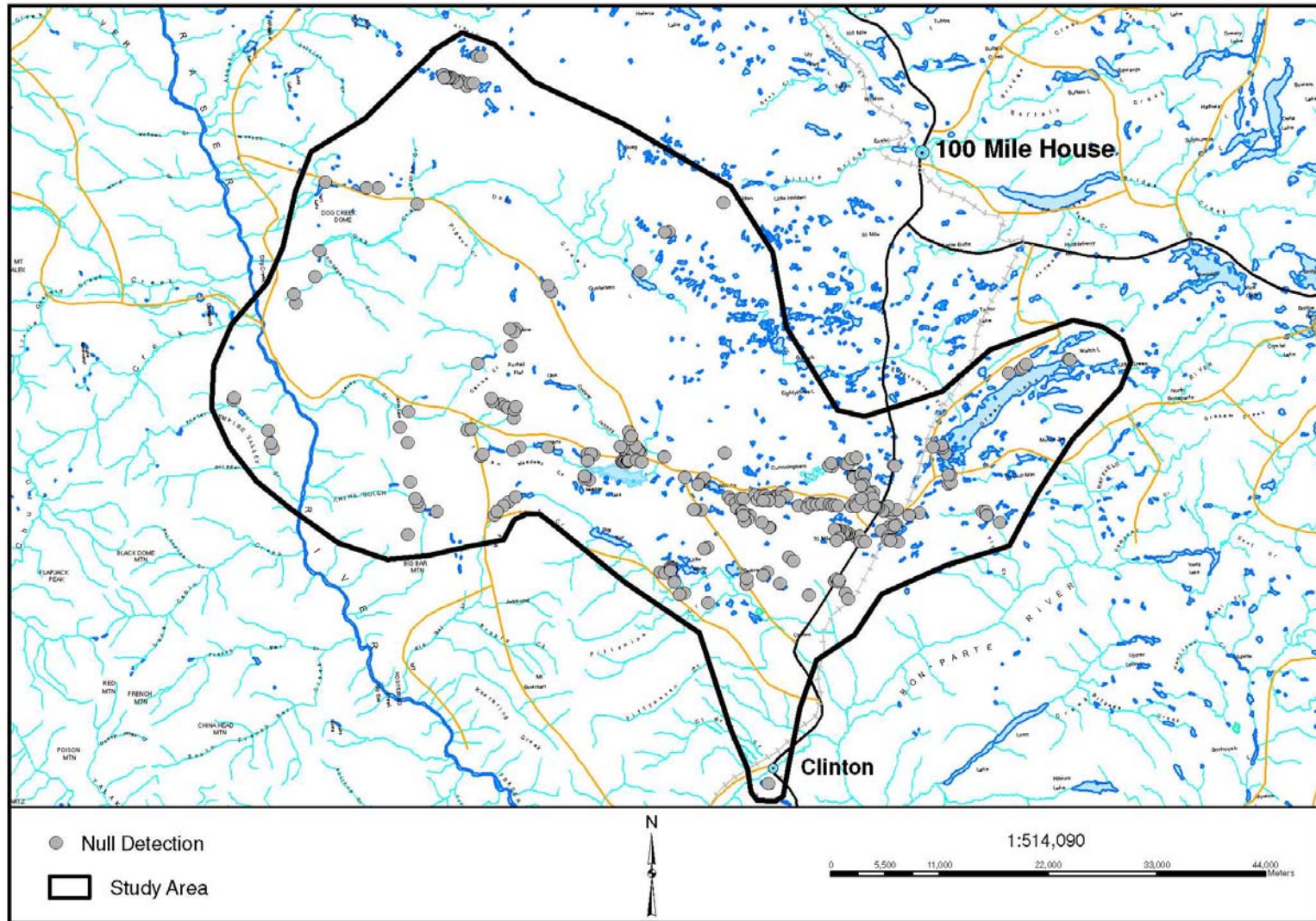


Figure 9. 2008 null detection locations (n=241) in the Cariboo Region.

Table 1. Relative abundance of amphibian detections in the Cariboo Region, 2008.

Species	Abundance code 1 detections	Abundance code 2 detections	Abundance code 3 detections	Total detections
Great Basin Spadefoot	43	12	6	61
Western Toad	16	0	0	16
Wood Frog	34	6	7	47
Pacific Chorus Frog	6	1	0	7
Columbia Spotted Frog	0	0	0	0

Spadefoots were first detected May 5 and last detected June 16, 2008. Western toads were detected from May 13 – 28, 2008, Wood Frogs called from April 16 to May 22, 2008, and Pacific Chorus Frogs called from April 29 to June 5, 2008.

When spadefoots were detected, they were heard in the first 5 minutes in 82.0% (n = 50) of the surveys and in the first 10 minutes in 90.2% (n = 55) of the surveys. After 14 minutes of surveying, no new calls were detected. On 8 occasions spadefoots were detected earlier than the 30 minutes after sunset when Resource Information Standards Committee (RISC) guidelines recommend surveys should begin.

Water temperatures were taken at 28 sites where spadefoots were detected calling. Temperatures ranged between 9 and 18.5° C with an average of 13.4° C +/- 2.8 SD.

Although detailed analysis of weather conditions at time of surveys was not completed, spadefoots were detected in variable conditions. In the 61 surveys when spadefoots were detected, 39.3% (n = 24) called in 95-100% overcast conditions, 42.6% (n = 26) called with 5-90% cloud cover, and 18.0% (n = 11) of surveys detected spadefoots in clear conditions. Over half (55.7%; n = 34) the detections were when there was no precipitation; however, almost all of those surveys (92.5%; n = 56) were conducted less than 48 hours after precipitation. Air temperatures ranged from 4.5 to 15° C with the majority (n = 45; 73.8%) of sites between 5 and 10° C.

The area occupied by spadefoots in the Cariboo in 2006 was estimated at 16 kms². In 2007 the estimated distribution quadrupled to 64 kms², and in 2008, more than doubled to 156 kms². An updated Cariboo Region spadefoot distribution map was created based on the past 3 years of detection locations (Figure 10).

As a result of the past 3 years of auditory surveys, we proposed 13 spadefoot WHAs containing a minimum of 48 breeding sites (Table 2). Fifteen (16.3%) spadefoot sites are currently protected within badger (*Taxidea taxus jeffersonii*) WHAs.

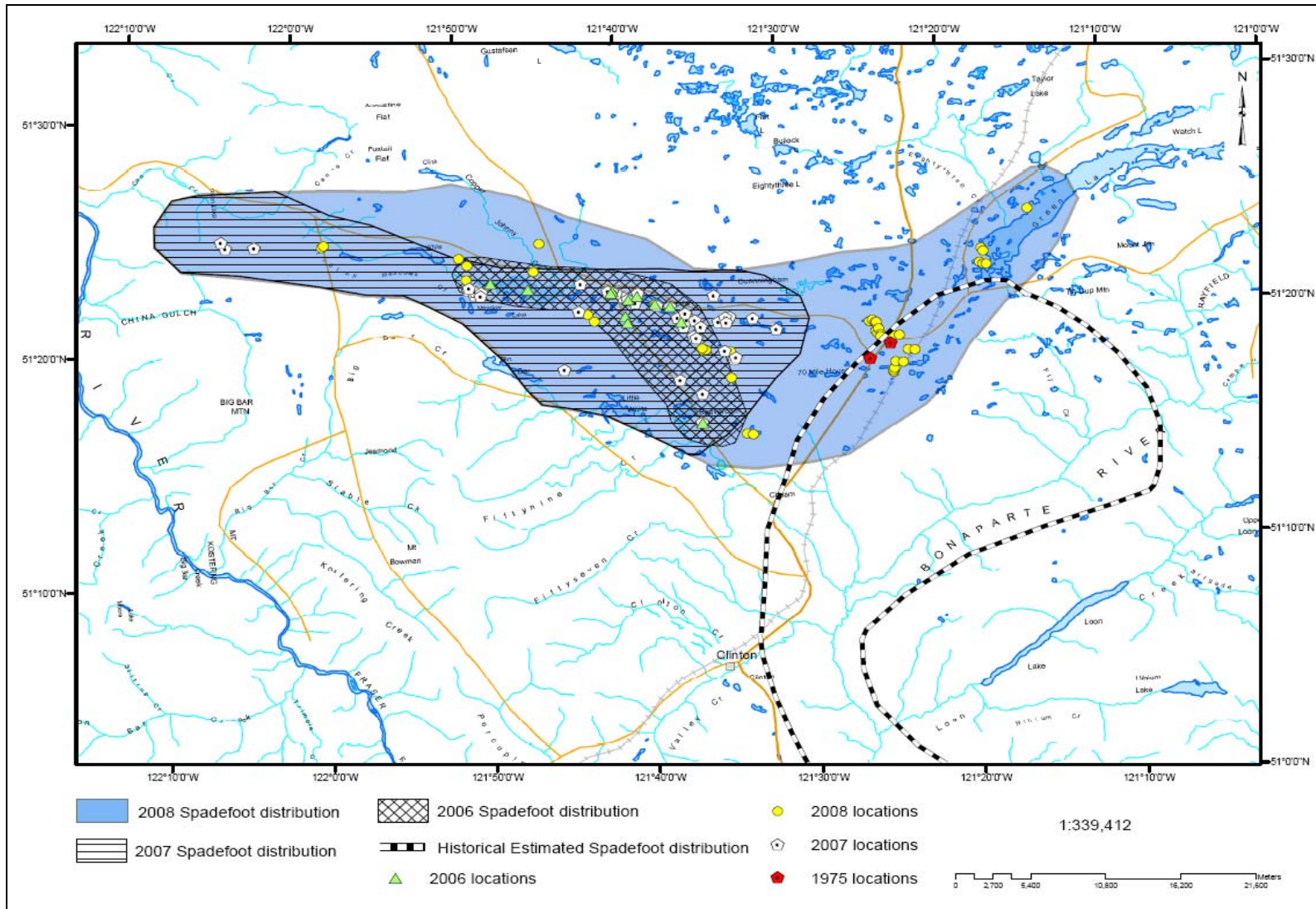


Figure 10. Updated Great Basin Spadefoot distribution in the Cariboo Region.

Table 2. Area (ha), number of spadefoot breeding sites and potential number of breeding sites in the 13 spadefoot wildlife habitat areas (WHAs) proposed for the Cariboo Region.

Tag #	WHA Name	Total area (ha)	Upland area (ha)	Wetland area (ha)	Minimum # of spadefoot breeding sites within WHA	Potential # of spadefoot breeding sites within WHA
5-001	Long Run	87.9	65.2	22.7	2	5
5-002	Long Run East	34.2	27.2	7.0	1	3
5-003	Indian Meadows	35.4	30.9	4.5	2	4
5-004	Pigeon Lake	126.0	105.7	20.3	6	10
5-005	Meadow Lake	72.1	53.9	18.2	3	8
5-006	Alberta Lake West	69.4	48.6	20.8	5	10
5-007	Alberta Lake East	119.3	96.6	22.7	3	4
5-008	River Lakes	12.3	9.1	3.2	3	4
5-009	Raphael Road	86.6	72.3	14.3	1	9
5-010	Complex 70 Mile House	50.1	25.1	25.0	11	17
5-011	Highway 97 Complex	6.6	1.9	4.7	4	3
5-012	Green Lake	95.6	79.2	16.4	5	9
5-013	3100 Road Complex	147.8	126.4	21.4	2	6
Total		943.3	742.1	201.2	48	92

5.0 Discussion

Although our auditory surveys didn't detect amphibians in 241 ponds, and Columbia Spotted Frogs were not detected in any surveys, not detected does not necessarily mean not present. Spadefoots (and other amphibians) calls can be irregular (Kline unpublished 2008) and calls of Columbia Spotted Frogs are low pitched, and therefore difficult to detect. Non-detection of amphibians at a pond should be followed up with additional auditory surveys and larval surveys to verify absence of breeding activity (Province of British Columbia 2008b).

A significant breeding population of Great Basin Spadefoots has been identified in the Cariboo Region in the last 3 years as a result of auditory surveys. In 2006, 12 spadefoot breeding sites were located (Verkerk et al. unpublished 2006) and in 2007, 37 new sites were identified (Nicolson and Packham in 2007). Although 54 spadefoot sites were detected in 2008, 10 were previously known to contain spadefoots; therefore, our study resulted in 44 new such sites being established. Ovaska, (2006) estimated there were 235 breeding sites in BC. Given that estimate, the 93 breeding sites identified in the Cariboo Region from 2006 - 2008 represents a 39.6% increase in the number of provincial breeding sites.

The estimated range of spadefoots in BC (Figure 1) was extended north to the Cariboo Region to capture the two 1975 records. As illustrated in Figure 1, the Cariboo spadefoot population is apparently connected to the Thompson population. To verify this

connection, we conducted several auditory surveys in 2007 (Nicolson and Packham 2008) and 2008 in specific locations, but our survey results thus far indicate that the Cariboo population is likely isolated from spadefoots to the south. An updated distribution boundary for spadefoots in the Cariboo is presented in Figure 10.

Relative abundance estimates of calling male spadefoots from 2007 and 2008 surveys indicate Cariboo spadefoots exist at a relatively low density. In 2007, Nicolson and Packham reported 67% of detections were abundance code 1 (individuals can be counted; calls not overlapping) and in 2008 over 70% of our detections were also abundance code 1. In both years, <10% of detections were full chorus.

Although auditory survey duration efficiency is widely published for many species of amphibians (Shirose et al. 1997; Pierce and Gutzwiller 2004; Tupper et al. 2007), none of these studies were specific to Great Basin Spadefoots. Therefore, survey durations recommended for other anurans may not be applicable to spadefoots. To refine recommended spadefoot auditory survey duration, we recorded time of first call in all surveys. In our surveys, 82% of spadefoot detections were in the first 5 minutes of surveys, and over 90% of detections were in the first 10 minutes. In no cases did we first detect spadefoots calling at a pond after 14 minutes of survey time. Even though over 90% of our detections were in the first 10 minutes of surveys, given the time required, on average, to access a pond in relation to the time required to complete an auditory survey, we recommend 15 minute surveys to maximize the possibility of detecting amphibians. This recommendation is consistent with the updated BC Resource Inventory Standards Committee standard for inventory of pond-breeding amphibians (of British Columbia 2008b).

Although surveys are ideally conducted shortly after or during precipitation (Province of British Columbia 1998), heavy rainfall and excessive wind prevented us from hearing spadefoots that were potentially calling. Light rain did not affect our ability to detect calling males, but on occasion heavy rain made hearing calls difficult and surveying was terminated. Surveys were also terminated when winds > 3 km/hr made detections difficult. On one occasion when surveys conditions were optimum i.e. no wind, and moist air from recent rain, we detected spadefoot calls, over water, from more than 6.5 kilometres away.

6.0 Recommendations

Our understanding of the distribution of spadefoots in the Cariboo has expanded significantly as a result of auditory surveys, but remains to be fully determined. There are still numerous potential spadefoot breeding sites to be surveyed and it is still not fully determined if Cariboo Region spadefoots are connected to the Thompson population, or if they are geographically isolated. It is also possible that Cariboo spadefoots are experiencing a range expansion. Future (2009) auditory surveys should focus primarily on un-surveyed sites in proximity to known spadefoot breeding sites to establish distributional boundaries and to determine if Cariboo spadefoots are indeed disjunct from the Thompson Region population, and to determine if a range expansion is occurring.

Genetic research also should be conducted to determine if Cariboo spadefoots are genetically distinct from the Thompson Region spadefoots.

Future surveys for spadefoots should commence in late-April to capture the onset of calling and continue until late-June or until breeding is finished. Surveys should be a minimum of 14 minutes in duration to ensure maximum detections, while maintaining survey efficiency. Portable weather instruments should be utilized on all surveys to measure weather parameters such as wind speed, air temperature, and relative humidity to ensure surveys are completed in favourable conditions to maximize detection probability. To achieve accurate results we recommend auditory surveys for spadefoots only be conducted when wind speeds are less than 3 km/hr.

Since there is conflicting evidence concerning amphibian population fluctuation and decline (Pechmann and Wilbur 1994), long-term monitoring sites should be established to monitor spadefoot populations. Monitoring could include further auditory surveys, systematic searches for tadpoles, and installation of call recording stations.

Habitat conservation through the creation of wildlife habitat areas in the Cariboo Region would ensure that both wetlands and grasslands remain intact, providing protected habitat for not only spadefoots, but many other Conservation Framework priority 1 and 2 species. Semlitsch (2008) suggests that habitat protection and population management for pond-breeding amphibians remaining near natal wetlands may be effective at a 1 kilometre spatial scale, but ideally meta-population or landscape-level management (>1-10 kilometres) should be implemented to ensure terrestrial connectivity. Conservation efforts should focus on the majority of breeding adults and juveniles in core habitat that includes foraging, breeding, and over-wintering sites, encompassing the entire amphibian's life cycle (Semlitsch 2008). However, few spadefoot studies have been completed in BC, thus our understanding of spadefoot ecology is limited. Therefore, research to determine breeding, summer/foraging, and over-wintering habitat requirements is required to ensure conservation efforts target the appropriate habitats.

Further identification of spadefoot WHAs following 2009 surveys would help meet the recovery goal of securing additional suitable habitat capable of maintaining a self-sustaining population.

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Appendix A. 2008 amphibian auditory survey data form.

OBSERVERS Roger Packham (Example form)

AMPHIBIAN AUDITORY SURVEY

Pg 1 of 1

SURVEY #	DATE YYYY-MM-DD	MAPSHEET i.e. 92P032	POLY# (i.e. 035)	YOUR LOCATION (UTM NAD83) easting northing	TIME START (AM/PM/HRS)	TIME END (AM/PM/HRS)	TIME FIRST CALL	SPECIES (A-????)	ABUNDANCE CODES (0,1,2,3,)	WATER TEMP (°C)	CLOUD COVER (%)	PRECIP (Y/N)	RECENT RAIN 24/48 HRS (Y/N)	WIND SPEED (km/hr)
R-125	2008-06-20	92P032	213	595989 5688531	22:05	22:20	n/a	n/a	0	12	80	N	Y	1-2
			TEMP. (°C)	RELATIVE HUMIDITY (%)	DEW POINT (°C)	BAROMETRIC PRESSURE (hPa)	ALTITUDE (m)	COMMENTS (moon 0, 1/4, 1/2, 3/4, full)						
			15.6	76.2	7.6	1001.8	1071	full moon, partially obscured, breezy, warm (Nothing heard)						
R-126	2008-06-20	92P032	208	596609 5688462	23:04	23:19	3:18	SPIN	1	13.5	85	Y	Y	0.0
			TEMP. (°C)	RELATIVE HUMIDITY (%)	DEW POINT (°C)	BAROMETRIC PRESSURE (hPa)	ALTITUDE (m)	COMMENTS (moon 0, 1/4, 1/2, 3/4, full)						
			16.2	88.9	16.0	1001.1	1082	full moon, mostly obscured, calm, warm (4 SPIN)						
			TEMP. (°C)	RELATIVE HUMIDITY (%)	DEW POINT (°C)	BAROMETRIC PRESSURE (hPa)	ALTITUDE (m)	COMMENTS (moon 0, 1/4, 1/2, 3/4, full)						

SPECIES CODES
 A-SPIN=Great Basin spadefoot
 A-BUBO=Western toad
 A-RALU=Columbia spotted frog
 A-RASY=Wood frog
 A-HYRE=Pacific tree (chorus) frog

ABUNDANCE CODES
 0 - no amphibians can be seen or heard
 1 - individuals can be counted (estimate number), calls not overlapping (1-5 individuals)
 2 - some individuals can be counted (estimate number), other calls overlapping (6-19 individuals)
 3 - full chorus, calls continuous and overlapping (20+ individuals)